

# Climate Change Impacts: An Annotated Bibliography for Occupy Wall Street

Compiled by Librarians from the MyMetro Researchers Project:

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## Purpose:

The citations in this annotated bibliography address specific impacts of climate change on plant & animal species, humans, public health, infrastructure, ecology, agriculture, coastlines, food supply, and the global economy. This bibliography is a finding aid that can point Occupy Wall Street Eco-Cluster members and other interested parties towards current, valid research that, due to the commercial nature of most academic research databases, may not be apparent or accessible to the general public. As librarians, we believe that knowledge is power, and we hope that providing access to this type of research will advance the ecological cause of Occupy Wall Street.

## What You Should Know:

- The studies, reports, and websites in this annotated bibliography were published by government agencies, scholarly (academic) journals, newspapers, and nonprofit organizations. They appear to contain accurate data and cover roughly the last ten years (1999-2012).
- We've included interactive websites and open access government reports in this bibliography; however, most of the scholarly journal articles come from subscription databases. When the full text is open access and available online for free, we have included links. The "websites" section of this bibliography may be particularly useful.
- Widely disseminating the full text of articles available only via subscription library databases would violate our libraries' contracts with database vendors. Fortunately, you can use [Google Scholar](#) and databases at your local public or university libraries to access the full text of many of these articles. Most public (and some private) university libraries will let guests search, print, and email from their databases on public computers at the library. If your local library does not have access to a particular article, you can usually request it via interlibrary loan for free or for a small fee. Just ask a reference librarian for help.

- There's more out there! Many reports and studies about real-world climate change impacts have been written, and more are being published every day. Ask your local librarian or talk to one of us if you need help finding more information on this topic.
  - Copies of this annotated bibliography will be shared through the Occupy Wall Street Library and OWS Eco-Cluster Google Group.
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## **General Reading & Reports**<sup>1</sup>

**Abatzoglou, J. T., & Kolden, C. A. (2011). Climate Change in Western US Deserts: Potential for Increased Wildfire and Invasive Annual Grasses. *Rangeland Ecology & Management*, 64(5), 471–478. doi:10.2111/REM-D-09-00151.1**

While the study was more about modeling and delivering information to invasive species managers/agencies, the lit review of this article was well-written and contained concise yet complete information about the link between climate change, wild fires, and the increases in invasive grasses in the western US, especially in deserts. The authors clearly make the case that these invasive grass species and a drier, hotter climate have lead to increased wildfires in the Southwest.

**Ashton, J. (2012, May 17). How Green is My Occupy? Rio+20 Environmentalists Team With #OWS. *Huffington Post*. Retrieved from [http://www.huffingtonpost.com/jerry-ashton/occupy-rio20-earth-summit\\_b\\_1520472.html](http://www.huffingtonpost.com/jerry-ashton/occupy-rio20-earth-summit_b_1520472.html)**

An extremely accessible article describing how the Occupy Wall Street movement is linking up with Rio+20 to mutually boost both groups visibility and enhance their messages. Information is given about Rio+20 and the work of Ted Schulman who has been involved in both movements. The article is interesting and informative but loses some credibility points by stating that the show *Mad Men* appears on HBO, when in fact it is on AMC. There are links leading to more information for those looking to get involved.

**Barnosky, A. D., Hadly, E. A., Bascompte, J., Berlow, E. L., Brown, J. H., Fortelius, M., Getz, W. M., et al. (2012). Approaching a state shift in Earth's biosphere. *Nature*, 486(7401), 52–58. doi:10.1038/nature11018**

Describes state shift theory and explains that these rapid changes in the earth's systems have previously been theoretical or seen in smaller ecosystems or over the course of millennia. At this point the domination of the planet by Humans is bringing about one of these rapid state

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<sup>1</sup> These scholarly articles, reports, news articles, and assessments are straightforward and generally easy for a lay audience to read. You don't have to be a climatologist to understand this research! Just read the summaries to see if an article looks like it would be useful to you.

shifts which will bring about a reality never before known to mankind. The article seeks to review past miniature state changes as well as slow progression (over millennia) state changes in order to better theorize the impact that the new rapid state change we are forcing upon the planet will have. Informative and information packed with several infographics.

**Breggin, L. (2012). States Adapting to Climate Change. *Environmental Forum*, 29(1), 10.**

Short but sweet article outlines actions of cities, states, and localities to prepare for and address climate change. Very accessible to a lay audience. Contains useful statistics for advocates of creating climate "adaptation plans" and measuring to counteract global warming, including the following: "A recent KPMG report based on input from over 40 of the world's largest cities found that 79 per- cent believe that climate change could jeopardize the successful operation of local businesses."

**Brown, K. S. (1999). Taking Global Warming to the People. *Science*, 283(5407), 1440–1441.**

Excellent, engaging article uses straightforward storytelling and journalistic style to bring the human dimension of climate change to light. Following the work of scientists like Mick Kelly in Vietnam, this article provides real-world examples of populations and communities that are put at risk by the effects of global warming. Article also examines the political, anthropological, and economic imperatives for societies to prepare for and adapt to climate change. This article argues for more work in climate anthropology that will go beyond merely predicting physical and weather phenomena to predicting the impacts of those phenomena on farmers, the food supply, rural and urban infrastructures, etc. in order to best prepare for the future (avoiding droughts, building storm shield barriers on riverbeds) and even attempt to take advantage of extreme weather events like La Nina/ El Nino (planting more rice crops strategically, maintaining mangroves to prevent typhoons & floods, etc.) Notable quotes: "This is a human ecosystem we're talking about in which environmental and economic forces are intertwined."

**Christiansen, D. E., Markstrom, S. L., & Hay, L. E. (2011). Impacts of Climate Change on the Growing Season in the United States. *Earth Interactions*, 15(33), 1–17. doi:10.1175/2011EI376.1**

Great graphics and accessible language. Includes many tables broken down by region highlighting changes in the growing season linked to climate change predictions. From the introduction: "This paper focuses on the potential impacts that climate change can have on GSL [growing season length] and the hydrologic cycles of 14 selected basins across the United States." This study contains models projecting how the growing season length will be changed due to global warming and how this will affect agriculture, forests, and the overall ecosystem of the U.S. Study looks at how 14 major basins across the U.S. will be affected. In the models used by the researchers, "GSL increased in all three climate change emission scenarios though the twenty-first century. The 14 selected basins in the United States have shown an overall increase in GSL ranging from 14 to 76 days by 2099, depending on the emission scenario. The modeled GSLs are positively correlated with forecasted increases in temperature."

Earth Interactions is published jointly by the American Meteorological Society, the American Geophysical Union, and the Association of American Geographers

**Clery, D. (2006). Climate Change Demands Action, Says U.K. Report. *Science*, 311(5761), 592b–592b. doi:10.1126/science.311.5761.592b**

Brief article describing the results of and reaction to an environmental assessment report produced by the Intergovernmental Panel on Climate Change (IPCC), which makes the case for immediate action in response to climate change. The report contains projection models relating to ocean acidity and the rise in sea levels. In a forward to the report, then U.K. Prime Minister Tony Blair states, "It is clear from the work presented that the risks of climate change may well be greater than we thought."

**Cohen, S., & Miller, A. (2012). Climate Change 2011: A status report on US policy. *Bulletin of the Atomic Scientists*, 68(1), 39–49. doi:10.1177/0096340211433007**

Great article from Bulletin of the Atomic Scientists summarizing the policies and political debates surrounding climate change in the U.S. Congress for 2011. The authors are academics from Columbia University's Earth Institute. Here's the abstract from the article, which basically says it all: "A growing partisan divide in Congress stalled almost all new federal climate policy in 2011. The divide frustrated efforts to pass a cap-and-trade carbon permitting system, spawned a battle between the US Environmental Protection Agency (EPA) and Congress, pushed most substantive climate change policy down to the municipal level and hindered US ability to effectively negotiate an international climate agreement. Amid the federal partisan wrangling, US cities have enacted far-sighted climate policy initiatives, and the growing cost of fossil fuels has stimulated investment in renewable energy, edging the country closer to commercially viable alternatives to fossil fuels. These trends could help provide an alternate route to climate mitigation, even without international treaties or national legislation. But the inevitable shift from fossil fuels to renewable energy sources would be greatly hastened by federal action to tax carbon dioxide emissions and use the revenue generated to support alternative energy technologies. That action is extremely unlikely to occur unless climate change comes to be seen in the United States as a practical, rather than ideological, issue."

**Doniger, D. D., Herzog, A. V., & Lashof, D. A. (2006). An Ambitious, Centrist Approach to Global Warming Legislation. *Science, New Series*, 314(5800), 764–765.**

A short article with a graphic demonstrating how a delay in action on climate change would result in the need for more drastic measures, which would create a harsher economic impact. Earlier action allows for a more gradual reduction in CO2 levels. The article also presents a response to analysts who posit that delay will save money by allowing for better technology to be developed. The article states that this theory is implausible because 1) this would require new technology to be implemented at a faster rate that can be reasonably expected, 2) without immediate hope for return on investment, there will be little incentive for the private sector to invest in developing these technologies, and 3) a new generation of conventional power plants, vehicles, etc. will be built in the meantime, burdening the next generation with the costs of

reducing CO2 levels.

**Dunne, N., & McCord, N. (2001, May 10). Pennsylvania wary about return of dirty old king coal: The state faces an uncertain future as the Bush administration attempts to ease the energy crunch. *Financial Times (London,England)*, p. Pg. 18.**

News article describing the blight and devastation that coal mining has caused in Pennsylvania. The article is written in reaction to then-President Bush's expected plan for "tackling the energy crunch" with "clean coal" from American sources, such as Pennsylvania. Economic impact is also touched on briefly - "coalfields and poverty go hand-in-hand in Pennsylvania."

**Ebi, K. L., Mills, D. M., Smith, J. B., & Grambsch, A. (2006). Climate Change and Human Health Impacts in the United States: An Update on the Results of the U.S. National Assessment. *Environmental Health Perspectives*, 114(9), 1318–1324. doi:10.1289/ehp.8880**

Average-length article examines the public health risks posed by Global Warming in the U.S. in five major categories: impacts of extreme weather/temperatures, air pollution, water and food borne illness, and vector and rodent borne disease. The authors conclude that research and data done since the 2000 U.S. National Assessment of health risks related to global warming confirms the threat levels found by the original study. This review article concludes by supporting the first HSA (Health Sector Assessment) findings that "the net health impact of climate change on the U.S. population is uncertain" but admits that certain risks were better understood in 2006 than in 2000.

**Environmental Protection Agency. (2010). *Climate Change Indicators in the United States* (p. 76). Washington DC: Environmental Protection Agency. Retrieved from [http://www.epa.gov/climatechange/indicators/pdfs/ClimateIndicators\\_full.pdf](http://www.epa.gov/climatechange/indicators/pdfs/ClimateIndicators_full.pdf)**

Glossy, informative report from the EPA profiling several major indicators of the climate change crisis. Includes easy-to-read charts, attractive images and clear organizational structure. Environmental indicators and risks discussed in this report include: heat waves, drought, tropical cyclone intensity, Arctic Sea Level, glaciers, snowpack, heat-related deaths, growing season length, leaf and bloom dates, bird wintering ranges, and more. Report builds on a basic understanding of concepts like greenhouse gases and global warming and introduces a lay audience to scientific data and human risks that indicate global warming.

**Frumhoff, P. C., & McCarthy, J. J. (2007). *Confronting Climate Change in the U.S. Northeast* (p. 160). Northeast Climate Impacts Assessment. Retrieved from <http://www.climatechoices.org/assets/documents/climatechoices/confronting-climate-change-in-the-u-s-northeast.pdf>**

Very useful, easy-to-understand report of the NECIA (Northeast Climate Impacts Assessment)

group. Outlines possible dangers of climate change along the Northeast region. Details impacts on coasts, agriculture, marine industry, winter recreation, human health, forests, and water supply. Provides many helpful charts, graphics and images. Proposes solutions and strategies for states in this region to mitigate and adapt to climate change.

**Frumhoff, P. C., Mccarthy, J. J., Melillo, J. M., Moser, S. C., Wuebbles, D. J., Wake, C., & Spanger-siegfried, E. (2008). An Integrated Climate Change Assessment for the Northeast United States. *Mitigation and Adaptation Strategies for Global Change*, 13(5-6), 419–423. doi:10.1007/s11027-007-9138-x**

Overview of a Synthesis Report of the Northeast Climate Impacts Assessment (NECIA), a group designed to provide scientific recommendations for mitigating consequences of climate-change to lawmakers in nine Northeastern states from NJ & PA north to Maine. This overview is probably less useful than the synthesis report itself would be.

**Grundstein, A., & Dowd, J. (2011). Trends in Extreme Apparent Temperatures over the United States, 1949-2010. *Journal of Applied Meteorology & Climatology*, 50(8), 1650–1653. doi:10.1175/JAMC-D-11-063.1**

This study examines trends in the frequency of days with extreme maximum and minimum apparent temperatures across the United States for 1949–2010. The authors find that by 2010 there were 12 more days with extreme apparent temperatures than there were in 1949. The authors stress human health consequences and incidents of heat-related mortality as the impetus for this study. They use an "apparent temperature" index which accounts for both temperature and humidity. A scholarly article that is short and pretty easy to follow.

**Harley, C. D. G. (2011). Climate Change, Keystone Predation, and Biodiversity Loss. *Science*, 334(6059), 1124–1127. doi:10.1126/science.1210199**

Useful article that discusses the effects of global warming on various animal species and interspecies reactions and biodiversity would be negatively affected by climate change. Concentrated on mussel populations in the Salish Sea in the Strait of San Juan de Fuco. Authors are from the Department of Zoology and Biodiversity Research Centre, University of British Columbia.

**Hughes, T. P., Baird, A. H., Bellwood, D. R., Card, M., Connolly, S. R., Folke, C., Grosberg, R., et al. (2003). Climate Change, Human Impacts, and the Resilience of Coral Reefs. *Science, New Series*, 301(5635), 929–933.**

Now that the impact of climate change on the bleaching of coral reefs is believed incontrovertible, it is time to look at future impacts on coral reefs, which may include the weakening of coral skeletons, an increase in reef disease and a shortened recovery time between tropical storms. Impacts of the damage to coral reefs on human industry are

explored. 30% of reefs are already seriously damaged and nearly 60% may be damaged by 2030. The ability of reefs to adapt to climate change varies by species.

**IPCC. (2012). *Renewable Energy Sources and Climate Change Mitigation. Special Report of the Intergovernmental Panel on Climate Change* (p. 1088). Cambridge University Press. [http://srren.ipcc-wg3.de/report/IPCC\\_SRREN\\_Full\\_Report.pdf](http://srren.ipcc-wg3.de/report/IPCC_SRREN_Full_Report.pdf)**

A comprehensive and lengthy report which includes many colorful maps charts, graphs, illustrations, diagrams and infographics detailing the Intergovernmental Panel on Climate Change (IPCC) Working Group's assessment of scientific literature on renewable energy technologies and how they may reduce greenhouse gas emissions. The Report covers not only many types of renewable energy technology (biofuels, solar, etc) and their implementation and integration with current and future infrastructure, but also the policymaking, physical and financial barriers faced in the field.

**Jaramillo, C., Ochoa, D., Contreras, L., Pagani, M., Carvajal-Ortiz, H., Pratt, L. M., Krishnan, S., et al. (2010). Effects of Rapid Global Warming at the Paleocene-Eocene Boundary on Neotropical Vegetation. *Science*, 330(6006), 957–961. doi:10.1126/science.1193833**

This study examines three tropical terrestrial sites during The Late Paleocene-Eocene Thermal Maximum period (PETM), which occurred 56.3 million years ago and, lasting about 100,000 to 200,000 years, was one of the most abrupt global warming events of the past 65 million years. It is estimated that the average temperature increased by about 3°C in the Northern Neotropics, and that during the peak of global warmth mean temperatures were between 31° and 34°C (±2°C). Today most tropical rainforests are found at below below 27.5°C, and "Many have argued that tropical communities live near their climatic optimum and that higher temperatures could be deleterious to the health of tropical ecosystems." Per capita rates of extinction among plant species are estimated to have increased significantly during PETM.

**Kerr, R. A. (2001). Rising Global Temperature, Rising Uncertainty. *Science*, 292(5515), 192–194. doi:10.1126/science.292.5515.192**

This article provides an interesting snapshot overview of the scientific community's uncertainty about global warming and the attribution of causality in 2001. Even in that atmosphere of uncertainty, climate researchers are "steadfast that the threat justifies action."

**Kerr, R. A. (2005). Millennium's Hottest Decade Retains Its Title, for Now. *Science*, 307(5711), 828a–829a. doi:10.1126/science.307.5711.828a**

Article describes feuding between certain scientists about a disputed piece of data which may or may not have corrupted a study of the climate from the last thousand years. It explains the claims made and the refutations made against them, but closes by stating that no matter who

is right, the temperature from the 1990's on has been the highest on the record

**Kerr, R. A. (2007). Global Warming Coming Home to Roost in the American West. *Science*, 318(5858), 1859–1859. doi:10.1126/science.318.5858.1859**

Short article about changes that have been taking place in the American West which impact the year-round availability of fresh water. In one study models were made isolating just that region and only when Human sourced greenhouse effect was input did the models reflect what has actually been taking place. This proves, almost beyond the shadow of a doubt, that these warming patterns are related to Human activity. Because the warm/dry season has been extended there is more water available as rain, and not as much available as run-off. This means that there is not year-round access to the fresh water that is needed, and this impacts everything from bull trout to Human residents.

**Kerr, R. A. (2007). Global warming is changing the world. *Science*, 316(5822), 188.**

Very accessible journalistic article that sums up the findings of the Intergovernmental Panel on Climate Change while declared "in no uncertain terms" that humans were responsible for the rising levels of greenhouse gases and that climate change was accountable for various changes and disruptions in geological and biological activities. This report contains many examples of species that have been disruptive as well as extreme weather phenomenon that are likely to increase across the world including droughts, arctic permafrost thaw, coastal flooding, decline of coral reefs, and and drying out of the mediterranean region. This news report also briefly discusses the IPCC's methodology: "To make it official, IPCC authors considered 29,000 series of observations from 75 studies. Of those series, 89% showed changes—glaciers receding or plants blooming earlier, for example—consistent with a response to warming."

**Kerr, R. A. (2007). How Urgent Is Climate Change? *Science*, 318(5854), 1230–1231. doi:10.1126/science.318.5854.1230**

The article bemoans the fact that political delays may cost us dearly when dealing with global warming. Many scientists who are looking at new models and data (as well as the findings of the Intergovernmental Panel on Climate Change) have begun to speak out in favor of dealing with the problem immediately so as to avoid absolute catastrophe over the next century. Many studies are referenced and scientists quoted.

**Kerr, R. A. (2007). Is a Thinning Haze Unveiling the Real Global Warming? *Science*, 315(5818), 1480–1480. doi:10.1126/science.315.5818.1480**

Short article about the thinning of a layer of haze that surrounds the planet, bouncing much of the sun's energy back out into space. The findings come from instruments aboard a weather satellite, and are under much scrutiny as the data was picked up by such a primitive tool and there is real measure of its reliability. However the thinning does seem to correspond with the

warming that has taken place which has been at a faster and greater level over the past few decades than was predicted.

**Kerr, R. A. (2007). Pushing the Scary Side of Global Warming. *Science*, 316(5830), 1412–1415. doi:10.1126/science.316.5830.1412**

Article stands out as being somewhat critical of the Intergovernmental Panel on Climate Change (IPCC), stating that the group is limited by its process and its use of models exclusively. Several groups of scientists are now pointing out that all of the data coming in about how much the planet has warmed and how high the sea level has risen fall in the upper reaches of the IPCC's predictions. If things continue on as they are, the IPCC's numbers will be put to shame by reality and we will see devastating coastal flooding and other ill effects for which we will be unprepared if all we pay attention to are scientists who play it safe when it comes to numbers.

**Kerr, R. A. (2008). Another Side to the Climate-Cloud Conundrum Finally Revealed. *Science*, 319(5865), 889a–889a. doi:10.1126/science.319.5865.889a**

Short article describing a problem that climate modelers have faced for decades: clouds. Now new research suggests that scientists have been trying to model the wrong things when it comes to studying the effects of and on clouds when it comes to global warming. New models look at the clouds themselves and on a much shorter scale and promise to solve many of the past several decades worth of questions.

**Kerr, R. A. (2008). Climate Change Hot Spots Mapped Across the United States. *Science*, 321(5891), 909–909. doi:10.1126/science.321.5891.909**

Short article describes what is in store for the United States if some of the climate models hold true. It goes on to say that in some areas of the country there have already been changes that can be seen such as in the American Southwest hot spots. The Intergovernmental Panel on Climate Change is cited as are several other reports. Contains one color map and a photograph.

**Kerr, R. A. (2008). Hurricanes Won't Go Wild, According to Climate Models. *Science*, 320(5879), 999a–999a. doi:10.1126/science.320.5879.999a**

Short article about global warming models that predict a decrease or at least a slowing in the increase of Atlantic tropical cyclones rather than the drastic increase that many have feared. It then goes on to say that many other models show a higher increase and that the data remains a bit cloudy to come to any serious conclusions. Includes one chart.

**Kerr, R. A. (2008). Mother Nature Cools the Greenhouse, but Hotter Times Still Lie Ahead. *Science*, 320(5876), 595–595. doi:10.1126/science.320.5876.595**

Short article describing climate models that have actual sea surface temperatures added to them for the beginning years that the model maps. Many of these models show that global warming we slow and then cease for the most part in coming years, but that it will start up again soon after. It points out that while things may seem to go back to normal, thus causing climate change critics to cheer and proponents to temporarily eat their words, the atmosphere will indeed begin to warm rapidly again after a few years.

**Kerr, R. A. (2008). OCEANOGRAPHY: Global Warming Throws Some Curves in the Atlantic Ocean. *Science*, 322(5901), 515a–515a. doi:10.1126/science.322.5901.515a**

Short article explains that ocean salinity levels are being lowered by global warming and the regular currents are being affected as a result. By looking at simulated models of this new data and adding or subtracting greenhouse gasses as a factor researchers have been able to pin down levels of Human causation. It is possible that the sure and steady “conveyor belt” currents of the ocean will soon be a thing of the past.

**Kerr, R. A. (2009). Arctic Summer Sea Ice Could Vanish Soon But Not Suddenly. *Science*, 323(5922), 1655–1655. doi:10.1126/science.323.5922.1655**

A short look at when (and whether) the Arctic will be completely free of summer sea ice. While many groups (including the Intergovernmental Panel on Climate Change, IPCC) have run dozens of climate models on just this question. Now two researchers have pared their own findings down to a few of the most likely models and it does not look good. While polar bears (which rely on the ice) are not going to see the complete disappearance of sea ice in the next few years, it will most likely happen in 20-30.

**Kintisch, E. (2005). Global Warming Skeptic Argues U.S. Position in Suit. *Science*, 308(5721), 482–482. doi:10.1126/science.308.5721.482**

This news article covers the story of how in 2006 the US Government enlisted statements from David Legates, an outspoken critic of global warming, in order to justify its case that funding of overseas energy projects did not hurt US interests because “[t]he basic connection between human induced greenhouse gas emissions and observed climate itself has not been established.” Legate’s statements challenging scientific evidence of rising temperature and pointing to natural variability are far afield from scientific consensus.

**Kintisch, E. (2007). Tougher Ozone Accord Also Addresses Global Warming. *Science*, 317(5846), 1843–1843. doi:10.1126/science.317.5846.1843**

Short article discusses a meeting of the United Nations Environment Programme at which they discussed strengthening the Montreal Protocol on ozone layer protection. The meeting not only discussed the usual ozone related threats but also those that create global warming

as well. Some history of the Montreal Protocol is given and some of the results of the latest meeting including complaints from some about the United States insistence on continuing the use of a fumigant used by farmers that is harmful to the ozone layer. Contains one chart and a photograph.

**Kintisch, E., & Kerr, R. A. (2007). Global Warming, Hotter Than Ever. *Science*, 318(5858), 1846–1847. doi:10.1126/science.318.5858.1846**

This short article highlights evidence that global warming and climate change are serious issues. Opening with the findings of the United Nations' Intergovernmental Panel on Climate Change which stated that not only was global warming occurring, but that humans are causing at least some of it. It also highlights scientific findings about ice shelf melt-rates and the political struggle to pass environmentally friendly legislation.

**Kintisch, E. (2009). New Push Focuses on Quick Ways to Curb Global Warming. *Science*, 324(5925), 323a–323a. doi:10.1126/science.324.5925.323a**

Short article pegs black carbon and tropospheric ozone as some of the short-lived pollutants that we should be cutting back drastically on in order to slow global warming and give us more time to solve the climate change problems that we are facing. Though these pollutants make up less of the problematic emissions than CO<sub>2</sub>, they also take far less time to clear out of the air and in some cases are more potent than CO<sub>2</sub> as a greenhouse gas. One scientist urges the disuse of aerosols as he believes they account for much of the arctic temperature increase.

**Kintisch, E. (2009). Projections of Climate Change Go From Bad to Worse, Scientists Report. *Science*, 323(5921), 1546–1547. doi:10.1126/science.323.5921.1546**

A short article covering a meeting in Copenhagen of 2,000 scientists who came together two years after the authoritative Intergovernmental Panel on Climate Change (IPCC) to share findings. The situation is grim: the worst predictions of the IPCC's report are in fact what is happening and some of the worst case scenarios do not even cover what is now taking place.

**Korner, C., & Basler, D. (2010). Phenology Under Global Warming. *Science*, 327(5972), 1461–1462. doi:10.1126/science.1186473**

A technical (but understandable) article about the effects of global warming on the budding and leafing cycles of plants. Many examples are given as well as some overall information on how new periods of hot and cold temperatures can wreak havoc on plant's ability to know spring from fall. Such cycles being thrown off kilter would also affect soil nutrients and other factors and, while they may lead to certain species invading new territories, will result in fewer plants and trees surviving on the whole.

**Lobell, D. B., Burke, M. B., Tebaldi, C., Mastrandrea, M. D., Falcon, W. P., & Naylor, R. L. (2008). Prioritizing Climate Change Adaptation Needs for Food Security in 2030. *Science*, 319(5863), 607–610. doi:10.1126/science.1152339**

This article examines 12 food-insecure regions of the world to make recommendations of what measures will be required for these regions to survive the agricultural impacts of climate change by 2030. Contains useful chart listing these 12 regions, number of malnourished people, and the crop yield predicted by the statistical model employed by the researchers. Also includes distribution graphs for specific crops. Good article that illustrates the human and agricultural impacts of global warming. This article takes climate change as a given and is focused on what can be done to mitigate disasters in the poorest areas of the world. "Results indicate South Asia and Southern Africa as two regions that, without sufficient adaptation measures, will likely suffer negative impacts on several crops that are important to large food-insecure human populations."

**Luber, G., & Hess, J. (2007). Climate Change and Human Health in the United States. *Journal of Environmental Health*, 70(5), 43–46.**

Well-written overview report touches on the major known health impacts that could be brought on in the U.S. due to climate change. The most serious include: catastrophic weather events, aging population will be more vulnerable to extreme temperatures, chronic diseases may increase in severity, outbreaks of vectorborne diseases may become more frequent, food supply will be disrupted leading to hunger, mental health stresses due to weather disasters and economic hardship. Proposes that migration of "environmental refugees" from Mexico & South America may increase as populations there come north due to economic, agricultural, and health related consequences of climate change. Provides predictions of environmental health consequences for each region of the U.S. Reads a bit more like opinion than research and does not make any proposals on how to address specific public health concerns other than to "shift public dialog on climate change" to emphasis the public health risks.

**Meserve, R. A. (2004). Global Warming and Nuclear Power. *Science*, 303(5657), 433–433. doi:10.1126/science.303.5657.433**

Short article reviewing an MIT study on the future of nuclear power as an alternative, carbon-free fuel. Reads as an opinion piece promoting nuclear power as a solution to reducing fossil fuels and carbon emissions. Advocates an educational campaign to make Americans see the benefits of nuclear power as well as the risks.

**Molnar, J. J. (2010). Climate Change and Societal Response: Livelihoods, Communities, and the Environment. *Rural Sociology*, 75(1), 1–16. doi:10.1111/j.1549-0831.2010.00011.x**

Working under the assumption that climate change will be the the largest and most compelling issue that will reshape life on our planet" in this century, this article assesses current lines of research and theory addressing the sociological aspects of climate change on the rural

population. "As climate-change impacts and policy responses begin to impinge on rural populations, the first line of resistance and participation will be the rural community" -- the key to mitigating climate change is as much sociological as it is scientific.

**Nordhaus, W. D. (2001). CLIMATE CHANGE: Global Warming Economics. *Science*, 294(5545), 1283–1284. doi:10.1126/science.1065007**

Written shortly after the signing of the Kyoto-Bonn agreement, this article evaluates the monetary cost of the Kyoto Protocol and some of the international economics and politics that may limit its effectiveness. The fact that the United States under George W. Bush did not sign the Protocol was a large loss of revenue for the project. Author also questions whether wealthy signers of the accord would be willing to divert funds to Russia and Eastern Europe for the reduction of carbon emissions. The author concludes: "Given the accord's high costs and small benefits, it might be preferable to redesign the accord along the lines of a globally harmonized carbon tax." Includes graphics showing prices and benefits.

**Normile, D. (2000). Some Coral Bouncing Back From El Nino. *Science*, 288(5468), 941a–942. doi:10.1126/science.288.5468.941a**

Brief review article describes how Indian and Pacific coral reefs were recovering after dangerous "bleaching" caused by El Nino in 1998. Discusses a hypothesis that new coral may be able to recover from the algae-born disease more quickly than adult coral. Scientists studying the coral reef's recovery say that global warming could trigger more episodes of bleaching and interrupt the ten years the coral need to fully recover.

**Nursey-Bray, M., Pecl, G. T., Frusher, S., Gardner, C., Haward, M., Hobday, A. J., Jennings, S., et al. (2012). Communicating climate change: Climate change risk perceptions and rock lobster fishers, Tasmania. *Marine Policy*, 36(3), 753–759. doi:10.1016/j.marpol.2011.10.015**

This article addresses the challenges of communicating the risks associated with climate change to culturally diverse groups, such as Tasmanian rock lobster fishers. Results showed that the fishermen were more greatly concerned by business risks, such as debt. 80% of those surveyed either believed that climate change was not occurring, or was part of a natural cycle.

**Oerlemans, J. (1994). Quantifying Global Warming from the Retreat of Glaciers. *Science*, 264(5156), 243–245. doi:10.1126/science.264.5156.243**

This short study explains that measuring the yearly gain or loss of mass at the surface of a glacier is the best way to measure how climate change has affected glaciers. The study concludes that over the last 100 years, glaciers have been retreated across the planet and that this retreat is caused by a trend of global warming over the last century.

**Overpeck, J. T., Meehl, G. A., Bony, S., & Easterling, D. R. (2011). Climate Data Challenges in the 21st Century. *Science*, 331(6018), 700–702.**

This article addresses how, thanks in part to new tools, such as active remote sensing mechanisms in satellites, the volume of global climate data being captured is expanding rapidly. There are challenges in archiving, preserving, and sharing this data openly. However, the potential use of these huge data sets to create complex model results to lend robustness and credibility to the work of climate scientists are promising. The article makes the argument that the future paradigm in climate data relies on international elimination of data-sharing restrictions.

**Perera, L. (2011). Climate Change May Be Hazardous to Your Health. *Catalyst (1539-3410)*, 7–9.**

Concise, journalistic-style article contains some useful data from cited medical models projecting increases in respiratory illnesses due to global warming and ozone pollution. Includes a useful chart of nine major urban states with high occurrences of acute respiratory symptoms and the corresponding costs to treat those systems. The article makes a financial as well as public health case for reducing greenhouse gas emissions and regulating air quality to reduce incidents of asthma and other respiratory illnesses that are exacerbated by pollution and climate change.

**Post, E., Forchhammer, M. C., Bret-Harte, M. S., Callaghan, T. V., Christensen, T. R., Elberling, B., Fox, A. D., et al. (2009). Ecological Dynamics Across the Arctic Associated with Recent Climate Change. *Science*, 325(5946), 1355–1358. doi:10.1126/science.1173113**

Discusses the sudden, direct changes in biodiversity in the arctic, mentioning the impacts of global warming on specific plant and animal species including: arctic foxes, polar bears moths, fish, shrubs, etc. Also addresses factors like rapid retreat of sea and lake ice, droughts, glacial melt etc. Includes plenty of maps, charts, plots, and pictures of arctic animals. Although very scientific, this article has lots of accessible data that make a clear case for the dangers posed by climate change to Arctic species.

**Raloff, J. (2011). Warming Arctic Comes Unglued. *Science News*, 179(11), 13.**

According to a 10-region regional assessment, arctic coastlines are eroding at the average rate of a half a meter annually, with some spots exceeding eight meters annually. The article cites Volker Rachold of the International Arctic Science Committee in Potsdam, Germany, which co-published the new report along with the Land- Ocean Interactions in the Coastal Zone Project, the Arctic Council's Arctic Monitoring and Assessment Programme, and the International Permafrost Association. Rachold says that Arctic coasts are particularly vulnerable to erosion as a result of global warming because the ice holds them together.

**Running, S. W. (2006). Is Global Warming Causing More, Larger Wildfires? *Science, New Series, 313*(5789), 927–928.**

Review article suggests that wild fires will increase due to global warming in the Western U.S. with potentially disastrous economic impacts. Finding the source article could be useful, but this author provides a concise summary with a reasonable amount of statistical and scientific data to back up his claims.

**Sabin, P. (2011, May). From King Coal to Carbon Tax: A Historical Perspective on the Energy and Climate-Change Debate. Rocky Mountain Institute.**

Very accessible article looks at climate change policy in the U.S. from a historical perspective and attempts to describe how views of past attempts and laws related to climate change influence what changes Washington is or is not willing to try in the present. Also attempts to debunk historical "myths" that anti-alternative energy advocates invoke to distort the political debate and block green energy policies.

**San Francisco Planning and Urban Research Association. (2011). *Climate Change Hits Home- SPUR Report* (pp. 1–40). Retrieved from [www.spur.org](http://www.spur.org)**

Official policy report from the San Francisco Planning and Urban Research Association (SPUR). This is a "climate change mitigation plan" for the SF Bay area. Written for a lay audience, this report focuses on three specific risks of global warming and what the SF Bay area can do to lessen the risks of: heat waves, drought/wildfire/extreme storms, and sea level rise. SPUR makes 30 recommendations to local agencies on how to handle public health, transportation, biodiversity, and energy concerns related to global warming. Includes very useful, pretty graphics showing, for example, coastal areas of the Bay Area that will be affected by sea level rise. The steps recommended in this report are part of urban planning but also disaster relief.

**Sandel, B., Arge, L., Dalsgaard, B., Davies, R. G., Gaston, K. J., Sutherland, W. J., & Svenning, J.-C. (2011). The Influence of Late Quaternary Climate-Change Velocity on Species Endemism. *Science, 334*(6056), 660–664. doi:10.1126/science.1210173**

A fairly technical report with great graphics and captions that explain the graphics adequately. This report maps both past (dating to the Last Glacial Maximum) and future migration schemes, highlighting areas of the planet where species are more or less prone to migrate. Comparing birds, mammals, and amphibians, the report concludes that the species most at risk of extinction are those which do not disperse/migrate very much and live in regions that previously had very a stable climate but now face high levels of climate change. In other words, species living in places like the Arctic, which was climatically stable for years but now faces global warming, are the most vulnerable because they have the lowest abilities to migrate to a more suitable climate.

**Service, R. F. (2008). Study Fingers Soot as a Major Player in Global Warming. *Science*, 319(5871), 1745–1745. doi:10.1126/science.319.5871.1745**

While carbon-dioxide is the number one contributor to global warming, the number two has been identified as black carbon and soot particulates. The article posits that reports from the Intergovernmental Panel on Climate Change (IPCC) and other such groups have underestimated the extent to which these sooty particulates are problematic because they do not take into account the aerosols and other things the soot mixes with and rides into the atmosphere which cause damage of their own. While it is difficult to curb soot levels it also takes far less time (a week rather than a millennium) for the damage to reverse itself.

**Sinervo, B., Mendez-de-la-Cruz, F., Miles, D. B., Heulin, B., Bastiaans, E., Villagran-Santa Cruz, M., Lara-Resendiz, R., et al. (2010). Erosion of Lizard Diversity by Climate Change and Altered Thermal Niches. *Science*, 328(5980), 894–899. doi:10.1126/science.1184695**

Interesting article examines lizard populations in Mexico and finds that since 1975, 12% of local populations have gone extinct. The study estimates that 4% of local lizard populations have gone extinct worldwide, but by 2080, local extinctions are projected to reach 39% worldwide, and entire species extinctions may reach 20%. With maps highlighting local extinctions of lizards and a chart listing all the lizard species that are extinct or threatened, this is a very concrete article with information that is easy to share and understand.

**Slangen, A. B. A., Katsman, C. A., Wal, R. S. W., Vermeersen, L. L. A., & Riva, R. E. M. (2012). Towards regional projections of twenty-first century sea-level change based on IPCC SRES scenarios. *Climate Dynamics [Clim. Dyn.]*. Vol. 38, 38(5-6), 1191–1209. doi:10.1007/s00382-011-1057-6**

Technical but moderately easy-to-read article discusses models for determining sea-level changes as a result of global warming. Contains many useful, full color diagrams and maps of the U.S. coasts depicting sea-level predictions in various scenarios. Authors used a combination of several different mathematical models to get a more accurate, overall picture of how sea-levels will change, stressing that using just one model is not enough. The authors conclude that global warming will occur and will affect coastal sea levels. Since this article is produced under an Open Access Creative Commons Noncommercial License, a university library can distribute it freely as long as it's for educational purposes.

**Stokstad, E. (2004). States Sue Over Global Warming. *Science*, 305(5684), 590b–590b. doi:10.1126/science.305.5684.590b**

A very short news article about a lawsuit brought against several big polluters by the attorneys general of eight states. Article discusses previous litigation and the reasons this suit was unlikely to be won by the states.

**Stone, R. (1995). Global warming. If the mercury soars, so may health hazards. *Science*, 267(5200), 957–958. doi:10.1126/science.7863337**

Short, helpful article. Contains a chart showing major tropical diseases likely to spread with global warming including: Malaria, Schistosomiasis, "sleeping sickness," Dengue, and Yellow Fever. Describes research showing cholera outbreaks in the early 1990s may have been tied to El Nino. Represents an early examination of literature considering the health risks of climate change. One major risk is that changing temperatures will change the migration vectors of insects, such as mosquitoes, spreading tropical diseases to climates that were previously safe.

**Stone, R., & Bohannon, J. (2006). U.N. Conference Puts Spotlight on Reducing Impact of Climate Change. *Science*, 314(5803), 1224–1225. doi:10.1126/science.314.5803.1224**

Briefly describes a U.N. conference on how to deal with all the problems the Human species is facing due to climate change. Given that global warming will at this point continue even if we cease all use of fossil fuels, some measures are recommended for mitigating the damage. Reforestation, dealing with increases in disease and even evacuating the world's smallest island nation which faces near certain obliteration are all recommended. The key word now is adapt.

**Taubes, G. (1997). Apocalypse Not. *Science*, 278(5340), 1004–1006. doi:10.1126/science.278.5340.1004**

This article argues that all of the studies that discuss the impact that climate change will have on the spread and proliferation of diseases are theoretical at best and simple fear-mongering and attention seeking at worst. The argument is made that while it is somewhat more likely that certain diseases will be aided by warmer and wetter climates, the increase will not be great and that human behavior and sanitation levels play a larger role than climate. While the article makes the claim that climate change will not bring about devastating spread of disease, much information about studies that claim the opposite are given, making the article useful for those interested in the other side of the argument as well.

**Townsend, A. R. V., Peter M. Vitousek and Benjamin Z. Houlton (2012). The Climate Benefits of Better Nitrogen and Phosphorus Management. *Issues in Science & Technology*, 28(2), 85–91.**

Much of the focus in climate studies has been on the carbon cycle, but this article addresses the unsustainable transformation of the nitrogen and phosphorus cycles over the past century. In part due to inefficient use of the elements in agriculture, "we have tripled the rate at which biologically available phosphorus enters ecosystems," with consequences that include "effects on climate, air pollution, acid rain, marine and freshwater eutrophication, biodiversity loss, and the stimulation of some invasive species." Includes a discussion of how smart nitrogen management could mitigate the effects of climate change, while providing nitrogen and

phosphorus fertilizer to regions such as Sub-Saharan Africa, "lessen[ing] food scarcity and initiat[ing] cascading social, economic, and environmental benefits."

**Trenberth, K. (2005). Uncertainty in Hurricanes and Global Warming. *Science*, 308(5729), 1753–1754. doi:10.1126/science.1112551**

The article discusses the increase in hurricanes which have formed over the past century and many of the factors that may contribute to this uptick. While it is certain that there have been more per season lately, many other possible triggers are cited. The article does not rule out global warming and Human actions as part of the problem.

**U.S. Global Change Research Program, American Association for the Advancement of Science, & National Oceanic and Atmospheric Administration. (2009). *Climate Literacy: The Essential Principles of Climate Sciences* (p. 17). Washington DC. Retrieved from <http://www.globalchange.gov/resources/educators/climate-literacy>**

This accessible, basic guide from the USGCRP is designed to explain climate change to a lay audience of "individuals and communities." It provides a glossary of key terms like global warming, carbon cycle, and mitigation and distinguishes between "likely, very likely, and virtually certain." Points and concepts are explained in easy-to-read bullets and short paragraphs accompanied by colorful photographs. The report summarizes its purpose here: "*Climate Literacy: The Essential Principles of Climate Science* presents information that is deemed important for individuals and communities to know and understand about Earth's climate, impacts of climate change, and approaches to adaptation or mitigation."

**Wang, T., & Overgaard, J. (2007). The Heartbreak of Adapting to Global Warming. *Science*, 315(5808), 49–50. doi:10.1126/science.1137359**

Provides a concise evaluation of a study by Pörtner and Kunst on the extent of the physiological limitations of fish to adapt to climate change. The results of the study suggest that the overall population of fish declines at a lower temperature change than that which affects the ability of individual fish to survive: "Thus, lowered scope for growth and reproduction, rather than heat-induced death per se, appears to cause the population decline."

**Wentz, F. J. (2007). Forecasting Global Warming's Monumental Impact. *Science*, 316(5831), 1547a–1547a. doi:10.1126/science.316.5831.1547a**

A very short newspaper article about the Vulnerability Atlas which highlights which historical landmarks are at the greatest risk from climate change and why. Two experts are quoted and some information is given about the Noah's Ark project which produced the Atlas.

**Wentz, F. J., Ricciardulli, L., Hilburn, K., & Mears, C. (2007). How Much More Rain Will Global Warming Bring? *Science*, 317(5835), 233–235. doi:10.1126/science.1140746**

This article highlights a discrepancy between climate change models, which suggest that precipitation rates are not tied to the total amount of water in the atmosphere, and scientific observation of past events, which suggest that the two are approximately relational. This suggests that precipitation increases may be higher than models are predicting.

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### **Advanced Reading<sup>2</sup>**

**Ljungqvist, F. C. (2010). A new reconstruction of temperature variability in the extra-tropical northern hemisphere during the last two millennia. *Geografiska Annaler: Series A, Physical Geography*, 92(3), 339-351.**

This highly technical study reconstructs extra-tropical Northern Hemisphere temperatures over the past two millennia. Records are used from various locations, some never previously used in previous large scale temperature studies. All sites are shown on a map and there are several charts and graphs as well. The study is compared to some previous studies and some of the results show temperature events that were previously unknown.

**Ackerly, D. D., Loarie, S. R., Cornwell, W. K., Weiss, S. B., Hamilton, H., Branciforte, R., & Kraft, N. J. B. (2010). The geography of climate change: implications for conservation biogeography. *Diversity & Distributions*, 16(3), 476–487. doi:10.1111/j.1472-4642.2010.00654.x**

A look at the climates of Nevada and California and how they will be affected by two different climate change scenarios: warmer and wetter or warmer and drier. Article is highly technical and includes many colorful maps, charts and graphs. There is a call for more studies on spatial heterogeneity as climate-to-climate buffer zones and more resources to conduct such studies.

**Cardenas, M. L., Gosling, W. D., Sherlock, S. C., Poole, I., Pennington, R. T., & Mothes, P. (2011). The Response of Vegetation on the Andean Flank in Western Amazonia to Pleistocene Climate Change. *Science*, 331(6020), 1055–1058. doi:10.1126/science.1197947**

Very technical report seeks to describe the changes to prehistoric vegetation in the Amazon over time. The authors analyze pollen fossils to create a "palaeoenvironmental reconstruction" of forest vegetation. They conclude that global temperature changes in the past have led to dramatic changes in the vegetation living in the Amazon and predict that future global warming

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<sup>2</sup> These "advanced" articles are from scholarly, scientific journals (mostly original studies) and require some technical knowledge and background to fully understand. They tend to address more specific, localized ecological concerns than the "general" articles.

will "induce a reorganization of Amazonian vegetation associations," i.e.: greatly alter the plant species biodiversity and ecosystem in the Amazon rainforest.

**Davis, S. J., Caldeira, K., & Matthews, H. D. (2010). Future CO2 Emissions and Climate Change from Existing Energy Infrastructure. *Science*, 329(5997), 1330–1333. doi:10.1126/science.1188566**

Pretty technical article uses projections of industry and carbon-dioxide emission levels to confirm that the entire CO2-emitting infrastructure will continue to expand--and continue to increase global warming-- unless major changes can be made in both the energy & political sectors.

**Delworth, T. L. (2000). Simulation of Early 20th Century Global Warming. *Science*, 287(5461), 2246–2250. doi:10.1126/science.287.5461.2246**

In trying to account for the rise in global temperature in the early 20th century (1925-1944), researchers created several models using varying amounts of human generated factors. One of the models turned out to follow almost exactly what actually occurred, making it a likely candidate for more accurate predictions of the future. This is a statistics- and math-heavy article.

**English, P. B., Sinclair, A. H., Ross, Z., Anderson, H., Boothe, V., Davis, C., Ebi, K., et al. (2009). Environmental Health Indicators of Climate Change for the United States: Findings from the State Environmental Health Indicator Collaborative. *Environmental Health Perspectives*, 117(11), 1673–1681. doi:10.1289/ehp.0900708**

This is a thorough and very academic review article that seeks to propose a set of standardized public health indicators related to climate change. Provides a useful list of all the ways climate change affects public health. The article first lists several environmental indicators/consequences of climate change and cites relevant climate change data from government agencies. Next, the article looks at mortality and injury rates and other public health indicators related to these phenomena. Includes a clear table of environmental and health indicators and lists of datasets showing how useful these indicators would be.

**Etterson, J. R. (2001). Constraint to Adaptive Evolution in Response to Global Warming. *Science*, 294(5540), 151–154. doi:10.1126/science.1063656**

Technical article about the ways plantlife deals with global warming and climate change and a look at three populations of plants in particular. There is discussion of the methods plants have used such as migrating and physically adapting. In the past, however, the change was far more gradual and even. The rapid and fragmented climate changes of the present pose greater threats to plantlife.

**Hansen, E. M., Bentz, B. J., Régnière, J., Fettig, C. J., Seybold, S. J., Hayes, J. L., Hicke, J. A., et al. (2010). Climate Change and Bark Beetles of the Western United States and Canada: Direct and Indirect Effects. *BioScience*, 60(8), 602–613. doi:10.1525/bio.2010.60.8.6**

Article aggregates several studies of bark beetle survival and migration and examines two case studies of Spruce beetles and Mountain Pine beetles in the northern U.S. and Canada. The authors find that due to climate change, bark beetles, especially the "aggressive" kind that kill living trees, are moving further north. This has already led to outbreaks and the death of forests. The results of this study's statistical predictions show that more forest death could result. The authors were unable to draw conclusions with certainty about where precisely the thresholds for bark beetle survival lie (i.e. how far north are trees in danger of bark beetle attacks).

**Harris, R. N. (1997). Borehole Temperatures and a Baseline for 20th-Century Global Warming Estimates. *Science*, 275(5306), 1618–1621. doi:10.1126/science.275.5306.1618**

Rather technical article detailing how reading data taken from boreholes can fill in much of the surface air temperature (SAT) information that we are missing. At present we only have a record of the SAT for the past century, but samples taken via boreholes have indicators of the SAT for millennia prior to our records. Details are given as to the method used in some of the borehole projects and the ways data was combined with other records. The method is not flawless as sometimes heat conduction distorts the data, but for the most part this method has reduced the fuzziness of climate change models. Several graphs and charts of findings are included.

**Hay, L. E., Markstrom, S. L., & Ward-Garrison, C. (2011). Watershed-Scale Response to Climate Change through the Twenty-First Century for Selected Basins across the United States. *Earth Interactions*, 15(17), 1–37. doi:10.1175/2010EI370.1**

This article discusses the results of modeling how climate change will affect 14 freshwater river basins across the U.S. While cautious about the uncertainties of any projections, the authors assert that their results predict less snow and indicate that snowmelt will occur earlier and affect basins and the watershed due to global warming. There are plenty of graphics, but they are rather technical, involving plots and statistical graphs. This article may be challenging for a lay audience and might not bring home the impacts of climate change in the most concrete way. The authors seem overly cautious and more interested in validating their methods and statistical model than interpreting their results.

**Huey, R. B. (2005). Hypoxia, Global Warming, and Terrestrial Late Permian Extinctions. *Science*, 308(5720), 398–401. doi:10.1126/science.1108019**

Technical but understandable article about the fate of endotherms during the late Permian period when the largest mass extinctions in the Earth's history took place. The event that

caused mass extinctions has now been found to have been preceded by a high rate of extinctions as well and followed by a very slow recovery period. Records now indicate that O<sub>2</sub> levels dropped drastically and the Earth's temperature rose at the same time; a one-two punch that killed off many species via hypoxia. Includes several charts. Supporting online material is available for download.

**Immerzeel, W. W., van Beek, L. P. H., & Bierkens, M. F. P. (2010). Climate Change Will Affect the Asian Water Towers. *Science*, 328(5984), 1382–1385. doi:10.1126/science.1183188**

Akin to the article studying how climate change affects U.S. freshwater basins, this study looks at river basins in India and China, including: Indus, Ganges, Brahmaputra, Yangtze, and Yellow rivers. The article shows that meltwater, which would be affected by global warming, is important in a few but not all of these river basins. The Brahmaputra and Indus basins are most susceptible to reductions of flow, threatening the food security of an estimated 60 million people because upstream water supply is crucial for trade and transportation in this part of the world. Contains a useful chart comparing human populations that rely on each river as well as graphs of changes in precipitation and other key environmental indicators related to these river basins.

**Li, X., Takahashi, T., Suzuki, N., & Kaiser, H. M. (2011). The impact of climate change on maize yields in the United States and China. *Agricultural Systems*, 104(4), 348–353. doi:10.1016/j.agsy.2010.12.006**

This study projects corn yields in the U.S. and China to 2030 using a model that takes climate change, economic change, and technology into account. The authors conclude that climate change will not negatively impact maize yields across the board. Different regions in the U.S. and China may be affected differently. Their model tries to account for the impact of climate change on farmers' livelihoods; a decrease in crop yields could be profitable if the price of corn increases due to scarcity. The authors, who are in the field of agronomy, recommend free trade practices and trade agreements between China and the U.S. to stabilize the world's maize supply and combat the negative consequences of climate change on maize crops. Fairly accessible and easy-to-read for a scholarly article, the study concludes: "The results in this simulation show that under severe climate change, changes in maize yields are not uniform throughout the world. This suggests that an important adaptation strategy to combat the negative consequences of climate change on crop production is freer trade in agriculture."

**Lindgren, E., & Andersson, Y. (2012). Monitoring EU Emerging Infectious Disease Risk Due to Climate Change. *Science*, 336, 418–419.**

Proposes practical epidemic surveillance techniques for public health departments to monitor and manage outbreaks of tropical diseases (aka Emerging Infectious Diseases) that are occurring increasingly in European countries where these diseases were not previously seen. Also presents a scale called "weighted risk analysis" that evaluates the link between climate change and increased incidents of specific infectious diseases like Dengue Fever, Visceral

leishmaniasis, and Chikungunya fever. Useful from both public health and climate change perspectives.

**Meehl, G. A., Washington, W. M., Collins, W. D., Arblaster, J. M., & al, et. (2005). How Much More Global Warming and Sea Level Rise? *Science*, 307(5716), 1769–72.**

This article verbally and visually compares climate change and sea-level simulations based on the Parallel Climate Model (PCM) and the Community Climate System Model version 3 (CCSM3). Both models show that "we are already committed to significant warming and sea level rise." Good graphics.

**Mishra, V., Cherkauer, K. A., & Shukla, S. (2010). Assessment of Drought due to Historic Climate Variability and Projected Future Climate Change in the Midwestern United States. *Journal of Hydrometeorology*, 11(1), 46–68. doi:10.1175/2009JHM1156.1**

Very statistics heavy. The authors use data about soil moisture in Illinois dating from 1916 to 2007 to trace changes in soil over the 20th century. Their findings indicate that soil in the Midwest, a key agricultural region that produces most of the nation's corn and soybeans, has been drier and the region is experiencing extended droughts, which the authors believe is caused by climate change. They write at length about the various statistical models used to determine this. Not the most appealing article for the general public.

**Montes-Hugo, M., Doney, S. C., Ducklow, H. W., Fraser, W., Martinson, D., Stammerjohn, S. E., & Schofield, O. (2009). Recent changes in phytoplankton communities associated with rapid regional climate change along the western Antarctic Peninsula. *Science*, 323(5920), 1470–1473.**

This study concludes that as temperatures rise, species that depend on ice move closer to the Antarctic poles and are displaced by "ice-avoiding species." e.g. Krill are being replaced by salps and Adelie penguins by Chinstrap penguins. The study shows that phytoplankton have been redistributed in Antarctica due to changes in the atmosphere, ice, and ocean temperatures. When phytoplankton move, it affects the entire Antarctic food web. Krill will migrate or be seen in larger numbers, attracting species that feed on krill to areas where they previously did not live. This article uses bio-chemical terminology and charts. The data is fascinating, but the writing style is fairly dense for a non-expert audience.

**O'Hagan, A. (2012). Probabilistic uncertainty specification: Overview, elaboration techniques and their application to a mechanistic model of carbon flux. *Environmental Modelling & Software [Environ. Model. Software]*. Vol. 36, 35–48. doi:10.1016/j.envsoft.2011.03.003 [accessed 6/15/12: <http://www.tonyohagan.co.uk/academic/pdf/probspec.pdf>]**

This article seems to be available openly at the URL listed above. It provides an advanced,

technical overview of how knowledge of probability is extracted from data. Then a case study using data on vegetation acting as a carbon sink gathered in England and Wales demonstrates how uncertainty is characterized in climate change models.

**Ruff, T. W., Kushnir, Y., & Seager, R. (2012). Comparing Twentieth- and Twenty-First-Century Patterns of Interannual Precipitation Variability over the Western United States and Northern Mexico\*\*. *Journal of Hydrometeorology*, 13(1), 366–378. doi:10.1175/JHM-D-10-05003.1**

Very technical study measuring the variability in precipitation levels in the Western U.S. and Northern Mexico over the 20th century. These researchers created a model that combines and compares 5 different climate models and techniques. Author discusses irregularities in precipitation due to El Nino but is unable to draw conclusions about the impact of climate change on precipitation. This study mainly shows that the models scientists use to predict and analyze variability in precipitation over time are valid models (i.e. the measurement techniques and resulting data are good), but it doesn't draw conclusions about whether global warming is linked to higher or lower precipitation. In fact, the models seem to indicate the contrary: global warming does not seem to affect the year-to-year variability of precipitation.

**Schofield, O., Ducklow, H. W., Martinson, D. G., Meredith, M. P., Moline, M. A., & Fraser, W. R. (2010). How Do Polar Marine Ecosystems Respond to Rapid Climate Change? *Science*, 328(5985), 1520–1523. doi:10.1126/science.1185779**

This article discusses advances in technology that will aid in observing the impacts of global warming on arctic marine life. Proposes new strategies for observing the Polar Ecosystem. More about process/scientific observation than about any specific impacts of climate change. Has one graphic with a penguin and walrus and some kind of Arctic observational probe.

**Weaver, A. J. (2004). OCEAN SCIENCE: Global Warming and the Next Ice Age. *Science*, 304(5669), 400–402. doi:10.1126/science.1096503**

Technical article seeks to dismiss the idea (put forth in certain other articles and popularized in the movie "The Day After Tomorrow") that global warming will cause rapid desalinization of the oceans which will shut down the Atlantic Meridional Overturning (AMO) which will then cause a rapidly forming ice age. While some early studies did show such things, they were controversial and all models that have been done recently (including at the Intergovernmental Panel on Climate Change, IPCC) dispute the idea that a new ice age will be brought on by global warming and desalinization. It is much more likely that we will not see another ice age for 50,000-100,000 years.

**Wehner, M., Easterling, D. R., Lawrimore, J. H., Heim, R. R., Vose, R. S., & Santer, B. D. (2011). Projections of Future Drought in the Continental United States and Mexico. *Journal of Hydrometeorology*, 12(6), 1359–1377. doi:10.1175/2011JHM1351.1**

This is another statistics-heavy article about the accuracy of mathematical models and finding new methods to predict drought. It's less about what those calculations and models actually predict than the math behind them. This study compares 19 different models for projecting drought and finds that the standard statistical model for measuring drought, the Palmer Drought Severity Index, is flawed. The authors' innovation is to factor projections in global temperature into past models for predicting drought to create more accurate projections. There are colorful maps of drought projects in the U.S. but many of them are difficult for a lay person to interpret..

**Williams, J. H. D. (2012). The Technology Path to Deep Greenhouse Gas Emissions Cuts by 2050: The Pivotal Role of Electricity. *Science*, 335(6064), 53–59. doi:10.1126/science.1208365**

Addresses the targets for greenhouse reductions that have been adopted by several states and countries. Looking more closely at California's goal of an 80% reduction, the author provides evidence for his reasoning that the state cannot meet the goal with current technology and standards in use -- more dramatic action is necessary, including widespread electrification of transportation and other sectors. This necessitates the use of "technologies that are not yet commercialized, as well as coordination of investment, technology development, and infrastructure deployment." The article contains graphics and charts.

**Williamson, C. E., Saros, J. E., & Schindler, D. W. (2009). Sentinels of change. *Science*, 323(5916), 887–888.**

Short article with lots of statistics about the health of inland lakes and reservoirs in the U.S. and Canada, which act as a "sentinel" or predictor of overall ecological health. Some useful statistics about extinct species in lakes and reservoirs as well as carbon levels.

**Wing, S. L. (2005). Transient Floral Change and Rapid Global Warming at the Paleocene-Eocene Boundary. *Science*, 310(5750), 993–996. doi:10.1126/science.1116913**

Article describes findings on how the Late Paleocene-Eocene Thermal Maximum (PETM) which was the highest global warming on record affected tropical forests. The forests fared far better than it is believed current tropical forests would, giving hope that perhaps the current climate change will not be as deadly to such ecosystems. The beginning of the article is rather accessible but the further it gets the more technical it becomes. Supporting online material is available for download.

## Websites<sup>3</sup>

**350.org. (n.d.). Retrieved April 10, 2012, from <http://www.350.org/>**

350.org is a nonprofit that seeks to build a global grassroots movement to solve the climate crisis. This website shares informational resources, events, campaigns, and ongoing projects. One main goal of this organization is to decrease the amount of CO<sub>2</sub> in the Earth's atmosphere to below 350 parts per million, a level that scientists recommend as safe.

**Climate-Change Research Heats Up, 1987-2011. (2012, May 6). *The Chronicle of Higher Education*. Retrieved from <http://chronicle.com/article/Climate-Change-Research-Heats/131775/>**

From *The Chronicle of Higher Education* website, this is a great interactive graphic of scholarly publications about global warming from 1987 to 2011, comparing the fields of Life Sciences, Physical Sciences, Engineering, and Social Sciences and showing an overall increase in the amount of studies being conducted on climate change. Less than 30 academic papers were published about climate change in 1987, but in 2011 over 19,000 were published. Below the graph is a timeline of important events in the research of climate change (e.g.: "1990: IPCC publishes first report, cites scientific certainty that human activities are increasing greenhouse gases."). Very accessible resource that provides an overview perspective on climate research done in the past 25 years.

**Connect the Dots/ Climatedots.org. (n.d.). Retrieved May 2, 2012, from <http://www.climatedots.org/>**

Connect the Dots sponsors events such as Climate Impacts Day, held on May 5, 2012 in locations throughout the world. This site allows you to search for related events near you. Connect the Dots seeks to bring people together across the globe to show the real-world effects of climate change and extreme weather on human and environmental populations and to lobby for a reduction of carbon dioxide and greenhouse gas pollution.

**Global Hazards Atlas. (n.d.). Retrieved June 12, 2012, from <http://www.pdc.org/atlas>**

Interactive online map of the world highlights current and historical natural disasters and other phenomena around the planet. While this map is not limited to conditions caused by climate change, many of the extreme weather disasters taking place can be attributed to global warming including: wildfires, tropical storms, tsunamis, droughts, and other happenings. The site allows you to search for specific disasters (current, ongoing, or historical) and to search in particular regions and locations. Also includes information on food crises and illnesses.

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<sup>3</sup> These websites feature reliable research, interactive tutorials or maps, and other trustworthy resources addressing the impacts of climate change. Websites relevant to the OWS movement are also included.

**Global Warming Effects Map - Effects of Global Warming. (n.d.). Retrieved April 10, 2012, from <http://www.climatehotmap.org/>**

The "hot map" is an interactive resource that shows the effects of climate change on different world locations. Click on pins placed on a world map to see facts about the impacts of global warming on people and the environment. Another page on this site, "Impacts," lists specific impacts of global warming on Oceans, Freshwater, Ecosystems and People. References are provided by this website which is sponsored by the Union of Concerned Scientists.

**IPCC - Intergovernmental Panel on Climate Change. (n.d.). Retrieved June 1, 2012, from <http://www.ipcc.ch/>**

The website for the Intergovernmental Panel on Climate Change, an international body that has issued many trusted reports on the effects of global warming since 1990. The assessments and decrees of the IPCC are frequently referenced in scholarly scientific literature. The website contains videos, special reports, and electronic copies of its published climate assessments and annual reports.

**Occupy Rio+20. (n.d.). *Occupy The Earth*. Retrieved May 2, 2012, from <http://occupytheearth.net/index.php/14-home-page-content/roktabs-fp/35>**

Website for the OWS environmental group "Occupy the Earth" which is participating in and protesting the Rio+20 United Nations Conference on environmentalism from June 20-22. You can read the Occupy Rio+20 People's Petition calling for more democratic, open source UN deliberations and for various ecological demands including cessation of deforestation in the Amazon Rainforest, food and water sovereignty, and other key goals.

**Occupy Wall Street Library. (n.d.). Retrieved April 10, 2012, from <http://peopleslibrary.wordpress.com>**

The website for the People's Library, aka the Occupy Wall Street Library. Source for information on the Zuccotti Park Library lawsuit, OWS poets, OWS catalog (via [Library Thing](#)), and upcoming literary events and protests related to the OWS movement.

**Open Source Ecology. (n.d.). *Open Source Ecology*. Retrieved May 2, 2012, from <http://opensourceecology.org/>**

From the About page: "Open Source Ecology is a network of farmers, engineers, and supporters that for the last two years has been creating the Global Village Construction Set, an open source, low-cost, high performance technological platform that allows for the easy, DIY fabrication of the 50 different Industrial Machines that it takes to build a sustainable civilization with modern comforts. The GVCS lowers the barriers to entry into farming, building,

and manufacturing and can be seen as a life-size lego-like set of modular tools that can create entire economies, whether in rural Missouri, where the project was founded, in urban redevelopment, or in the developing world."

**United States Global Change Research Program. (n.d.-a). Retrieved June 13, 2012, from <http://www.globalchange.gov/>**

The U.S. Global Change Research Program (USBCRP) "coordinates and integrates federal research on changes in the global environment and their implications for society." The USGCRP website is a vast resource for up-to-date reports and assessments of climate change. The site also includes news items, PDF publications, an image gallery of climate impacts, a research library, and an explanation of USGCRP's partnerships with various federal agencies.

**United States Global Change Research Program. (n.d.-b). Climate Change Impacts By Sector. *United States Global Change Research Program*. Retrieved June 13, 2012, from <http://globalchange.gov/publications/reports/scientific-assessments/us-impacts/climate-change-impacts-by-sector>**

A great, digestible set of interactive pages showing facts and summaries of how each sector of the U.S. infrastructure is affected by climate change. Sectors include: Society, Human Health, Ecosystems, Agriculture, Water Resources, Transportation, and Energy. Each summary links to the relevant PDF chapters of the full 2009 Global Climate Change Impacts Report.

**United States Global Change Research Program. (n.d.-c). Regional Climate Change Impacts. *United States Global Change Research Program*. Retrieved June 13, 2012, from <http://globalchange.gov/publications/reports/scientific-assessments/us-impacts/regional-climate-change-impacts>**

Use the "Regional Climate Change Impacts" map on the US Global Change Research Program website to learn about specific climate change impacts and assessment for each region of the United States: Northeast, Southeast, Midwest, Great Plains, Southwest, Northwest, and Alaska. Also contains information about U.S. islands and coastlines. This website is sponsored by the USGCRP, a federal body charged with synthesizing federal research on global and climate change.

**United States Global Change Research Program. (n.d.-d). Resource Library. *United States Global Change Research Program*. Retrieved June 13, 2012, from <http://library.globalchange.gov/>**

This is a library of the research produced by the USGCRP. Includes many open access, freely downloadable annual reports, strategic plans, and assessments. Also includes an image gallery with graphs and photos depicting the impacts of climate change. One set, "Our Changing Planet 2009" has particularly appealing, accessible photos illustrating extreme weather phenomena

and the changes brought forth by global warming.

**United States Global Change Research Program. (n.d.-e). Global Climate Change Impacts in the U.S.- Key Findings. *United States Global Change Research Program*. Retrieved May 1, 2012, <http://globalchange.gov/publications/reports/scientific-assessments/us-impacts/key-findings>**

A summary of the ten key findings of a 2009 report on Global Climate Change Impacts in the United States. This report was compiled by the U.S. Global Change Research Program (USGCRP) which "coordinates and integrates federal research on changes in the global environment and their implications for society." The USGCRP parent website contains other up-to-date reports and assessments of climate change.

**We All Occupy- Other Groups. (n.d.). *We All Occupy*. Retrieved May 2, 2012, from <https://sites.google.com/site/wealloccupy/other-groups>**

This user-driven resource serves as a directory of all subgroups and affiliates of Occupy Wall Street. It includes links to facebook, twitter, blogs, websites and other online presences of various branches of the Occupy movement.

**United States Environmental Protection Agency. (n.d.). Climate Change | U.S. EPA. Retrieved April 20, 2012, <http://www.epa.gov/climatechange/>**

A good background resource for all levels. Contains reports on climate change indicators in the U.S., an interactive map of impacts of climate change on various regions of America, a multimedia gallery with video tutorials, Greenhouse Gas Data, and Climate Change FAQs. Also provides information about current EPA initiatives and about laws & regulations related to pollution, agriculture, manufacturing, transportation and other sectors.