Sustainable Development Law & Policy

Volume 7
Issue 2 *Winter 2007: Climate Law Reporter 2007*

Article 11

Climate Change and Federal Environmental Law

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Introduction

Human activities, particularly the combustion of fossil fuels and the large-scale transformation of land cover, affect ecosystems around the world. Changes in temperature, precipitation, and water chemistry are altering our environment. These changes will also affect environmental regulatory frameworks, either rendering them ineffective or forcing them to adapt to achieve their goals under changing conditions.

Global temperature has increased by 0.8°C over the last century. Climate scientists estimate that we are committed to an additional 0.5°C increase due to the amount of carbon dioxide ("CO_2") that is already present in the atmosphere.[1] Rising temperatures have been accompanied by a wide range of environmental changes, including, retreat of sea ice and glaciers, sea level rise, and changes in the intensity and frequency of storms and precipitation events.[2] Rising CO_2 concentrations has not only changed the composition of the air, but it is also changing the chemistry of the water: CO_2 is absorbed by the oceans, which forms carbonic acid, causing the acidification of the oceans.[3]

These changes mean that regulations intended to protect natural resources and promote conservation will be applied under conditions significantly different from those that prevailed when they were drafted. Achieving the original goals of these regulations will require a careful assessment of long-standing assumptions, as well as decisive action to change regulatory practices in ways that accommodate, offset, and mitigate climate change. Three such laws will be explored in this article: the Endangered Species Act ("ESA"), the Clean Water Act ("CWA"), and the Clean Air Act ("CAA").

Climate change undermines the ambitious goals of the ESA, the CWA, and the CAA.

Climate Change and the Endangered Species Act

The stated purpose of the ESA is "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved."[4] The architects of the ESA intended to save creatures from proximal threats, such as bulldozers and dams. Yet, today we see clear evidence that climate change creates new threats to already imperiled species by contributing to the disruption of ecological processes essential to entire ecosystems. Deteriorating conditions will impact the viability of endangered species and the practices used to protect them through implementation of the ESA (*e.g.*, listing, "take" permitting, and recovery planning).

For example, in 2006, two species of Caribbean coral, Elkhorn (*Acropora palmata*) and Staghorn (*A. cervicornis*) coral, were listed as "threatened" for their entire range under the ESA. The listing stated that "the major threats to the species' persistence (*i.e.* disease, elevated sea surface temperature, and hurricanes) are severe, unpredictable, likely to increase in the foreseeable future, and, at current levels of knowledge, unmanageable."[5] This listing identifies three key threats that all relate to climate change: rising sea surface temperatures, disease susceptibility, and hurricane-related impacts. Sea surface temperatures are closely related to increasing global surface air temperatures. A severe Caribbean coral-bleaching event in 2005 demonstrated that high temperatures cause coral bleaching and bleaching corals become more susceptible to disease.[6] Moreover, as global temperatures rise, the intensity and frequency of hurricanes may increase.[7] The timing of this listing was particularly profound as it followed the unprecedented 2005 Caribbean summer, during which the region experienced the hottest water temperatures ever recorded with large-scale bleaching followed by disease,[8] and a record breaking hurricane season.[9]

Recently, the U.S. Fish and Wildlife Service proposed listing Polar Bears (*Ursus maritimus*). The bears rely on Arctic sea ice for access to food and breeding sites. Their primary food source, the ringed seal (*Phoca hispida*), is also an ice dependent species. The loss of nearly 30 percent of Arctic ice cover over the past century, together with the possibility that the Arctic will be seasonally ice-free before the end of this century, strongly suggest that climate change will jeopardize the survival of this species.[10]

Another example is the Key Deer, which is now limited to living on two islands in the Florida Keys. Most of the Keys have less than two meters of elevation. If sea levels were to rise one meter, most the Key Deer habitat would be lost. The only way to limit sea level rise and protect remaining Key Deer habitat is to

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take action to mitigate the rate and extent of climate change.[11]

These three species represent the tip of the iceberg, so to speak. Because climatic conditions are central to basic ecological processes that control the distribution and abundance of life, the list of species that are or will be endangered by climate change is potentially enormous.[12] The most direct way to protect the ecosystems in which these species live — the mandate of the ESA — will be to address the cause of climate change: greenhouse gas emissions. However, because some impacts are inevitable, it is important that we also consider how implementation of the ESA can be used to reduce the vulnerability of imperiled species and aid in their recovery despite changing conditions.

Climate Change and the Clean Water Act[13]

The CWA provides the legislative foundation for the protection and restoration of the waters of the United States. The Act seeks to "restore and maintain the chemical, physical, and biological integrity of the nation's waters" with the goal of achieving water quality that "provides for the protection and propagation of fish, shellfish, and wildlife, and recreation in and on the water."[14] The CWA gives the U.S. Environmental Protection Agency ("EPA") the statutory authority to establish water quality standards and to regulate the discharge of pollutants into waters of the United States.

Climate and water quality are linked by hydrologic processes involved in the global water cycle. These processes move water from the oceans, into the atmosphere, and back down into rivers, streams, wetlands, and estuaries. The net result is a sustainable supply of clean, fresh water and a wide variety ecosystem services, such as recreational opportunities and food production. It has long been recognized that humans intervene in this cycle through activities that intercept, store, utilize, or otherwise alter natural hydrologic processes (*e.g.*, the expansion of impermeable surfaces, application of excess fertilizer, and removal of ecological filtration processes such as wetlands). The CWA provides a framework for understanding these sources of impairment and acts to restore impaired waters and prevent further degradation. Over time, the CWA contributed to significant improvements in surface water quality in the United States despite a steadily growing population and expanding economy.

Climate change adds a new and potentially disruptive element to these long-running efforts. The Intergovernmental Panel on Climate Change predicts a wide variety of changes, including rising air temperature, more frequent heat waves, more intense precipitation events, and increasingly severe dry-spells and droughts.[15] These changes reflect the biophysical consequences of an overall acceleration of the global hydrologic cycle, and these general conclusions have been a feature of the scientific literature for nearly twenty years. However, the local and regional consequences of these complex processes remain difficult to predict. The key conclusion for local and regional decision makers is that "change" will be the operative word, and historic observations will provide an increasingly unreliable guide to future conditions. Changes in hydrologic processes will be reflected in changes in the quantity and quality of surface waters, and, in many cases, they are likely to undermine important assumptions used in the implementation of the CWA. For example:

- More intense precipitation events will increase nonpoint source pollution loads.
- Increasing storm water volumes may exceed expectations and design specifications for water treatment works and sewer infrastructure.
- Decreases in flow volume may increase in-stream pollutant concentrations and reduce the ability of waters to accommodate pollutant discharges.
- Increases in ambient air temperature will raise temperatures in surface waters and threaten aquatic ecosystems.
- Humans may respond to some climate change-related impacts through increased use of some pesticides, fungicides, and fertilizers, increasing the concentrations in surface and groundwater (*e.g.*, expanding nuisance species).
- Climate change may also decrease the toxicity thresholds of bioindicators to these pollutants.

These changes have significant implications for the most important and far-reaching CWA programs, including the control of point source discharge, management of nonpoint source pollution, and environmental monitoring.

Point source discharges are typically managed by engineered systems. Most modern systems are designed to accommodate a relatively wide range of environmental conditions. However, there are limits, and climate change may drive systems unexpectedly close to their design tolerances — sometimes risking catastrophic outcomes (*e.g.*, levies surrounding New Orleans). Changes to long-term, capital-intensive investments such as sewer and stormwater facilities are costly and time consuming. Consequently, those involved in their design, construction, and operation need to begin anticipating the impacts of climate change immediately.

Nonpoint source pollution represents a different kind of problem. By definition, nonpoint loads come from many small sources. Pollution is controlled by means of so-called Best Management Practices ("BMPs"), such as riparian buffers, retention ponds, and cover cropping. Climate change will alter both the volume and concentration of nonpoint source pollution and the effectiveness of BMPs. Managing nonpoint source pollution under changing climatic conditions will require thoughtful monitoring and attention to the relative sensitivities of different land uses and BMPs. In many cases, thoughtful land use planning and the selection of climatically-robust BMPs may be able to achieve many nonpoint source pollution control goals despite changing conditions.

CWA programs are based on observations of the actual water quality conditions and activities that may contribute to impairment. Observations include information about a water body's physical, chemical, and biological condition. These indicators are used to assess compliance with water quality standards and attribute degradation to specific sources. This process typically assumes that drivers of change can be found within a given watershed. However, climate change will alter water quality regardless of local actions and, in most cases, climate-related changes will compound or exacerbate on-going water quality

problems and a myriad of existing conditions and on-going restoration activities. In other words, climate change will make an already complicated analysis significantly more challenging.

Untangling complex, changing mixtures of factors contributing to water quality will require monitoring systems that allow for separation of climatic and non-climatic factors. The EPA uses a system of bioindicators to evaluate the biological integrity of surface waters.[16] These are typically fish, aquatic insects, and other organisms that have well-known responses to changes in water quality. These bioindicators provide synthetic measures of water quality that can help diagnose specific causes of impairment or degradation. However, bioindicators are themselves part of ecological systems that will respond to changes in both climate and water quality.[17] The myriad examples offered in toxicological literature demonstrate that elevated temperature and altered water chemistry can exacerbate the toxicity of pollutants. Consequently, the use of this important information for attribution will require understanding the response of specific bioindicators to changing conditions and specifically selecting indicators with methods that allow for partitioning between climatic and non-climatic impacts.[18]

Climate Change and the Clean Air Act

The stated purpose of Title IV of the CAA is "to reduce the adverse effects of acid deposition."[19] It seeks to address Congressional findings that:

(1) the presence of acidic compounds and their precursors in the atmosphere and in deposition from the atmosphere represents a threat to natural resources, ecosystems, materials, visibility, and public health;

(2) the principal sources of the acidic compounds and their precursors in the atmosphere are emissions of sulfur and nitrogen oxides from the combustion of fossil fuels;

(3) the problem of acid deposition is of national and international significance;

(4) strategies and technologies for the control of precursors to acid deposition exist now that are economically feasible, and improved methods are expected to become increasingly available over the next decade; and

(5) current and future generations of Americans will be adversely affected by delaying measures to remedy the problem.[20]

The CAA is primarily targeted at reduction of sulfur ("SO_X") and nitrogen oxides ("NO_X"). It also may be interpreted or amended to apply to greenhouse gases. Rising atmospheric CO_2-levels acidify ocean water and threaten marine resources and ecosystems. Reducing CO_2 emissions would help mitigate this global problem, potentially using CAA mechanisms originally designed for SO_X and NO_X. For example, Title IV of the CAA encourages "energy conservation, use of renewable and clean alternative technologies, and pollution prevention as a long-range strategy, consistent with the provisions of this title, for reducing air pollution and other adverse impacts of energy production and use."[21] These activities also reduce CO_2 emissions and in so doing mitigate the effect of atmospheric CO_2 on the ocean.

Finally, CO_2 acidification, like SO_X and NO_X, is a problem of national and international scope. Current and future generations will be affected by any delay in taking action. Due to the fact that roughly half of anthropogenic emissions end up in the oceans and because CO_2 remains in the atmosphere for a substantial period of time, CO_2 will continue to acidify the Earth's oceans for decades or centuries to come. Failure to limit anthropogenic emissions will only perpetuate this problem. The likelihood that reducing greenhouse gas emissions will limit acidification is very high.

To date, the EPA has been unwilling to regulate CO_2 as an air pollutant, and legal action by states and municipalities on this issue awaits a decision by the U.S. Supreme Court. Interpreting or amending the CAA to regulate CO_2 as an acidifying agent may be an effective mechanism for curbing CO_2 emissions.

Climate and water quality are linked by hydrologic processes involved in the global water cycle.

Conclusion

The ESA, the CWA, and the CAA form the foundation of the effort to protect and restore the environment in the United States. Climate change undermines the ambitious goals of these laws. Changes in climate can jeopardize the survival and recovery of endangered species. Climate change is likely to alter hydrologic processes in ways that could undermine the goal of providing clean, safe water resources. Climate change can also exacerbate long-standing air quality issues by increasing the likelihood of unhealthy or ecologically-damaging conditions. The first step is to take our collective foot off our fossil fuel-powered accelerator by implementing prompt and deliberate measures to reduce the emission of greenhouse gases.

This first step, while necessary, is not sufficient. We are already committed to significant levels of climate change due to the accumulation of CO_2 in our oceans and atmosphere. Achieving conservation and resource protection goals will require developing robust and resilient practices that explicitly anticipate and address the potential for changing conditions. In the years ahead, efforts to mitigate and adapt to climate change will constitute important, new dimensions to these critical pieces of environmental legislation.

Endnotes: Climate Change and Federal Environmental Law *on page 79*