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Environmental Regulation

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federal and state offices addressing these issues and in statutes in the United States and abroad.

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Environmental Regulation

The terms *environment* and *regulation* are commonplace in political and policy debates about the natural environment, the role of science, and the behavior of government. Indeed, these terms reference a very contentious area of public policy and are emblematic of the growing tensions between science and politics. This chapter overviews the definition, types, and history of environmental regulation before turning to the intersection of science and politics in environmental policy and considering current and future challenges for this aspect of governmental activity.

The terms *environment* and *regulation* are frequently employed with a host of meanings. Broadly speaking, regulations refer to the government's mandates or prohibitions regarding individual and/or organizational behaviors whereas the environment generally encompasses the natural world, ranging from air and water to land, plants, and animals. Accordingly, putting the two terms together, we arrive at a definition of environmental regulation as the prohibitions or mandates government places on individuals and organizations regarding the natural environment. As indicated at the outset, this term is commonplace in debates and has come to refer to many dimensions of U.S. environmental, energy, and natural resources policies. This usage, however, conflates distinct areas of policy. Environmental regulation typically refers to government actions regarding pollution control and abatement more specifically, whereas energy policy pertains to energy issues, and natural resource policy deals with land and resource management, despite the obvious overlap of these issues.

Federal Environmental Regulation

Unlike many other areas of policy, the federal government has been actively engaged in environmental regulation for only a comparatively short time—a little more than forty years. Government interest in the natural environment began at the turn of the twentieth century and gained momentum, particularly under Theodore Roosevelt's administration; however, environmental regulation, as we understand it contemporaneously, was not put into place until the late 1960s and early 1970s. Prior to this time, efforts to curb pollution and other harmful effects occurred at the local and state government level. For example, Cincinnati, Ohio, was among the nation's first cities with air pollution laws (Andrews 1999). Early efforts at mitigating environmental impacts were chiefly the result of health concerns.

The social unrest of the 1960s brought about a wave of changes ranging from equal rights for African Americans and women to cultural revolution.

Coinciding with these movements were major environmental focusing events that called the public's attention to the environment, including the Cuyahoga River in Cleveland catching on fire due to high levels of pollution. Perhaps more important, scientific understanding of pollution and environmental degradation reached a point at which scientists had studied the ill effects of pollution and had enough understanding of these issues to raise alarm. Moreover, biologist Rachel Carson had written a seminal book in 1962, *Silent Spring,* intended for the average person, which detailed the harmful effects of a common pesticide, DDT. These factors, among others, coupled with growing public outcry regarding the environment, precipitated the first major environmental legislation, which led to environmental regulations under the National Environmental Policy Act of 1969. Prior to the 1960s, a number of federal environmental statutes had passed, but they bear little resemblance to the modern environmental regulation. For example, the first Water Pollution Control Act was passed in 1948, and it mandated plans to deal with the public health effects of water pollution. Similar laws were passed in the following decades, leading up to the major environmental statutes of the 1970s, but these statutes did not mandate the pollution controls and other attributes of modern environmental regulation. (See Andrews [1999] for further detail.)

The 1960s gave way to the most productive decade of environmental policymaking the United States has seen to date. During the 1970s more than two dozen environmental laws were passed, including the oft-cited Clean Air Act, Clean Water Act, Resource Conservation and Recovery Act, and others. These laws established the foundation for the environmental regulation that still exists today—command and control regulation. It is also worth noting the bipartisanship that shepherded these laws through passage.

These statutes, along with their subsequent amendments and additions, provide the legislative authority for environmental regulations. Since then, environmental regulations have come to encompass a wide swath of areas of environmental concern, from the traditional air and water pollution control regulations to dictates about the clean-up of toxic waste spills and the operations of confined animal feeding operations (CAFOs). Since the advent of environmental regulation, there have appeared more than 15,000 pages of federal environmental regulations alone, not counting state and local regulations (Fiorino 2006, 1). Adorning the thousands of pages of environmental regulations are different types of regulation, as regulation is a broad term used to encompass many different policy instruments used by the government (Cooper 2009). Different forms of environmental regulation run the gamut from tradable permits, information disclosure requirements, to the most common—command and control regulations.

Command and Control Regulations

As the name might imply, command and control regulations are established by the government, and they command individuals and organizations to comply with predetermined controls (e.g., emission limits or particular technology to be employed).

> Under command and control, government agencies develop a set of rules or standards. These determine technologies to be used or avoided; amounts of pollutants that can be emitted from a particular waste pipe, smokestack, or factor; and/or the amounts or kinds of resources that may be extracted from a common pool such as a fishery or a forest. These agencies issue commands in the form of regulations and permits to control the behavior of private firms, other government agencies, and/or individuals. (Dietz and Stern 2002, 3)

Stated differently, command and control regulations are the policy instrument most often thought of when considering means of environmental protection as they set specific limits on pollutants, such as nitrous oxides, that may be released from a facility or mandate the particular type of pollution abatement technology that another facility must use.

Command and control regulations are not typically the statutory language Congress puts in place; rather the process of creating these regulations is simply started by legislative action. The first step in establishing command and control regulations is the process of setting goals. For example, in the Clean Water Act of 1972, part of the goals as defined by the law include eliminating high amounts of toxic pollutants to make the nation's water "swimmable," "fishable," and "navigable." Congress (or another legislative body) often establishes broad goals that a law is designed to achieve; yet this is just the first of several steps in arriving at specific regulations.

Second, criteria must be established. For instance, what is meant by "clean water" or "clean air"? Such language in the goals is laudatory, but its meaning elusive. Frequently, Congress delegates the authority for establishing criteria to one or more executive agencies because the expertise and scientific knowledge of these organizations are recognized. In other words, Congress acknowledges it does not have the technical prowess or the political capacity to determine which pollutants are most harmful to waterways and to establish what the limits on releases of those pollutants should be. Congress leaves those determinations to agencies like the U.S. Environmental Protection Agency. Establishing criteria can be difficult because much research and data collection are needed on pollutants and their effects, and much of that information may not be readily available. With these data, agencies start putting specifics around lofty goals of clean air and clean water.

After determining the criteria, agencies move into the third stage of command and control regulations: setting standards. After the criteria have determined the broad aims of the regulations, standards are established that detail the specific means of achieving those broad aims. For example, to reduce the presence of 189 hazardous air pollutants (HAPs) as identified by the Clean Air Act, the standards determine how many HAPs a facility may be allowed to emit depending on its size and industry classification. These are the standards that environmental inspectors use to assess compliance when they are conducting their routine inspections of facilities.

The final step of command and control regulations concerns enforcement. Environmental inspectors are charged with assessing compliance with the standards established. To determine compliance, these inspectors routinely visit facilities that generate pollution and gauge their compliance with applicable standards. If an inspector finds a facility out of compliance with a particular standard, then the inspector will begin the steps up the enforcement pyramid to see that the facility returns to compliance and that the nation's environmental goals are being met.

With this outline of command and control regulations and the process associated with bringing them to fruition and ensuring ongoing compliance, it is necessary to make mention of a few fundamental assumptions of these regulations that are imperative as we consider the role of science and politics in environmental regulations. First, these regulations are top-down, or derived by government. Government dictates these rules, and everyone must comply or else face enforcement proceedings. Related, these regulations presume that government is in the position to know best—to have all the information from the best science and technology about what the appropriate standards are and what are the best technologies to mandate. Moreover, these regulations employ a "one-size-fits-all" approach to compliance. All organizations are subject to these regulations, with little differentiation for size and scope of a facility's operations. (This statement merits qualification: Facilities that are in the same industry and are operating at similar levels have the same standards to meet. Small businesses are often subject to altered regulations.) Finally, compliance with these regulations is ensured through a deterrence strategy—facilities must comply or face the consequences set forth by government. This brief overview of command and control regulations as the primary tool of environmental policy has given us a foundation with which to move forward and explore how science and politics pervade environmental regulation.

Role of Science in Environmental Regulation

The preceding discussion about command and control regulations implicitly notes numerous instances where scientific research should be part of the process to dictate the contours of the regulatory structure. However, this area is another example of where politics and science collide and tensions abound. Recall that environmental policy begins with the broad dictates of an elected body of lawmakers. These politicians devise the framework for a piece of environmental legislation. Politicians, despite their self-described expertise, generally rely on their own staffers as well as experts from think tanks, interest groups, and trade associations in devising the outlines of the legislation. Although there is likely to be science and technical expertise informing the creation of legislation, it is important to remember that political calculations concerning the possibility for a bill's passage and overarching rhetorical debate will dictate the language of a bill rather than scientific knowledge. Consider the 2009 example of failed "cap and trade" climate change legislation in the Senate. Although the American Clean Energy and Security Act—better known as the Waxman-Markey bill for its sponsors in the U.S. House of Representatives—was informed by science and technical capabilities, markup of the bill in the House came down to political calculations.

Even when environmental legislation successfully passes Congress and becomes law, the struggles between politics and science do not end there. Typically, the text of environmental laws delegates the responsibility for implementation to any number of federal executive agencies, and as discussed previously, criteria and standards are devised. For example, the U.S. EPA is delegated the responsibility of implementing the Clean Air Act, according to Congress. Then within the U.S. EPA the process of creating the specific regulations begins. Those individuals tasked with writing these regulations have varying backgrounds and must work within the confines of the Administrative Procedures Act (APA) of 1946 to ensure that the process of promulgating regulations is done transparently, and they can be held accountable since they are unelected government employees. Frequently, these individuals have technical backgrounds, perhaps environmental engineering or earth sciences, but they still must contend with political forces.

During the process of creating command and control regulations, the APA requires various forms of public participation in the process to ensure that the public's voice is heard and accounted for. Once draft regulations are complete, for instance, the agencies have to solicit feedback from affected parties—such as the regulated community—and often they have to respond to each comment and address the concerns raised. Additionally, writing regulations does not happen in a political vacuum, and the superiors of these government employees are often political appointees charged with carrying out political mandates. In times of economic downturn, politicians frequently command regulatory agencies to go through additional steps during the creation of regulations to demonstrate that new requirements do not adversely affect economic development. This is also the case at the state level. For example, in Ohio, Governor John Kasich instituted the Common Sense Initiative in 2012, which requires such measures. After the regulations are finalized, then comes enforcement. Environmental regulators often lament the regulations do not take into account technical capabilities (Pautz and Rinfret 2013). As briefly discussed in this section, the opportunities for politics to coopt science are plentiful in the creation of environmental regulation.

The Mismatch of Science and Politics in Environmental Regulation

More generally, the mismatch of science and politics is particularly evident in environmental regulation because science and politics are fundamentally unalike in important respects. First, questions of uncertainty are treated in science and politics differently. In science, researchers rarely prove anything or are certain about much. Instead, researchers disprove things or find evidence that one event may lead to another. Climate change is a prime example. The majority of peer-reviewed science has found evidence leading to the conclusion that the changing of the planet's climate is mostly due to anthropogenic (human) activity. Yet scientists will not say with 100 percent certainty that humans cause climate change. To do so would violate the inherent tenets of scientific research and the scientific method. By contrast, politicians are all about certainty, with less regard to the facts and what research can substantiate. Politicians distill complex problems into catchy political rhetoric that clearly demonstrates cause and effect (cf. Stone 2012).

Also, Americans are increasingly distrustful of science, especially when science is intangible and it defies their commonly held assumptions. Again, climate change serves as an example. Due to rather successful advocacy campaigns of climate change contrarians, the percentages of people who believe the vast majority of scientists about climate change are decreasing, rather contrary to expectations as more people understand climate change (Rabe 2010). Additionally, the public is increasingly skeptical of the scientific community for seemingly coming out with a study one week saying something is good for us and then another study released the following week says that something is bad for us.

Finally, science and politics operate on two different time horizons. Science and scientific knowledge do not happen quickly. Scientists observe phenomena in hopes of advancing knowledge, and this understandably takes lots of time. By contrast, the world of politicians changes by the second, particularly in the age of a 24/7 news cycle. One minute a politician might be facing an easy re-election bid, and then an offhand comment becomes national news and his election prospects plummet. Accordingly, when politicians are working on environmental legislation, they need answers immediately and do not have time to wait for science to get back to them on a given topic. Furthermore, in the realm of environmental protection, many of the solutions to environmental problems will not be manifested in a sort time span, and more important, the timeline for a politician's short elected term. Therefore, passing laws about mitigating the invasive species in a particular region may not show results before the politician has to run for re-election, yet the law will require major expenditures to get going. Politicians in this scenario are far less likely to be supportive of action that cannot immediately demonstrate results for their constituents.

Conclusion

The mismatch between science and politics aside, the existing modus operandi of environmental regulations—command and control regulations—faces significant challenges today. Much could be written about each of these challenges independently of one another, but for the purposes here, consider three broad categories of challenges: regulatory structure itself, evolution in science and environmental issues, and politics.

As this chapter has indicated, environmental policy generally embraces command and control regulations as the dominant policy tool. The structure of such regulations is increasingly problematic. Regulations that command facilities to achieve certain levels of emissions or use particular technologies do not allow for flexibility in securing environmental outcomes; rather, they focus on process. Therefore, if a facility is permitted to emit 1.5 tons of nitrous oxides and it is currently emitting 1.35 tons, there is no incentive to reduce emissions—indeed the facility could increase its emissions. Moreover, these regulations are frequently narrow in scope, which means that alterations to air regulations may not take into account water or waste issues at a facility. Finally, this regulatory apparatus presumes facilities are not motivated by environmental performance, which is increasingly flawed (Fiorino 2006; Prakash and Potoski 2006).

Additionally, understanding of environmental issues has improved as technology and science have evolved, making existing regulatory structures less and less appropriate to meet environmental challenges. Furthermore, the pollution issues of the 1960s have given way to more complex challenges today, such as climate change, the loss of biodiversity, and preventing environmental issues from occurring. Future regulations need to be focused on contemporary environmental problems, not past challenges.

Finally, U.S. politics have evolved to an era of hyper-partisanship, where more and more issues are used to divide rather than unite policy makers. Environmental policy is one area that has come to signify divergence among Republicans and Democrats—unlike in past decades. Congressional gridlock and concerns about the economy, terrorism, and other domestic issues have largely crowded out concerted efforts regarding environmental regulation in recent years. Regardless of these challenges, environmental regulation persists despite the political environment and the complex nexus of politics and science.

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ETHANOL

The fuel additive called ethanol is derived from corn, but the large-scale production and use of ethanol is derived from a nexus of technology, markets, and policy. The rationales for using ethanol as a fuel additive are based on both national security and environmental concerns. Energy independence has been a stated goal of the United States since the oil embargo imposed by OPEC in 1973, and the use of domestically produced ethanol is seen as enhancing this objective. Both the Energy Policy Act of 2005 and the Energy Security and Independence Act of 2007 have mandated a production quota of biofuels to help achieve this goal, while subsidies to corn growers and tariffs on sugar imports (also used to produce ethanol) have supported domestic producers. In addition, the use of ethanol is an important part of meeting the air pollution targets mandated by the Clean Air Act Amendments of 1990, as it helps to mitigate the emissions of carbon dioxide and other pollutants harmful to air quality.

The production of ethanol in the United States has dramatically increased in the twenty-first century, when biofuel production goals became mandated by law as part of the Renewable Fuel Standard. Whereas only 1.6 billion gallons of ethanol were produced in 2000, about 14 billion gallons were produced in 2011 (almost all of it used domestically), making the United States the world's largest producer of ethanol (U.S. Energy Information Administration 2013). This level of ethanol production involves a significant undertaking. In 2011, roughly 40 percent of the 93 million acres devoted to growing corn in the United States were destined for ethanol, not food (though cattle feed is a by-product in ethanol production, so the net acreage going solely to fuel is less), while 209 biorefineries were in operation processing this corn into fuel (U.S. Department of Agriculture, National Agricultural Statistics Service 2011).

In 2013, most of the fuel used for cars and light trucks in the United States contains a blend of up to 10 percent ethanol, and this blend is known as E10. While a small number of cars can operate on an E15 blend (containing 15% ethanol), it is expected that this number will increase in the coming years, and that a growing number of new "flex-fuel" cars will run be able to run on an E85 fuel mix.

A LOOK AT THE NUMBERS

Total U.S. Ethanol Production (2011): 14 billion gallons

Total Conventional Gasoline Consumed in U.S. (2011): 134 billion gallons

Percentage of U.S. Fuel Supply Met by Ethanol (2011): 9%

Acres of Corn Planted (2011): 92 million

Percentage of Acres Planted Used for Ethanol: 40%

Number of Ethanol Biorefineries in the United States in 2000/2011: 54/209

Price of Corn per Metric Ton in 2005/2012: $98/$332

This rapid expansion of ethanol production and use is not without its drawbacks. Critics have suggested that a strong agricultural lobby has encouraged public support of an industry that would not otherwise exist at the levels it does. These arguments have become even more salient in light of recent scientific scholarship suggesting that the energy savings and carbon dioxide reductions thought to result from ethanol may not be as large as originally thought, and in some instances may even result in setbacks. At the same time, the use of ever more land to produce fuel instead of food appears to be driving an increase in the price of corn and other staples around the world.

It is expected that many of these concerns can be addressed by the development of advanced biofuels, especially cellulosic ethanol, which is found in all plants and can be derived from wood chips, grass clippings, agricultural waste and by-products (think corn husks instead of kernels of corn), and the inedible parts of plants. Cellulosic ethanol, which is not yet available for large-scale commercialization, can potentially provide more energy per gallon than ethanol, while better combating climate change, without diverting as much land or food sources toward fuel production.

Scientific Background

The scientific considerations involving the production and use of ethanol as a motor fuel are many. Numerous studies have been conducted (and continue to be carried out) that examine its energy and environmental impacts. The major issues that tend