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U.S. Environmental Politics
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Table of Contents

Section 1: Modern Interpretations of the Endangered Species Act	3
<i>Section 1.1: Serena Ryan, The Endangered Species Act in the 21st Century: Regulating Greenhouse Gas Emissions Using the Polar Bear Listing</i>	5
<i>Section 1.2: Carolyn Whitlock, National Regulation of Pesticides Using the Endangered Species Act</i>	27
Section 2: Local Consequences of U.S. Energy Policy	43
<i>Section 2.1: Melissa Gallant, Hydraulic Fracturing: Investigating Water Contamination and Regulation</i>	45
<i>Section 2.2: Elli Blaine, The Arctic National Wildlife Refuge: Should ANWR be Opened Up for Oil and Gas Extraction?</i>	70
Section 3: Agricultural Reform in a Climate of Agency Capture	91
<i>Section 3.1: Shilpa Idnani, Regulating Genetically Engineered Food Organisms: Unprecedented Genetically Engineered Salmon</i>	93
<i>Section 3.2: Betsy Riley, Concentrated Animal Feeding Operations: The issue of waterway reform</i>	110
<i>Section 3.3: Julie Vining, FDA Labeling for Genetically Engineered Foods</i>	127

Section 1

Modern Interpretations of the Endangered Species Act

Serena Ryan, *The Endangered Species Act in the 21st Century: Regulating Greenhouse Gas Emissions Using the Polar Bear Listing*

Carolyn Whitlock, *National Regulation of Pesticides Using the Endangered Species Act*

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Executive Summary

Growing concern about the negative impacts of human activities on certain species of plants and animals led Congress to pass the 1973 Endangered Species Act (ESA), which protects threatened and endangered species and the ecosystems upon which they depend. This law is one of a suite of broad, far-reaching environmental laws passed during the “golden era” of U.S. environmental policy that occurred from the mid-1960s through the 1970s, and as such it explicitly gives citizens the right to file suits against corporations, organizations, or the government itself if these entities fail to uphold the spirit of the legislation. As a result, filing lawsuits against the government has become a key strategy for environmental groups that wish to list endangered or threatened species under the ESA and/or force stricter protection and more critical habitat designation for listed species, as in the case of the *Northwest Spotted Owl*.¹

Since 2000 and the onset of gridlock in Congress, however, environmental groups such as the Center for Biological Diversity (CBD) have increasingly tried to use the ESA as an alternative policy pathway to advance large-scale, national issues. Two lawsuits filed by the CBD that highlight this trend are (1) the suit against the Fish and Wildlife Service (FWS) in 2005 to list the polar bear as a threatened species under the ESA due to climate change-induced Arctic sea ice habitat loss, and (2) the suit against the Environmental Protection Agency (EPA) in 2011 to mandate reevaluation of nearly 400 pesticides currently in use and the effects they have on endangered species across the nation.

There are important similarities and differences between these two issues. Climate change due to greenhouse gas emissions and biodiversity decline due to pesticide contamination of local ecosystems are both problems caused by non-point source pollution, though at dramatically different scales. While pesticide runoff from farmland, lawns, and golf courses can impact species on a regional scale at most, greenhouse gas emissions from burning fossil fuels are well-distributed in the atmosphere and thus their warming impact is felt globally. This difference is important in the context of regulating national pesticide use or greenhouse gas emissions using the ESA because while it is certain that addressing the former would have a positive impact on many endangered species, it is not clear that U.S. action on the latter would be sufficient to prevent Arctic sea ice from melting drastically; rather, this issue requires international agreements to ensure substantial reduction of greenhouse gas emissions worldwide.

While the CBD’s recent ESA court cases have successfully drawn attention to the existing inadequacies in pesticide regulation and the lack of any comprehensive climate policies in the U.S., court-ordered regulations to address these large-scale environmental problems using the ESA are not an appropriate long-term solution. Such regulations would place an enormous burden on the FWS and the EPA, both of which lack the resources to carry out the tasks these regulations would require. If congressional gridlock continues to block any possibility of reform through legislation, a more appropriate policy pathway to address these issues is agency rule-making. Because federal agencies are ultimately responsible for carrying out environmental regulations, they need to be principally involved in creating them such that the regulations can be carried out effectively and efficiently using resources currently available to the agencies.

¹ Marcot, Bruce. *Of Spotted Owls, Old Growth and New Policies: A History Since the Interagency Scientific Report*. USDA, 1997.

Section 1.1

Modern Interpretations of the Endangered Species Act

Serena Ryan, *The Endangered Species Act in the 21st Century: Regulating Greenhouse Gas Emissions Using the Polar Bear Listing*

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ACRONYMS

API	American Petroleum Institute
CAFE	Corporate Average Fuel Economy
CBD	Center for Biological Diversity
DOT	Department of Transportation
ESA	Endangered Species Act
FWS	Fish and Wildlife Service
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
USGS	United States Geological Survey

Summary

In 2005, a radical environmental organization called the Center for Biological Diversity (CBD) submitted a petition to the United States Fish and Wildlife Service (FWS) requesting that the FWS list the polar bear under the Endangered Species Act (ESA) as a species threatened by climate change. Climate change due to anthropogenic greenhouse gases is causing sea ice in the Arctic to melt, which threatens the polar bear populations that depend on this ice for survival. The CBD reasoned, logically, that because sea ice loss is only expected to worsen in the foreseeable future as global surface temperatures continue to rise, polar bear populations will likely decline. Through this listing, the CBD attempted to advance its agenda to force national reductions in greenhouse gas emissions by arguing that under the ESA, federal agencies must not engage in activities, such as issuing permits for greenhouse gas-emitting power plants, that could indirectly harm the polar bear or its designated critical habitat.

Concerned about the implications that listing a species as threatened due to climate change would have for greenhouse gas emitting facilities throughout the nation, the FWS delayed taking action until May of 2008 when, under a court-ordered deadline, it finally listed the polar bear as threatened under the ESA. Yet the CBD's plan failed, because two rules passed by the Bush administration in conjunction with the listing, the 4(d) rule and the agency consultation rule, removed any legal obligation for the FWS to regulate national greenhouse gas emissions under the ESA. The Obama administration has since reversed the consultation rule and designated an enormous tract of land as critical habitat for the polar bear. However, the Obama administration chose to uphold the 4(d) rule that exempts greenhouse gas emitting facilities outside the polar bear's range from being subject to regulation under the ESA, arguing that the ESA is not the proper tool for obtaining national emissions reductions and that instead, climate change should be addressed through congressional legislation.

Environmental, industry, and government stakeholders hold a range of opinions regarding whether the polar bear listing under the ESA should be used to regulate national greenhouse gas emissions. This paper examines all sides of this policy issue, and ultimately concludes that while the polar bear case has brought important public attention to the fact that the U.S. still lacks any comprehensive, national climate change legislation, climate change is a global problem that calls for an international solution, and this cannot be achieved through the ESA.

TIMELINE

- February 2005 The CBD petitions the FWS to list the polar bear as a threatened species under the ESA
- May 2006 The polar bear is listed as “vulnerable” on the IUCN Red List of Threatened Species
- December 2006 FWS releases a proposal for listing the polar bear as “threatened” under the ESA
- February 2007 Fourth Assessment Report of the IPCC released
- September 2007 National Snow and Ice Data Center announces that the summer sea ice minimum was the lowest on record since satellite measurements began in 1979
- February 2008 The Minerals Management Service opens up almost 30 million acres of Arctic land and sea ice for oil and gas exploration
- May 15, 2008 FWS lists the polar bear as a threatened species under the ESA to meet a court-ordered deadline

The Bush administration issues an interim final rule under Section 4(d) of the ESA (the “4(d) rule”) that prevents the FWS from using the polar bear listing as a way to regulate greenhouse gases
- The Bush administration issues an interim final rule that eliminates the ESA stipulation that federal agencies must consult with the FWS before going forward with an activity that could potentially impact a threatened or endangered species
- March 2009 The Omnibus Appropriations Act of 2009 gives the Secretary of the Interior discretion to reverse or reissue the Bush administration’s two special rules
- May 2009 The Obama administration reverses the consultation rule but maintains the 4(d) rule
- October 2010 The FWS begins the process of developing a recovery plan for the polar bear. A Draft Recovery Plan is due June of 2012
- March 2011 The Obama administration designates 187,000 square miles as critical habitat for the polar bear

When the Endangered Species Act (ESA) was passed in 1973, no one conceived that it could be used to regulate national pollution emissions from the fossil fuel industry. Yet in 2005, the Center for Biological Diversity (CBD) petitioned the Fish and Wildlife Service (FWS) to list the polar bear as a threatened species under the ESA with the intention of using the ESA as a way to regulate greenhouse gas emissions. The CBD argued that once the polar bear gains protection under the ESA, the nation must reduce greenhouse gas emissions that contribute to global climate change and, consequently, loss of the Arctic sea ice that polar bears depend on. Under a court-ordered deadline, the FWS listed the polar bear as threatened on May 15, 2008. While the listing has resulted in added protection for the species against hunting and trading and, in 2011, the designation of a large tract of land as critical polar bear habitat, it has not yet been successfully used to address national greenhouse gas emissions. This paper examines the scientific consensus, relevant laws and rules, administrative initiatives, and stakeholder positions surrounding this issue in order to determine whether or not the ESA is an appropriate tool for achieving national reductions in greenhouse gas emissions.

Climate Change, Arctic Sea Ice and the Polar Bear: Scientific Consensus

When addressing the policy issue at hand, a preliminary discussion of relevant scientific facts can clarify reasons for the species listing and debunk false interest group claims. The primary basis upon which the FWS has listed the polar bear as threatened under the ESA—significant loss of the species' Arctic sea ice habitat in the foreseeable future due to climate change—has been challenged by interest groups that oppose the listing and thus deserves careful examination.

Climate change projections and effects on Arctic sea ice extent

Due to anthropogenic greenhouse gas emissions generated primarily from the burning of fossil fuels, the global surface temperature has increased by over 0.5 degrees Celsius in the past century (see Figure 1). How do scientists expect the global climate to change in the future, and how will this change affect Arctic sea ice extent? The leading body on climate science, the Intergovernmental Panel on Climate Change (IPCC), predicts that global temperatures will continue to rise over the next 40 to 50 years even if greenhouse gas emissions stabilize in the next few years

(an unlikely scenario), due to the long residence time of carbon dioxide in the atmosphere (200 years).¹

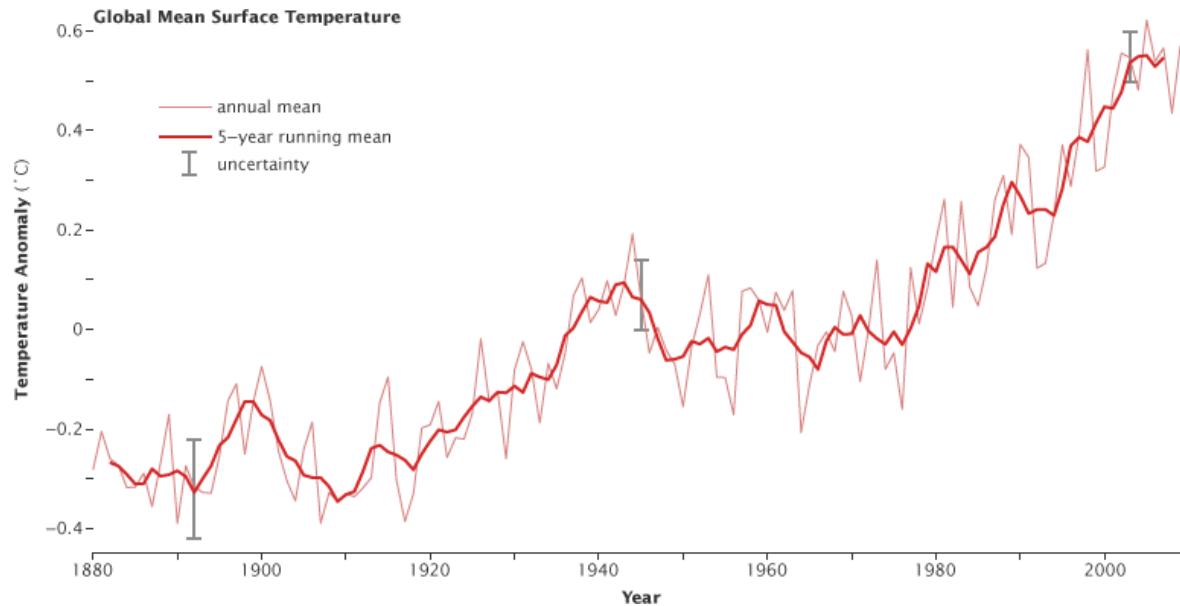


Figure 1:Changes in Global Mean Surface Temperature Over the Past 250 Years²

While the climate is subject to high natural variability, it is currently warming at a faster rate than it naturally would due to the influx of anthropogenic greenhouse gases into the atmosphere.

In the Arctic, summer melting periods are already starting earlier in the season and lasting longer (see Figure 2), and annual snowfall is decreasing.³ The 2007 melt season marked the lowest level in Arctic sea ice extent since satellite measurements began in 1979.⁴ As the climate continues to warm, scientists expect to see increases in sea ice fragmentation, reduced sea ice extent (particularly in the summer months), and a decline in ice thickness and quality.⁵

¹ *IPCC Fourth Assessment Report*. Rep. no. AR4. Ed. R. K. Pachauri and A. Reisinger. Geneva: IPCC, 2007. Print.

² "Global Warming." *NASA Earth Observatory*. Web. 15 May 2011.

<<http://earthobservatory.nasa.gov/Features/GlobalWarming/page2.php>>.

³ *IPCC Fourth Assessment Report*.

⁴ "Annual Report 2007." *National Snow and Ice Data Center*. World Data Center for Glaciology, Boulder. Web. 9 May 2011. <http://nsidc.org/pubs/annual/NSIDC_Annual_Report_2007.pdf>.

⁵ *IPCC Fourth Assessment Report*.

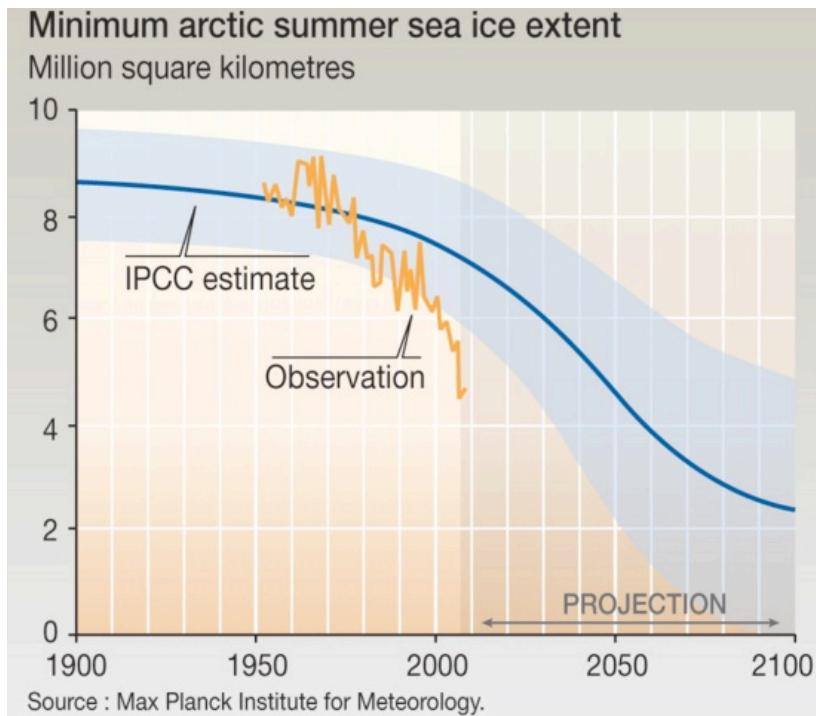


Figure 2: The annual Arctic sea extent is declining even more than the IPCC's 2007 estimate, especially in the summer months, due to warming temperatures.⁶

The polar bear and its dependence on Arctic sea ice

Ursus maritimus, commonly known as the polar bear, resides in the Arctic region of the globe and is dependent on sea ice for survival. The species' range includes the Greenland Sea and Barents Sea of northern Europe, Baffin Bay (which lies between Canada and Greenland), the Canadian Arctic archipelago, the Chukchi Sea and the Beaufort Sea (see Figure 3). Polar bears spend almost the entire year living on sea ice, although some populations may occupy land for maternal denning in the winter or to escape melting sea ice in the summer.⁷ In recent years, Inuit hunters have reported seeing more bears on land during the summer and fall than in the past as a result of melting sea ice.⁸

⁶ "Minimum Arctic Summer Sea Ice Extent." UNEP/GRID-Arendal Maps and Graphics Library. 2009. Web. 15 May 2011. <<http://maps.grida.no/go/graphic/minimum-arctic-summer-sea-ice-extent>>.

⁷ Amstrup, S. C. "Polar Bear." *The Natural History of an Arctic Oil Field: Development and the Biota*. Ed. Joe C. Truett and Stephen R. Johnson. New York: Academic, 2000. 133-57. Print.

⁸ Dowsley, Martha. "Inuit Perspectives on Polar Bears (*Ursus Maritimus*) and Climate Change in Baffin Bay, Nunavut, Canada." *Research and Practice in Social Sciences* Feb. 2007: 53-74. Print.

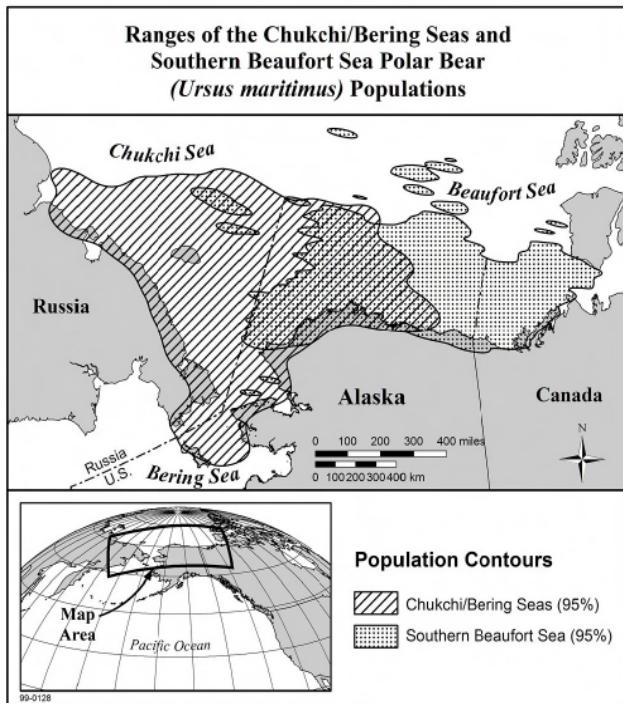


Figure 3: Polar Bear Range⁹

Polar bears use sea ice as a hunting and feeding platform, a mating and breeding grounds, sometimes a maternal denning location, and a transportation route between disconnected terrestrial areas.¹⁰ The polar bear's hunting and feeding activities occur solely on sea ice. The polar bear's primary prey is the ringed seal (*Phoca hispida*), an Arctic ice-dependent species that the bear hunts by stalking the seals' breathing holes in the ice and occasionally by diving off the ice pack into the open water.¹¹ Because the ringed seal is also dependent on Arctic sea ice, melting sea ice poses a direct threat to this species as well as the polar bear.

Polar bear population projections

Not all polar bear populations are declining currently, but almost all are expected to decline in the next 50 years due to climate change. Of the 19 populations of polar bear recognized by the International Union for Conservation of Nature (IUCN), three are listed as stable, one is listed as increasing, eight are listed as declining, and seven are data-deficient.¹² Some interest groups commented to the FWS that the polar bear should not be listed as threatened because current

⁹ "Ranges of the Chukchi/Bering Seas and Southern Beaufort Sea Polar Bear (*Ursus Maritimus*) Populations." FWS. Web. 9 Apr. 2011. <http://alaska.fws.gov/fisheries/mmm/polarbear/maps_final/general_maps.pdf>.

¹⁰ Amstrup 2000.

¹¹ Stirling, I. C., C. Jonkel, P. Smith, R. Robertson, and D. Cross. "Interrelationships of Arctic Ocean Mammals in the Sea Ice Habitat." Proc. of Circumpolar Conference on Northern Ecology. Vol. 2. 1975. 129-36.

¹² "Summary of Polar Bear Population Status per 2010." IUCN/SSC Polar Bear Specialist Group. 11 May 2010. Web. 10 Apr. 2011. <<http://pbsg.npolar.no/en/status/status-table.html>>.

populations are stable or increasing.¹³ Indeed, some polar bear populations are growing, but this increase is due to several agreements made among Arctic countries during and after 1970s that halted the severe overharvesting of polar bears that had been occurring up to that point.¹⁴ Those successes do not diminish the species' risk of future decline due to habitat loss.

Polar bears are already feeling the impacts of Arctic sea ice loss and this is only expected to worsen in the next fifty years. As the annual sea ice extent continues to shrink, the polar bear's essential survival functions such as hunting, feeding, breeding, denning, and transportation will be jeopardized. This could render the species endangered or extinct within the foreseeable future. Not only will sea ice changes diminish the polar bear's primary habitat but they will also alter ice seal population dynamics and ultimately lead to a decline in the polar bear's principal food source.¹⁵ For these reasons, the FWS, in agreement with United States Geological Survey (USGS) studies, an IUCN Polar Bear Specialist Group assessment, and expert peer-reviewed literature, determined that *all* polar bear populations will be negatively affected by climate change within the foreseeable future and thus the species should be classified as "threatened" under the ESA.

INSUFFICIENT REGULATIONS

The polar bear is currently protected from anthropogenic interference through a patchwork of domestic laws and international agreements. While the ESA could potentially be used to address the sea ice habitat loss that currently threatens the polar bear, most other treaties and laws pertaining to the polar bear focus on minimizing hunting and harvesting of the species and are not capable of addressing climate change. Two of them, the Marine Mammals Protection Act and the Convention on International Trade in Endangered Species of Wild Fauna and Flora, are briefly mentioned in this section.

Marine Mammals Protection Act

The Marine Mammals Protection Act (MMPA), passed in the United States in 1972, protects marine mammals, including the polar bear, from being killed or harassed and prevents the trade or transport of their parts.¹⁶ The MMPA was passed to address the severe overharvesting of polar bears

¹³ Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Polar Bear (*Ursus Maritimus*) Throughout Its Range; Final Rule, 50 CFR § 17 (2008). Print.

¹⁴ 50 CFR § 17.

¹⁵ 50 CFR § 17.

¹⁶ Marine Mammals Protection Act of 1972.

that was occurring in Arctic nations in the mid-twentieth century. As a result of the MMPA, the 1973 International Agreement on the Conservation of Polar Bears, and similar laws and agreements passed in other countries, polar bear harvesting has decreased sharply over the past 30 years and previously imperiled populations have begun to recover.¹⁷ Yet the MMPA is ill suited to address the sea ice habitat loss that currently threatens the polar bear's existence because it does not require any habitat conservation measures to be taken by the federal government.¹⁸

Convention on International Trade in Endangered Species of Wild Fauna and Flora

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is a treaty that regulates international trade of endangered species. Polar bears have received protection under CITES since 1975. Like the MMPA, CITES has played an important role in halting the overharvesting of polar bears, but addressing polar bear sea ice habitat loss is outside the scope of the treaty.

EXTENDING THE ENDANGERED SPECIES ACT

When Congress passed the ESA in 1973, it did not anticipate how powerful this sweeping environmental law would become. The ESA's authors wrote the ESA in order to protect imperiled species on the brink of extinction due to habitat loss or invasive species; they did not intend for the law to be used as a regulatory mechanism for national pollution control. Recently, however, congressional gridlock and the resulting lack of any broad, national climate legislation has led environmental groups such as the Center for Biological Diversity to turn to the ESA as a possible pathway to require the nation to reduce its greenhouse gas emissions.

Overview

Precisely what components make up the ESA, and how might these be used to address anthropogenic climate change? The purpose of the ESA is "to provide for the conservation of endangered and threatened species of fish, wildlife, and plants."¹⁹ The ESA is administered by the

¹⁷ 50 CFR § 17.

¹⁸ Alexander, Kristina. "CRS Report RL34573 - Does the Endangered Species Act (ESA) Listing Provide More Protection of the Polar Bear?: A Look at the Special Rules - NLE Abstract." *National Council for Science and the Environment (NCSE)*. 10 Nov. 2010. Web. 10 Apr. 2011. <<http://www.cnse.org/nle/crs/abstract.cfm?NLEid=2095>>.

¹⁹ Endangered Species Act of 1973 [As Amended Through Public Law 107-136, Jan 24, 2002]

Department of the Interior’s FWS (for terrestrial and freshwater organisms) and the Commerce Department’s National Marine Fisheries Service (NMFS) (for marine wildlife). Under the ESA, a species may be listed as either “endangered,” meaning in danger of extinction throughout all or a significant portion of its range,²⁰ or “threatened,” meaning likely to become an endangered species within the foreseeable future.²¹ The FWS and the NMFS must list species based solely on scientific evidence of their status, without regard to economic or other considerations. Once an animal species is listed, “take”—defined as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct”²²—of that animal becomes illegal. Interstate and international trade of listed animals and plants is also prohibited. After listing, the relevant agency is required to designate “critical habitat” and develop a recovery plan for the species.

Take and Section 4(d)

The ESA Section 9 prohibition of “take” is particularly relevant to the question of whether national greenhouse gas emissions can be regulated using the polar bear listing. The Department of the Interior interprets the term “harm” in the take definition above to include indirect harm to the species through significant habitat modifications.²³ The CBD theorized that major greenhouse gas emitters, such as power companies and automakers, would have to reduce their emissions so their actions would not result in an illegal “taking” of the polar bear via harm to its habitat (sea ice). However, their strategy was undermined by subsection 4(d) of the ESA, which allows the Secretary of the Interior to issue a “special rule” that legalizes taking of a *threatened* species (not an endangered species) with certain atypical management needs.

Critical Habitat

Another key component of the ESA that is relevant to the polar bear case is the requirement that the Secretary of the Interior designate critical habitat for a species at the time of listing. Critical habitat is defined in the ESA as follows:

The “specific area within the geographical area occupied by the species...on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require specific management considerations or

²⁰ ESA Sec. 3 (6).

²¹ ESA Sec. 3 (20).

²² ESA Sec. 3 (19).

²³ 50 CFR § 17.3.

protection; and (ii) specific areas outside the geographical area occupied by the species...[that] are essential for the conservation of the species.”²⁴

The responsible agency (FWS or NMFS) must conserve and protect critical habitat and prevent it from being developed. Unlike the species listing process, during which the Interior cannot take economic impacts into consideration, critical habitat designation may involve a cost-benefit analysis. If the Secretary finds that the costs to society of designating a specific area of land as critical habitat to outweigh the benefits to the species, he/she can exclude that area as long as doing so is not expected to result in extinction of the species.²⁵ In petitioning for listing the bear, the CBD hoped that this stipulation of the ESA would result in climate change regulations; if the FWS designates Arctic sea ice as critical habitat for the polar bear, the CBD reasoned, it would be required by law to maintain the integrity of this habitat by calling for a national reduction in greenhouse gas emissions.

Agency Consultation under Section 7

Also of critical importance to the polar bear case is Section 7 of the ESA, which requires federal agencies to consult with the FWS and the NMFS on any agency actions that could potentially jeopardize a listed species or its critical habitat:

Section 7 (2) Each Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency (hereinafter in this section referred to as an “agency action”) is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with affected States, to be critical, unless such agency has been granted an exemption for such action by the Committee pursuant to subsection (h) of this section.²⁶

During such a consultation, the FWS or NMFS must give a “biological opinion” of the proposed agency action and its impacts on the species in question. If the FWS or NMFS finds that the action jeopardizes the species, the agency must come up with “reasonable and prudent” alternatives to the initially proposed action.²⁷

In petitioning for the polar bear to be listed as a threatened species, the CBD hoped to utilize Section 7 of the ESA to influence sectors of the federal regulatory nexus that are

²⁴ ESA Sec 3 (5)(A).

²⁵ ESA Sec 4 (2).

²⁶ ESA Sec. 7 (2).

²⁷ ESA Sec. 7 (3)(A).

responsible for major greenhouse gas emissions nationwide. For example, because the EPA issues permits for coal-fired power plants, it could be required to consult with the FWS about the impacts that power plants have on climate change and consequently the polar bear's critical habitat. The FWS could theoretically determine that the EPA's action poses an unacceptable threat to the species and that the EPA should cease permitting of coal-fired power plants. Similarly, if the FWS determined that the Department of Transportation's (DOT) Corporate Average Fuel Economy (CAFE) standards jeopardized the survival of the polar bear due to carbon dioxide emissions from automobiles, the DOT could be required to revise CAFE standards for automakers.

POLAR BEAR PROTECTION IN THE BUSH AND OBAMA ADMINISTRATION

In 2008, the CBD succeeded in forcing the FWS to list the polar bear as threatened under the ESA, despite having petitioned to one of the most anti-environmental administrations in history. But in conjunction with the listing, the Bush administration passed two administrative rules that squashed any potential use of the polar bear's new status as a mechanism for regulating greenhouse gases—much to the dismay of several environmental groups. The Obama administration has provided the polar bear with major protections via critical habitat designation and has reversed one of Bush's special rules that would have gutted the ESA of most of its power, but it maintains the Bush-era position that the ESA should not be used to regulate greenhouse gases.

FWS 2008 Listing

On May 15, 2008, Secretary Kempthorne of the Department of Interior listed the polar bear as threatened under the ESA, citing Arctic sea ice loss in the foreseeable future due to climate change as the rationale for listing.²⁸ This was the first time a species had been listed under the ESA as threatened due to future climate change projections; in fact, the Interior had to define “foreseeable future” in the polar bear rule because no formal definition had been provided the ESA. According to the final rule, “foreseeable future” in the context of the polar bear is defined as 45 years, which the FWS considers to be “the timeframe over which the best available scientific data allows [the FWS] to reliably assess the effect of threats—principally sea ice loss—on the polar

²⁸ 50 CFR § 17.

bear.”²⁹ But while the rule says that the scientific evidence for climate change and sea ice loss in the next 45 years is sound, it explicitly states that the best scientific information available today “has not established a causal connection between specific sources and locations of emissions to specific impacts posed to polar bears or their habitat”³⁰ and as such, greenhouse gases projected to be emitted from a facility would *not* trigger consultation with the FWS due to its perceived indirect effect on the polar bear.

The Bush Administration’s Special Rules

In addition to the polar bear listing, the Bush administration passed two related administrative rules, both of which made clear that the Bush administration was determined to prevent greenhouse gases from being regulated using the ESA. The first rule, an interim version of which was issued on the same day that the polar bear was listed, is known as the “4(d) rule” after the relevant subsection of the ESA.³¹ As previously mentioned, subsection 4(d) of the ESA allows the Secretary of the Interior to issue a “special rule” that legalizes the taking of a *threatened* species that has certain atypical management needs. The polar bear 4(d) rule adopts the existing conservation regulatory requirements under the MMPA and CITES—both of which prevent polar bear harvesting and trade but have no mechanism for addressing loss of habitat due to climate change—as the appropriate regulatory provisions for the species. More critically, it *legalizes the incidental take of polar bears due to activities occurring outside of the species’ range*. In other words, the rule prevents anyone from suing a party responsible for greenhouse gas emissions outside the bear’s range on the grounds that the party’s emissions contributed to climate-related sea ice loss and thereby constitute as a taking.

Notably, this rule does not legalize the incidental take of polar bears due to activities occurring within the species’ range. Such an exemption would be quite radical and would likely be viewed as an abuse of the administration’s discretionary powers. The rule, as it currently stands, has raised concern among industry stakeholders operating greenhouse gas-intensive facilities within the polar bear’s designated range. These stakeholders fear that this rule leaves open the possibility for environmental groups to sue them for engaging in activities that contribute to climate change and

²⁹ 50 CFR § 17.

³⁰ 50 CFR § 17.

³¹ Endangered and Threatened Wildlife and Plants; Special Rule for the Polar Bear, 50 CFR § 17 (2008). Print.

therefore could constitute as a polar bear taking.³² The debate over whether or not the administration should close what these stakeholders term the “Alaska gap” by legalizing the incidental take of polar bears within the species range is further discussed in the Stakeholders section below.

The second rule, proposed by the administration in August 2008 and made final during Bush’s last month in office, removes the ESA stipulation that federal agencies must consult with the FWS before going forward with an activity that could potentially impact a threatened or endangered species.³³ Eliminating the consultation component of the ESA not only removes the need for greenhouse gas emitters to consult with the FWS but also renders consultation for all proposed federal actions unnecessary, gutting the ESA of much of its power. The Bush administration created this rule with the intention of weakening the ESA not only in the context of greenhouse gases and the polar bear, but across all listed species.

The Obama Administration’s Approach

After Congress passed an omnibus appropriations bill that gave the Secretary of the Interior discretion to reverse or reissue the Bush administration’s two special rules regarding the polar bear in March of 2009, the Obama administration chose to reverse the consultation rule but kept the 4(d) rule unchanged,³⁴ with the reasoning that “the Department does not believe that a project-by-project ESA review of proposed actions that have the potential to increase greenhouse gas emissions...is the appropriate tool for addressing climate change impacts. A comprehensive approach is needed in order to protect the polar bear and other species that are impacted by climate change.”³⁵ While no climate regulations or agreements have been passed under the Obama administration yet, in March of 2011 Secretary Salazar of the Interior designated 187,000 square miles—an area greater than the size of California—as critical habitat for the polar bear (see Figure 4).³⁶ This is a major leap forward in national protection of Arctic species. Secretary Salazar has also begun the process of developing

³² Chua, Jasmin Malik. "Industry Groups Suing To Reverse Polar Bear Protection." *TreeHugger*. 1 Sept. 2008. Web. 11 Apr. 2011. <<http://www.treehugger.com/files/2008/09/industry-groups-want-polar-bear-protection-reversed.php>>.

³³ Endangered and Threatened Wildlife and Plants; Special Rule for the Polar Bear, 50 CFR § 17 (2008). Print

³⁴ Winter, Allison. "Should the Endangered Polar Bear Prompt Action on Climate Change?" *Scientific American*. 4 May 2009. Web. 11 Apr. 2011. <<http://www.scientificamerican.com/article.cfm?id=polar-bear-prompts-climate-change-action>>.

³⁵ "Polar Bear 4(d) Rule – Q's and A's." *FWS.gov*. Web. 10 Apr. 2011.

<www.fws.gov/home/feature/2009/pdf/QandApolarbear4drule.pdf>.

³⁶ Daly, Matthew. "Polar Bears Get 'critical Habitat' off Alaska." *MSNBC.com*. 25 Nov. 2010. Web. 11 Apr. 2011. <http://www.msnbc.msn.com/id/40362221/ns/us_news-environment/>.

a recovery plan for the polar bear as required by the ESA, a draft of which will be issued in January 2012.³⁷

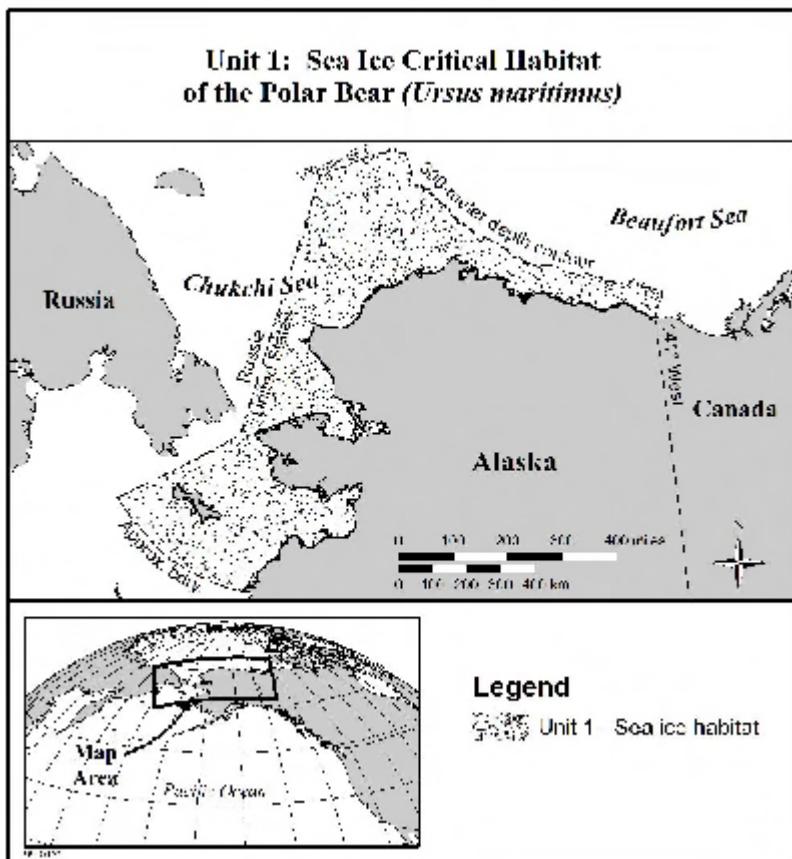


Figure 4: Sea Ice Critical Habitat of the Polar Bear. Designated by FWS in 2011³⁸

STAKEHOLDERS AND POSITIONS

The question of whether the polar bear listing under the ESA should be used to regulate national greenhouse gases is hotly debated. The CBD argues that the best way to save the polar bear from endangerment or extinction is to significantly reduce greenhouse gas emissions and that the ESA is a suitable vehicle through which to regulate emissions. Major players in the environmental community are in agreement on this issue despite being divided in other areas; several other prominent environmental groups such as the National Wildlife Federation, the World Wildlife Federation, Greenpeace International, and the National Resource Defense Council, support the

³⁷ "Polar Bear; Endangered Species Act." *Marine Mammals Management, Alaska Region*. FWS. Web. 11 Apr. 2011. <<http://alaska.fws.gov/fisheries/mmm/polarbear/esa.htm>>.

³⁸ "Sea Ice Critical Habitat of the Polar Bear." FWS. Web. 9 Apr. 2011. <http://alaska.fws.gov/fisheries/mmm/polarbear/maps_final/general_maps.pdf>. ³⁸ Amstrup 2000.

CBD's position. Other groups such as the State of Alaska, many industry groups, and the Inuit people disagree with the CBD, voicing concerns about the economic implications of the listing and proposed emissions regulations.

Center for Biological Diversity

The CBD, a radical-left environmental interest group known for launching controversial court cases, is the primary party pushing for greenhouse gas regulation through the polar bear listing. The CBD was the original petitioner for the species listing in 2005, later joined by Greenpeace International (another fairly radical interest group) and the National Resources Defense Council (a more moderate environmental organization).³⁹ In addition to pushing for emissions regulations for carbon dioxide emitters like automobiles and power plants, the CBD stresses the importance of reducing non-carbon dioxide pollutants—such as tropospheric ozone and black carbon—that are particularly concentrated in the atmosphere above the Arctic region and thus proportionally have a greater warming impact on this region than globally.⁴⁰

National Wildlife Federation

The National Wildlife Federation (NWF), the largest nonprofit conservation organization in the United States, supports the CBD's position that greenhouse gases should be regulated under the ESA to protect the polar bear. This group's support is particularly interesting because it is one of the more conservative, mainstream environmental interest groups in the U.S. and it has historically disagreed with the CBD on controversial environmental issues such as delisting the grizzly bear from the ESA. Yet in the case of regulating greenhouse gases to save the polar bear, the positions of the NWF and the CBD are unified, which gives more weight to their argument. The NWF claims that Secretary Salazar's decision to maintain the Bush-era 4(d) rule under the pretense that there is no known direct link between a particular emissions source and the polar bear is based on scientifically unsound information and sends the wrong message to the public. Senior NWF counsel John Kostyack feels that, "the Obama Administration is missing a chance to tell the American

³⁹ Greenemeier, Larry. "U.S. Protects Polar Bears Under Endangered Species Act." *Scientific American*. 14 May 2008. Web. 11 Apr. 2011. <<http://www.scientificamerican.com/article.cfm?id=polar-bears-threatened>>.

⁴⁰ Siegel, Kathy, Brendan Cummings, Anna "Mickey" Morowitz, and Brian Nowicki. "Not Too Late to Save the Polar Bear: A Rapid Action Plan to Address the Arctic Meltdown." *Center for Biological Diversity*. 17 Oct. 2007. Web. 11 Apr. 2011. <<http://www.biologicaldiversity.org/publications/papers/ArcticMeltdown.pdf>>.

people what global warming is doing to their wildlife.”⁴¹ The NWF is currently pressuring the administration to reclassify the polar bear as endangered, rather than threatened.⁴²

Inuit People

Native Inuit populations of Canada and Alaska are opposed to the listing of the bear under the ESA, arguing that current regulations and agreements on polar bear protection are adequate and that listing the species hurts the economic well-being of Inuit communities that benefit from polar bear sport hunting revenues.⁴³ Both the Government of Nuvanut and the Inuvialuit Game Council of Nuvanut, Canada sent in comments to the FWS arguing that listing the polar bear is unnecessary because bear populations are increasing and information about climate change is not currently sufficient to warrant an ESA listing. The FWS took these comments into consideration when making its decision to list the polar bear; however, it ultimately concluded that polar bear populations are only increasing in areas where the species was severely overharvested up until the 1970s international hunting agreements, and that all populations are still at risk of endangerment due to climate change in the foreseeable future.⁴⁴

State of Alaska

The State of Alaska vociferously opposes any protection of the polar bear under the ESA because it significantly limits the state’s ability to develop its natural oil and gas resources that occur on land designated as critical habitat for the bear. Untapped offshore drilling sites could yield enough fossil fuels to fill the trans-Alaska pipeline, which is currently running at less than one-third capacity, and fill a proposed \$26 billion natural gas pipeline that could bring in a significant source of revenue,⁴⁵ but unfortunately for Alaska these sites overlap with the polar bear’s critical habitat. Alaska Governor Sean Parnell and his predecessor Sarah Palin have both fought litigation battles with the FWS to delist the bear in order to preserve the state’s ability to develop its petroleum. The Alaska state government has also fought against the ESA and environmental constraints against

⁴¹ Walsh, Bryan. "Obama's Interior Dept. Won't Overturn Bush's Polar Bear Rule." *TIME.com*. 8 May 2009. Web. 11 Apr. 2011. <<http://www.time.com/time/health/article/0,8599,1897080,00.html>>.

⁴² "Help the Polar Bear: Reduce Greenhouse Gases and Reclassify to Endangered." *Wildlife Promise*. National Wildlife Federation, 20 Dec. 2010. Web. 09 May 2011. <<http://blog.nwf.org/wildlifepromise/2010/12/help-the-polar-bear-reduce-greenhouse-gases-and-reclassify-to-endangered/>>.

⁴³ Buscemi, Franco. "NTI Brings Inuit Voice to National Polar Bear Roundtable." *Nunavut Tunngavik Inc.* 19 Jan. 2009. Web. 11 Apr. 2011. <<http://www.tunngavik.com/2009/01/19/nti-brings-inuit-voice-to-national-polar-bear-roundtable/>>.

⁴⁴ 50 CFR § 17.

⁴⁵ "Alaska Fights to Reverse Polar Bear Listing." *Msnbc.com*. 15 Nov. 2009. Web. 11 Apr. 2011. <http://www.msnbc.msn.com/id/33955415/ns/us_news-environment/>.

offshore drilling more broadly, although the 2010 oil spill in the Gulf of Mexico was a major setback for the state.⁴⁶ Governor Parnell says he is determined to remove polar bear protections that hinder oil and gas drilling, and that, “We’re going to take every step we can to fight for Alaskan jobs and our economy.”⁴⁷ The court case he is currently involved in has yet to be resolved.

American Petroleum Institute et al.

After the FWS listed the polar bear as threatened in 2008, the American Petroleum Institute, the Chamber of Commerce, the National Mining Association, the National Association of Manufacturers, and the American Iron and Steel Institute sued Secretary of the Interior Dirk Kempthorne—not over the listing of the bear as a threatened species, but over the 4(d) rule. The plaintiffs agree with the Department of Interior’s determination that Endangered Species Act is not an appropriate tool for regulating national greenhouse gas emissions, but disagree with what they term the “Alaska Gap” – the stipulation that excludes actions resulting in greenhouse gas emissions that occur *within* the range of the polar bear from the “taking” exemption awarded to actions occurring *outside* the range.⁴⁸ The plaintiffs, all of whom operate greenhouse gas-intensive facilities within the polar bear’s designated range, fear that this rule leaves open the possibility for environmental groups to sue them for engaging in activities that contribute to climate change and therefore could constitute as a polar bear taking.⁴⁹ They argue that the Alaska Gap will place unfair permitting burdens on industry operations in Alaska and that the interim final 4(d) rule issued by the Department should be expanded to include Alaska.⁵⁰ This case has been consolidated with a related case issued by the Chamber of Commerce, and the litigation (*re: Polar Bear Endangered Species Act Listing and 4(d) Litigation*) is currently awaiting a decision from the US District Court.⁵¹

RECOMMENDATION

As the climate continues to warm and Congress remained gridlocked, alternative policy pathways have become attractive routes for environmental groups attempting to achieve broad

⁴⁶ Krauss, Clifford. “Shell Tries to Calm Fears on Drilling in Alaska.” *NYT.com*. 2 May 2011. Web. 15 May 2011. <<http://www.nytimes.com/2011/05/02/business/energy-environment/02shell.html?hp=&pagewanted=print>>.

⁴⁷ "Alaska Fights to Reverse Polar Bear Listing."

⁴⁸ Chua 2008.

⁴⁹ Chua, Jasmin Malik. "Industry Groups Suing To Reverse Polar Bear Protection." *TreeHugger*. 1 Sept. 2008. Web. 11 Apr. 2011. <<http://www.treehugger.com/files/2008/09/industry-groups-want-polar-bear-protection-reversed.php>>.

⁵⁰ Chua 2008.

⁵¹ "In Re: Polar Bear Endangered Species Act Listing and 4(d) Litigation." *National Chamber Litigation Center*. Web. 09 May 2011. <<http://www.chamberlitigation.com/re-polar-bear-endangered-species-act-listing-and-4d-litigation>>.

reductions in greenhouse gas emissions. The CBD petitioned the FWS to list the polar bear in 2005 despite facing an even friendlier Congress than it is today; increased party polarization since Obama took office in 2008 has made Congress less receptive to environmentalists' pleas for a national climate policy. Obama's decision to uphold the 4(d) rule passed by the Bush administration that blocks the use of the ESA as a vehicle for regulating greenhouse gas emissions was predicated on passing climate change legislation—but gridlock in Congress has prevented any such legislation from passing. Therefore, the urgency of the ESA strategy for the CBD has only increased since 2005.

At first glances, the polar bear listing under the ESA appears to be a reasonable way to address climate change due to the obvious connection between greenhouse gases and Arctic sea ice loss. But upon careful examination of the ESA structure, it becomes apparent that this golden-era legislation is not suitable for addressing such a complex, global issue as climate change. The ESA is designed to look at federal actions that could potentially be harmful to a listed species on a case-by-case basis. Fossil fuels are tied to so many essential functions of daily life in America and the world at large that separately evaluating each federal activity for its impact on climate change is impractical and inefficient. More critically, even if the US did significantly reduce greenhouse gas emissions that threaten the polar bear, it is unclear whether its actions would be sufficient to prevent Arctic sea ice from melting unless other countries agreed to do the same—and there is no guarantee that they would do so.

Yet all is not lost for the CBD and other environmental groups. By listing such an iconic species as the polar bear as threatened due to the greatest environmental peril of the 21st century, environmentalists have successfully tugged at the public's heartstrings and brought increased attention to the devastating consequences of anthropogenic climate change. Above all, they have highlighted the glaring fact that the United States has yet to adopt any broad, comprehensive strategy to reduce greenhouse gas emissions. In the current state of Congressional gridlock, agency initiatives, such as the EPA's current plan to regulate greenhouse gases under the Clean Air Act, are an appropriate alternative policy pathway for addressing climate change. Federal agencies are better positioned than the courts to establish feasible strategies to address climate change using currently available resources. Perhaps as more species become listed as threatened under the ESA due to climate change over the next decade, Congress will be driven to take action on this issue. Whether such action will tend towards gutting the ESA of its power or passing sweeping climate change legislation remains to be seen.

Section 1.2

Modern Interpretations of the Endangered Species Act

**Carolyn Whitlock, *National Regulation of Pesticides Using the
Endangered Species Act***

June 1, 2011

U.S. Environmental Politics
Environmental Studies Program

Summary

Pesticide regulation in the United States currently relies on two tiers of legislation. The primary tool for regulating pesticides in the US is the Federal Fungicide, Insecticide and Rodenticide Act (FIFRA), which requires pesticides sold in the United States to be reviewed at regular intervals by the Environmental Protection Agency (EPA). If, however, the initial FIFRA evaluation finds that a pesticide “may affect” an endangered species, the pesticide must be evaluated under section 7 of the Endangered Species Act (ESA). The National Marine and Fisheries Service (NMFS) or the Fish and Wildlife Service (FWS) then provide a recommendation on how to best use the pesticide while minimizing negative effects on endangered species.

In recent years, there has been a strong movement from the agricultural industry and from federal agencies to try and smooth out the pesticide review process, which is slow and often suffers from a backlog of requests. Since Section 7 consultations are time-consuming and taken at the discretion of the EPA, much of the effort to streamline the regulatory process has relied on decreasing the number of interagency consultations. This has worried environmental advocacy organizations, who feel that current pesticide toxicity tests are not rigorous enough.

In response, environmental groups have turned to the courts and the ESA in an attempt to alter pesticide regulations, turning civil suits into a powerful and successful alternative policy pathway. In recent years, these organizations have sought to regulate more pesticides over a larger area, culminating in a suit brought by the Center for Biological Diversity (CBD) against EPA in January of this year for a failure to consult with the Fish and Wildlife Service or the National Marine and Fisheries Service on the effects that 381 pesticides have on 214 species currently protected by the ESA.

Although environmental advocacy organizations are using the ESA in precisely the way its authors intended it to be used, widespread and repeated use of the Act only serves to highlight how broken our regulatory system is. Two parallel regulatory processes result in regulatory decisions that only satisfy farmers and court decisions or that only satisfy environmental groups, pulling policy back and forth between two extremes without compromise. The ESA is a useful tool for addressing threats to endangered species, but it should not be used in place of broader regulatory reform.

ACRONYMS AND DEFINITIONS

APA – Administrative Procedures Act

CBD – The Center for Biological Diversity, an environmental advocacy organization and one of the plaintiffs in the case.

EPA – Environmental Protection Agency

ESA – Endangered Species Act

FIFRA – Federal Fungicide, Insecticide and Rodenticide Act, the primary legislation for regulating pesticides in the United States.

FWS – Fish and Wildlife Service

IPM – Integrated Pest Management

JCESAR - Joint Counterpart Endangered Species Act Section 7 Consultation Regulation

NMFS – National Marine and Fisheries Service

PAANA – Pesticide Action Network of North America, an environmental advocacy organization and one of the plaintiffs in the case.

Pesticide – A substance or substances designed to repel, destroy and mitigate pests. The term can refer to herbicides, insecticides, rodenticides and fungicides.

RPA – Reasonable and Prudent Alternative

Services – The Fish and Wildlife Service and the National Marine and Fisheries Service

TIMELINE

Significant ESA Pesticide Regulation Lawsuits in the United States

2000-2002: *Californians for Alternatives to Toxics v. EPA.* The EPA was required to determine the effect of 18 pesticides on 33 endangered and threatened species in California.

2002-2004: *Washington Toxics Coalition v. EPA.* A series of court orders required the EPA to determine the effect of 54 pesticides on 26 listed salmonid species, and forced restrictions on use of the pesticides while the evaluation was carried out.

2002 – 2006: *Natural Resources Defense Council v. EPA.* The EPA was required to set a schedule for determining the effect of atrazine on 20 listed species across the nation.

2003-2005: *Center for Biological Diversity v. Johnson.* The EPA was required to set a schedule for determining the effect of six pesticides on the Barton Springs Salamander, with FWS consultation as appropriate.

2005-2006: *Center for Biological Diversity v. Johnson.* EPA was required to determine the effects of 66 pesticides on the California red-legged frog, and place injunctions on the use of the pesticides near critical habitat in the meantime.

2007-2010: *Center for Biological Diversity v. EPA.* The EPA was required to set forth a schedule for determining the effects of 75 pesticides on 11 species in Northern California, and restrict use of the pesticides in the interim.

2010 - ?: *Center for Biological Diversity v. EPA and FWS.* The CBD is suing both the EPA and FWS for failure to implement the consultations on pesticides that might affect the red-legged frog in a timely manner, as the 2006 settlement required.

2011-?: *Center for Biological Diversity v. EPA.* The CBD is suing the EPA for a failure to consult with the FWS or the NMFS on the effect that 381 pesticides have on 214 endangered and threatened species across the nation. The CBD also seeks a restriction on use of these pesticides during the evaluation process.

Introduction

In response to congressional gridlock on environmental issues, environmental advocacy groups have turned to the courts in order to affect environmental policy through civil suits. The Endangered Species Act (ESA), with its broad applications, strong provision for citizen suits in the legislation, and cost-benefit-analysis free interpretations, has been an especially popular vehicle through which to launch environmental policy suits.

The past decade, however, has seen an expansion in the scale of issues brought through the courts. This trend is especially obvious in the case of suits over pesticide effects on endangered species; overall, the cases cover more species, involve more pesticides and affect more of the country than ever before. This process has culminated in the January 2011 lawsuit filed by the Center for Biological Diversity (CBD) against the Environmental Protection Agency (EPA) for a failure to consult with the Fish and Wildlife Service (FWS) or the National Marine and Fisheries Service (NMFS), which are collectively referred to as the Services, on the effect that a total of 381 pesticides have on 214 species currently protected by the ESA. It is one of the most sweeping lawsuits ever to find its way into a federal court, and could result in a ban or restriction on pesticide use in 49 states.

At the same time, however, there is a growing concern over pesticide regulation in the United States, in terms of avoiding an undue regulator burden on farmers. Though the ESA allows environmental organizations to address concerns over pesticide use that the regulatory agencies do not cover, there is an ongoing debate over whether the ESA is, in fact, the right tool to address those concerns – especially when the EPA and the Services have often failed to follow the pesticide review deadlines that the courts have required them to fulfill. In order to better judge how and if pesticides should be regulated in the courts under the ESA, this paper provides a background on the current regulation and the current stakeholders and gives a recommendation about how pesticide regulation in the US should proceed.

Regulatory Background

FIFRA

The Federal Insecticide and Rodenticide Act (FIFRA) governs the primary regulatory process for pesticides in the United States. In order for a manufacturer to sell a pesticide in the US, the manufacturer must get a permit from the EPA specifying how and where the pesticide can be

used, and must renew the permit at 15-year intervals. Each potential use of the pesticide is tested separately – that is, use of a pesticide for grain crops is considered separately from use of a pesticide on mosquitoes – for adverse effects on workers applying the pesticide, probable adverse effects on civilians who might be exposed, and “unreasonable adverse effects on the environment⁵²”. If, during this process, it is determined that the active ingredient poses sufficient risk to humans or animals, it enters the special review process, to determine under the FIFRA whether the benefits of using the pesticide outweigh the risks of its use⁵³. Risk analysis includes toxicology studies measuring short-term and long-term effects on organisms, probable exposure pathways, residence time in the environment, and the effects of breakdown products⁵⁴. The testing process is essentially underwritten by the extensive registration fees companies pay to the EPA regardless of whether the pesticide is approved upon registration or re-registration. This has provided companies a significant incentive to avoid trying to market pesticides that are likely to be suspended or restricted by the EPA. Although the EPA has approved the majority of pesticides that have been put forward for re-registration, thousands have been cancelled voluntarily by the manufacturers⁵⁵.

The ESA

Since the pesticide regulatory process is a federal activity, pesticides are also subject to regulation under section 7(a)(2) of the ESA, which forbids federal activities from affecting the take of an endangered species⁵⁶. If the EPA finds during its initial FIFRA consultation that a pesticide under review “may affect” a listed species or critical habitat, then during the special review process the EPA must consult with the NMFS or the FWS, who carry out section 7 consultations.

Alternatively, if the NMFS or the FWS finds that an endangered species is threatened by a pesticide, they can request a review from the EPA, with the expectation that the EPA will then consult with them as well. The NMFS or the FWS will then give a Biological Opinion (BO), relying on their experts and all relevant information – including the cumulative effects of all activities in the area, both federal and nonfederal, for the listed species. If the BO finds that the federal agency’s

⁵² Federal Register. “Federal Insecticide, Fungicide and Rodenticide Act as Amended through P.L. 110-24,” Effective May 22, 2008

⁵³ Cropper, Maureen. “The Determinants of Pesticide Regulation: A Statistical Analysis of EPA Decision Making”. The Journal of Political Economy, Vol. 100. No. 1. 1992. Pgs 175-197.

⁵⁴ United States Environmental Protection Agency. “Pesticides: Regulating Pesticides.” Last modified April 11, 2011. <<http://www.epa.gov/pesticides/regulating/index.htm>>

⁵⁵ Toth, Stephen J. “Federal Pesticide Laws and Regulations”. Southern Extension and Research Activity – Information Exchange Group 1 (Southern Region Pesticide Impact Program), March 1996.

⁵⁶ Federal Register. “Endangered Species Act of 1973 As Amended Through Public Law 107–136”, Jan. 24, 2002.

activity is likely to jeopardize the species, the BO must specify reasonable and prudent alternatives (RPAs) for the agency to take that will avoid undue danger to the species. The FWS also specifies conservation measures for ensuring that the Federal agency does not adversely affect the take of the species⁵⁷. For the EPA and its regulation of pesticides, this process has a third step: a country bulletin regarding how the pesticide should be used in the immediate area of the habitat, including restrictions on application, implementation of buffer zones, and maximum allowable distribution of a pesticide⁵⁸.

After the initial consultation, there is a period of public comment when interested parties can submit data and opinions that they think are relevant to the decision to permit the pesticide, in accordance with the Administrative Procedures Act⁵⁹. New data can be anything from better information on local conditions to studies on the toxicology of a pesticide. The EPA also publishes its own research and findings to comment by the public during this period. Although the EPA is supposed to weigh these public opinions in its final decision to regulate a pesticide, the ultimate decision on which findings to acknowledge and which to ignore lies with the EPA⁶⁰.

Concerns with Current Procedure and Regulatory Amendments

The Process is Inefficient

The regulatory process through both paths has been plagued by inefficiencies ever since its creation. The EPA had a backlog of pesticides yet to be reviewed in 1975, and requested that Congress amend the FIFRA to allow expedited re-review of pesticides already approved once by the EPA. In 1977, Congress amended FIFRA again to require the EPA to approve the 600-or-so active ingredients currently in use, instead of the 40,000 marketed pesticides used in the United States. And there is still a backlog; in 1996, it took two to three years for the EPA to make a complete review of an active ingredient of a pesticide.

Pesticide regulation under the ESA can be even slower. In 2003, the EPA requested a consultation under section 7 of the ESA for 37 different pesticides to the NMFS; by 2007, the

⁵⁷ Litmans, Brian and Jeff Miller. "Silent Spring Revisited: Pesticide Use and Endangered Species". The Center for Biological Diversity, 2006. <http://www.biologicaldiversity.org/publications/papers/Silent_Spring_revisited.pdf>

⁵⁸ EPA, "Pesticides: Regulating Pesticides." <<http://www.epa.gov/pesticides/regulating/index.htm>>

⁵⁹ Federal Register, "Administrative Procedure Act (5 U.S.C. Subchapter II)." <<http://www.archives.gov/federal-register/laws/administrative-procedure/>>

⁶⁰ Cropper, "Determinants of Pesticide Regulation A Statistical Analysis of EPA Decision Making"

NMFS had started none of the consultations. As a result, the Northwest Coalition for Alternatives to Pesticides sued the NMFS for failure to complete the consultation. In 2008, the NMFS and the plaintiffs negotiated a settlement that required the biological opinions by 2012 – nine years after the initial request⁶¹.

The Process is Not Thorough Enough

Despite the regulatory delay between pesticide development and certification, many environmental and consumer organizations argue that the current certification process does not test pesticides thoroughly enough. Specifically, they claim that the EPA's initial assessments are simply not extensive enough, and fail to take new science into account when calculating exposure pathways, such as wind drift from crop fields, and the potential for pesticides interacting with each other to produce biological effects that are orders of magnitude more severe than either pesticide would be on its own⁶². There is also a growing concern that the EPA may be ignoring civilian scientists and their research, and taking its cues for interpreting risks to human and animal health instead from agricultural industry. In the conflict over the approval of atrazine for unrestricted use, for instance, the EPA dismissed findings from the University of California that tadpoles exposed to 0.01 parts per billion of atrazine became hermaphrodites⁶³. Atrazine is found in nearly every groundwater reservoir in the United States, often at concentrations greater than one part per billion⁶⁴. And, environmental advocacy groups feel that the current public review period does not allow for sufficient deliberation over the effects of pesticides; draft biological opinions are usually open for public comment for thirty days, and the technical documentation can be 1000 pages thick⁶⁵.

⁶¹ Washington State Department of Agriculture. “The Endangered Species Act and the Impact to Pesticide Registration and Use”. 2010

⁶² Litmans, “Silent Spring Revisited”

⁶³ Litmans, “Silent Spring Revisited”

⁶⁴ USGS, “Watershed Regressions for Pesticides (WARP) Atrazine Model. Accessed April 21, 2011.
<<http://infotrek.er.usgs.gov/warp/>>

⁶⁵ House Committee on Agriculture, “Testimony from Dan Newhouse, Director, Washington State Department of Agriculture, on Behalf of the National Association of State Departments of Agriculture Before the Committee on Agriculture, United States House of Representatives”, May 3, 2011.
<<http://agriculture.house.gov/pdf/hearings/Newhouse110503.pdf>>

Attempts to Alter Legislation

Agency Attempts to Streamline the Review Process

For the most part, efforts to streamline the regulatory process have relied on agency rulemaking and procedural changes. For instance, the establishment of the Endangered Species Protection Plan (ESPP) was intended to standardize, streamline and enforce the restrictions on pesticide use recommended by the NMFS and the FWS in their biological opinions. Although discussion of the ESPP began back in 1988, the date on which the ESPP would come into effect was pushed back repeatedly, and it was not until 2005 that the ESPP came into effect.⁶⁶ In 2004, the EPA released a proposed Joint Counterpart Endangered Species Act Section 7 Consultation Regulation (JCESACR), under which the EPA could decide for itself whether a pesticide required consultation with the Services, and avoid a process of secondary review if the opinion of the EPA disagreed with that of the NMFS or the FWS⁶⁷. Even though the second district court of Washington overturned the JCESACR due to a lawsuit brought by the Washington Toxics Coalition⁶⁸ later that year, this case only underlines how anxious federal agencies have been to move registration through faster – and how anxious environmental organizations have been to keep them from doing so.

Environmental Organizations and the ESA

Due to the lack of direct input into the regulatory process outside of the comment period, most of the efforts by environmental organizations to effect pesticide regulation have been by dragging the EPA into the courts to re-examine the impacts of a pesticide under the ESA through citizen suits. Litigating under section 7 of the ESA has several advantages over attempting to use FIFRA. For one, FIFRA lacks the ESA's explicit defense of standing for environmental organizations, and the ESA's provisions for citizen suits. Moreover, since FIFRA requires a cost-benefit analysis to govern permitting of a new pesticide, the agency can argue that economic benefits of a given pesticide outweigh the costs. The ESA, however, requires whatever action is necessary to preserve a species regardless of cost – and so, if an environmental organization can prove to the satisfaction of the court that an endangered species is threatened, the courts can order

⁶⁶ EPA "Pesticides: Endangered Species Protection Program." Last modified April 16, 2011. <<http://www.epa.gov/oppfead1/endanger/basic-info.htm>>

⁶⁷ Litmans, "Silent Spring Revisited."

⁶⁸ Congressional Research Service "The Endangered Species Act (ESA) in the 111th Congress: Conflicting Values and Difficult Choices." October 2010.

the EPA to review the pesticide's permit or restrict its use.⁶⁹ Thus, organizations can get results from the ESA that they often could not get otherwise; Even though the National Resources Defense Council (NRDC) had attempted to convince the EPA not to give regulatory approval to atrazine because of possible risks to human health since 2001,⁷⁰ it was not until their 2003 suit against the EPA for a failure to consider the effects on several species, including sea turtles in the Chesapeake Bay, that they managed to get the EPA to re-evaluate atrazine⁷¹.

Over the past decade, this has resulted in more and more suits being brought in order to affect pesticide regulation. Moreover, the scope and scale of the lawsuits has increased to affect more land, more species, and more pesticides. The CBD's 2003 lawsuit against the EPA asked for re-evaluation of the effect of six pesticides on one endangered species; their 2007 lawsuit sought re-evaluation of the effect that 75 pesticides had on 11 species in Northern California.⁷²

The Center for Biological Diversity and the Lawsuit Against the EPA

The escalation of lawsuits to regulate pesticides culminated in this suit against the EPA. On January 19, 2011, the Center for Biological Diversity and the Pesticide Action Network of North America (PANNA), sued the EPA in the United States District Court for the Northern District of California for failure to consult with the FWS and NMFS on the effect that 381 pesticides had on 214 endangered and threatened species in the continental US and Hawaii⁷³, as the agency is required to do under the ESA. The pesticides include several compounds that have come under increased scrutiny in the past few years, such as Atrazine, and altogether accounted for about 40% of the pesticides sold in the United States in 2007 by weight.⁷⁴

The CBD claims that the EPA's research standards for pesticide certification are severely lacking. In particular, the EPA has consistently failed to take into account several important factors affecting the safety of pesticides on wildlife, such as effects on the young of a species, seasonal variation in pesticide levels, and chronic toxicity. They also claim that when data did exist showing

⁷⁰ Federal Register. "Endangered Species Act of 1973 As Amended Through Public Law 107–136"

⁷¹ EPA, "Natural Resources Defense Council (NRDC) v. EPA - EPA Signs Settlement Agreement Regarding Endangered Species 2003". <http://www.epa.gov/espp/litstatus/NRDCsettlement_fs.htm>

⁷² Litmans, "Silent Spring Revisited"

⁷³ "Complaint for Declaratory and Injunctive Relief In the United States District Court for the Northern District of California, San Francisco Division." *Center for Biological Diversity, Pesticide Action Network North America v. Environmental Protection Agency*. 2011

⁷⁴ EPA. "Pesticide Industry Sales and Usage: 2006-2007 Market Estimates." <<http://www.epa.gov/opp00001/pestsales/07pestsales/usage2007>>

that there was a distinct threat to an endangered species the EPA often ignored it, and cite twelve specific examples of studies by the EPA and FWS that identified species in danger of extinction from pesticide use for which no action has been taken. Moreover, all of the 214 endangered species on the list have pesticides listed as a source of their endangerment by the Services.

Finally, the CBD claims that the EPA should have re-consulted with the Services over species already consulted from 1989 to 1993 because new information on pesticides and their effects now exists. Moreover, since the EPA's ESPP and the corresponding regulatory framework had not been approved within this period, compliance with the Biological Opinions issued by the Services was not enforced during this period. No data exists to determine whether the assumptions made in the biological opinions are still valid – and since the Services assumed that the BOs would be followed, any recommendations made in there should be reexamined. By failing to consult with the Services again, the EPA is in violation of section 7 of the ESA.

As its relief, the CBD and PAANA ask the court to order the EPA to “begin or reinitiate consultation” with the Services on the species and pesticides listed in the brief. It also wants the court to order “appropriate restrictions” on use of the pesticides in places where they may affect critical habitat. Exactly what this entails will be left up to the courts; however, given the outcome of previous pesticides suits brought against the EPA by the CBD, this will likely entail either significant buffer zones between critical habitat and pesticide spraying or aerial application, or an outright moratorium on using these pesticides in places where they might affect critical habitat⁷⁵.

Stakeholders and Responses to the Lawsuit

Environmental Advocacy Groups

The two most prominent environmental advocacy groups in this case are the two that are bringing the suit. The Center for Biological Diversity has made a reputation for itself by “systematically and ambitiously [using] biological data, legal expertise, and the citizen petition provision of the powerful Endangered Species Act”,⁷⁶ in order to effect environmental policy through the courts. The CBD has secured habitat and protection under the ESA for over three hundred species since its founding and 95% of the species listings since 2000, and claims that 93%

⁷⁵ *Center for Biological Diversity and Pesticide Action Network of North America vs. the EPA*, 2011.

⁷⁶ Cener for Biological Diversity, “Our Story.” <<http://www.biologicaldiversity.org/about/story/index.html>>

of the lawsuits that it has initiated have had some favorable outcome.⁷⁷ The Pesticide Action Network of North America, on the other hand, is the American branch of the Pesticide Action Network (PAN), a global organization dedicated to exposing and mitigating risks associated with applications of pesticides. PAANA has undertaken several actions to protect humans and wildlife threatened by pesticides, including a lawsuit banning use of carcinogenic methyl iodide on strawberries⁷⁸ and publishing a leaked memo from the EPA linking colony collapse disorder in bees and a widely-used pesticide called Clothianidin⁷⁹.

Both organizations have stated their intention to seek a ban on the use of the pesticides during the evaluation period in their Complaint for Declaratory and Injunctive Relief⁸⁰, and have stated that this is an opportunity for American agriculture to account for the real costs of pesticides and transition to more sustainable methods⁸¹. Several more prominent environmental organizations, such as the Sierra Club and the National Resources Defense Council, have failed to make any public statement on the issue. Since many of these organizations have come out in favor of the CBD's and PAANA's actions in the past⁸², it might be a sign that some of the more mainstream organizations think that this lawsuit goes too far⁸³.

Farming Industry Advocates

Farming today in the United States relies heavily on pesticide use; over 507 million pounds of pesticide were applied to crops in 2007. Together, the 381 pesticides outlined in this suit are more than 40% by weight of the total pesticides used for agriculture in 2007 - a 9.8 billion-dollar industry⁸⁴. The potential costs to farmers for shifting to other pesticides are immense, and would affect farmers in every state in the country except Alaska.

⁷⁷ Center for Biological Diversity, "About Our Endangered Species Work." <<http://www.biologicaldiversity.org/programs/biodiversity/index.html>>

⁷⁸ "Coalition Sues California Over Approval of Cancer-Causing Strawberry Pesticide." eNews Park Forest, January 4, 2011. <<http://www.enewspf.com/latest-news/science-a-environmental/20840-coalition-sues-california-over-approval-of-cancer-causing-strawberry-pesticide.html>>

⁷⁹ Keim, Brandon. "Leaked Memo Shows Doubts about Bee-Killing Pesticide" Wired Science, December 13, 2010. <<http://www.wired.com/wiredscience/2010/12/epa-clothianidin-controversy/>>

⁸⁰ *Center for Biological Diversity and Pesticide Action Network of North America vs. the EPA*, 2011

⁸¹ Joint Press Release, CBD and PANNA. "Landmark Lawsuit Filed to Protect Hundreds of Rare Species from Pesticides" January 20, 2011. <<http://www.panna.org/press-release/landmark-lawsuit-filed-protect-hundreds-rare-species-pesticides>>

⁸² NRDC, "Ruling Offers Polar Bears a New Opportunity For Full Protection." <<http://www.nrdc.org/media/2010/101104a.asp>>

⁸³ NRDC, "Press Release: Kids More Vulnerable To Pesticides Than Previously Believed, Study Shows." <<http://www.nrdc.org/media/pressreleases/060302b.asp>>

⁸⁴ EPA, "Pesticide Industry Sales and Usage: 2006-2007 Market Estimates."

Accordingly, several industry lobbying groups, including CropLife America⁸⁵ and the American Farm Bureau Federation⁸⁶ have filed motions to intervene, claiming that "the interests of Intervenor-Defendants and their members in this action are not adequately represented by EPA⁸⁷", and that the EPA "has no interest in protecting pesticide licenses or distribution rights." Agricultural groups are not happy about the results of previous settlements between the CBD and the EPA; the Washington Toxics Coalition's 2002 suit against the EPA resulted in 100-1,000-foot riparian buffer zones that affected between 48 and 72% of farmland in Washington State.⁸⁸

If the agricultural advocacy organizations have their motions to intervene accepted, they would be allowed a seat at the table for any negotiated settlement between EPA and the CBD. This would dramatically change the dynamic of the negotiations; in their motion to intervene, CropLife states that it wants to prevent a settlement that would "put in place some or all of the restrictions sought by Plaintiffs, but to which Intervenor-Defendants object⁸⁹", implying an utter unwillingness to compromise with the CBD.

Regulatory Agencies: The EPA and the NMFS/FWS

The EPA is currently trying to negotiate voluntary restriction in pesticide use with the industry, to little effect⁹⁰. If the EPA could get the industry to agree to such restrictions, it would be significantly easier for all agencies to regulate and enforce pesticide use, at a time when all three are currently suffering from a lack of adequate staff and funds. The court-ordered pesticide reviews have strained their resources; in 2010, the EPA, out of 11 million dollars total operating expenses, spent 4.5 million on court-mandated pesticide review⁹¹. In addition, the FWS has admitted that it

⁸⁵ AgFax, "Ag Groups Intervene on EPA Settlement on Basis That Ag Interests Not Represented." <<http://agfax.com/Content/ag-groups-intervene-onn-epa-settlement-on-basis-that-ag-interests-not-represented-03212011.aspx>>

⁸⁶ Farm Press, "AFBF Intervenes IN Pesticide Lawsuit." <<http://southeastfarmpress.com/government/afbf-intervenes-pesticide-lawsuit>>

⁸⁷ Ibid.

⁸⁸ Washington State Department of Agriculture, "The Endangered Species Act and the Impact to Pesticide Registration and Use"

⁸⁹ Farm Press, "AFBF Intervenes In Pesticide Lawsuit." <<http://southeastfarmpress.com/government/afbf-intervenes-pesticide-lawsuit>>

⁹⁰ Letter from L. Markey, J. Garmedi (Natural Resources Committee) and G. Napolitano (Subcommittee on Water and Power) to Lisa Jackson, Director of EPA, April 5, 2011.

⁹¹ House Committee on Agriculture, "Testimony of Dr. Steven Bradbury, Director, Office of Pesticide Programs, U.S. Environmental Protection Agency, Before the Committee on Natural Resources and Committee on Agriculture." May 3, 2011. <<http://agriculture.house.gov/pdf/hearings/Bradbury110503.pdf>>

simply does not have the personnel to carry out the re-evaluations according to the court-ordered schedule.

In spite of the backlog and accusations that the two-tiered review process results in performing the same tests twice⁹², both the EPA and the Services have said that the current system is necessary, if not efficient⁹³. Currently, the EPA and the Services are trying to coordinate and standardize their testing procedures, with a special emphasis on coming up with standardized evaluations for pesticide risk exposure, in order to streamline pesticide evaluation without sacrificing rigor⁹⁴.

Congress

In response to the growing conflict concerning pesticide regulations in the United States, Congress has convened a series of hearings on the issue on May 3, 2011⁹⁵. The House of Representatives seems to be evaluating both complaints raised against pesticide regulation: whether current pesticide regulations are an undue regulatory burden, and whether current pesticide regulations do not do enough to protect the environment. So far, the split has been mostly been along party lines; Democrats argue that attempts to strip the EPA of more regulatory authority are a reaction to the Obama administration enforcing environmental regulations more thoroughly than the Bush administration did, and House Republicans, most notably Doc Hastings, Chair of the Natural Resources Committee, argue that existing pesticide regulation is too restrictive, and places an undue economic burden on the nation at a time when the nation is recovering from a recession⁹⁶.

⁹² House Committee on Agriculture, “Statement of the American Farm Bureau Federation Before the Committee on Natural Resources and Committee on Agriculture.” May 3, 2011. <<http://agriculture.house.gov/pdf/hearings/Bushue110503.pdf>>

⁹³ House Committee on Agriculture, “Testimony of Rowan Gould, Acting Director U.S. Fish and Wildlife Service, Department of the Interior, Before the Committee on Natural Resources and Committee on Agriculture.” May 3, 2011. <<http://agriculture.house.gov/pdf/hearings/Gould110503.pdf>>

⁹⁴ House Committee on Agriculture, “Testimony of Dr. Steven Bradbury”

⁹⁵ House Committee on Agriculture, “Joint Public Hearing to review the Costs of Federal Regulatory Dysfunction to American Jobs, Agriculture, Health and Species”, May 3, 2011.

<<http://agriculture.house.gov/hearings/hearingDetails.aspx?NewsID=1370>>

⁹⁶Natural Resource Report, “House Looks at Endangered Species Review.” <<http://naturalresourcereport.com/2011/05/house-looks-at-endangered-species-review/>>

Possible Consequences of the Lawsuit

Decision in Favor of the EPA

If the EPA is not required to initiate review of the pesticides, it devalues the ESA in the court system. The 214 species listed in the lawsuit are in danger of extinction, and the ESA is one of the most powerful tools to address this danger; a failure to act could establish a precedent that would weaken further uses of the ESA. Moreover, it fails to resolve the issue; environmental advocacy organizations can and probably will attempt to force reevaluation and sanctions upon the use of all pesticides on this list. The courts can affect policy faster than Congress or the regulatory agencies can, and it is fairly simple to re-try a civil suit in another court, since environmental groups have a presence, and therefore standing, in every district court.

Out-Of-Court Settlement Requiring Further Review

A settlement or victory that requires further review, however, could be equally destructive. Not only would here be significant economic consequences associated with restricting use of some of the most commonly-used pesticides in the United States⁹⁷, but, the sheer volume of pesticides that would require review will overwhelm the EPA in a way that previous claims simply have not. Even though previous cases with the CBD have wound up with court-ordered review, no more than 75 pesticides in one geographic area have required review, which relieved some of the pressure attempt to review the effect of over 27,300 species-pesticide combinations at once is going to overwhelm both the EPA and the Services, who do not have the resources to keep up with the testing that they are currently undertaking. At a time when EPA administrator Lisa Jackson is being called before Congress to defend the EPA's current slice of appropriations⁹⁸, it is debatable whether the EPA would be able to receive the funds to implement such broad-scale testing.

Finally, a victory or a settlement requiring significant review or significant restrictions on pesticide use would draw unwanted attention to the ESA, which has existed in an awkward regulatory limbo for the past two decades. Congressional authorization for the ESA was renewed in five-year intervals until 1992, when there was a significant effort to weaken or repeal the act

⁹⁷ Delaplain, Keith. *Pesticide Usage in the United States: History, Benefits, Risks and Trends*. Southern Extension and Research Activity – Information Exchange Group 1 (Southern Region Pesticide Impact Assessment Program), 1996.

⁹⁸ Federal Register, “Testimony of Lisa Jackson, Administrator U.S. Environmental Protection Agency, Before the Committee on Agriculture, United States House of Representatives”, March 20, 2011.

entirely⁹⁹; since then, its funding has been quietly added to the appropriations for the Department of the Interior without a whole lot of comment, but the act itself has not been reauthorized. If it is brought up for debate once again, it is unlikely that it will be passed with such broad powers again – or passed at all, for that matter¹⁰⁰.

Conclusions and Recommendations

In any individual pesticide case, the ESA is being used precisely as it was originally intended: to address an immediate threat to a species in danger of extinction. It is not, however a long-lasting solution. Regulating pesticides through litigation makes the regulatory process unpredictable and expensive. Moreover, courts do not promote compromise; there is no meaningful interaction between the environmental organizations with legitimate concerns about pesticide use and the agricultural coalitions with equally valid concerns about making farming economically unviable. And, courts have shown a tendency to order change and review faster than the agencies can act; even if the courts do order more reviews of pesticides, only Congress can authorize the funds for the EPA to carry them out.

One reasonable solution is to provide more funding for the EPA, NMFS and FWS, in order to allow more personnel to work on the testing process and to keep up with the court claims. However, though any attempt at broader regulatory reform should include more funding for the agencies, acting on funding alone will not be effective. Keeping the same the procedure would still exclude environmental advocacy groups from redressing their concerns about pesticide use in the far more predictable regulatory process.

The one bipartisan agreement to come out of the Congressional hearings so far has been that the current system needs to change¹⁰¹. What the nation needs is regulatory reform of a broader sort, focused on reducing intercurrence and allowing environmental interest groups more of a say in the regulatory process, so that it can avoid this kind of court-ordered confusion.

⁹⁹ Federal Register. “Endangered Species Act of 1973 As Amended Through Public Law 107–136”, Jan. 24, 2002

¹⁰⁰ Congressional Research Service, “Reauthorization of the Endangered Species Act (ESA): A Comparison of Pending Bills and a Proposed Amendment with Current Law.”
<http://www.nationalaglawcenter.org/assets/crs/RL33309.pdf>

¹⁰¹ The Sacramento Bee, “Some Fear that the EPA Is Going Too Far In Regulating Pesticides.”
<http://www.sacbee.com/2011/05/06/3608071/some-fear-that-epa-is-going-too.html>

Section 2

Local Consequences of U.S. Energy Policy

Melissa Gallant, *Hydraulic Fracturing: Investigating Water Contamination and Regulation*

Elli Blaine, *The Arctic National Wildlife Refuge: Should ANWR be Opened Up for Oil and Gas Extraction?*

June 1, 2011

U.S. Environmental Politics
Environmental Studies Program

Executive Summary

The United States' dependence on foreign and domestic energy sources requires that the government adopt a comprehensive energy policy to guide energy production, imports, and use. Major sources include coal, nuclear, petroleum, and natural gas, as well as some renewable sources, including hydropower, solar, and wind. Currently, 73 quadrillion Btu is produced domestically and 30 quadrillion Btu, or 29 percent, is imported in the form of petroleum.¹ In recent years the primary goals of energy legislation have been to reduce dependence on foreign oil and generate revenue. Under the Obama administration, more emphasis has been placed on shifting towards less carbon intensive sources, as energy-related carbon dioxide emissions currently account for 81.5 percent of total U.S. greenhouse gas emissions.²

In the past six years, three major bills have been passed that apply to the energy sector. The 2005 Energy Bill was largely focused on providing for more conventional forms of energy, including policies on nuclear energy, offshore drilling, ethanol, and revisions to the tax policy. The 2007 Energy Bill focused more strongly on the need for increased efficiencies and technologies, focusing on the automobile industry through the implementation of new CAFE standards, a hybrid vehicle program, and further ethanol requirements, in addition to energy efficiency standards and investment in smart grid research. 2009 marked a notable changes in proposed energy policy, with increased attention to the need for the United States to transition to a more green economy. The American Clean Energy and Security Act was proposed to create clean energy jobs and address climate change, yet this comprehensive energy bill never became law.³ The 2009 Stimulus Act was primarily aimed at stimulating economic growth and ending the recession, yet still included several important clauses related to energy, including creating renewable energy loan guarantees, building efficiency funds, and investing in research on carbon sequestration, electric cars, and the smart grid.⁴ The United States is still in need of comprehensive energy legislation, however, to provide direction and incentives to create a more efficient and environmentally friendly national energy sector.

U.S. legislators and the public have expressed a desire and a need to reduce dependence on foreign oil. The following case studies provide examinations of two key options for replacing imported oil with domestically produced fossil fuels. Both also highlight the local impacts of energy production, aspects that are often ignored in political energy debates. The first paper examines the possibility of expanding drilling for oil in the 1002 Area of the Arctic National Wildlife Refuge. The second investigates hydraulic fracturing in extracting natural gas. Both papers address the historical context, environmental impacts, local consequences, relevant stakeholder positions, and the current regulatory status of their respective issue, and conclude with a policy recommendation.

¹ "Annual Energy Review 2009." U.S. Energy Information Administration (EIA), 19 Aug. 2010. Web. 16 May 2011. <<http://www.eia.doe.gov/emeu/aer/diagram1.html>>.

² *Energy Information Administration (EIA)*. Department of Energy, 16 May 2011. Web. 16 May 2011. <<http://www.eia.doe.gov/>>.

³ "Waxman-Markey Climate Change Bill -- H.R. 2454 [111th]: American Clean Energy and Security Act of 2009 (GovTrack.us)." *GovTrack.us: Tracking the U.S. Congress*. Web. 16 May 2011.

<<http://www.govtrack.us/congress/bill.xpd?bill=h111-2454>>.

⁴ Turner, James. *Energy Policy Handout*. Rep. Wellesley, MA: ES 381, 2011. Print.

Section 2.1

Local Consequences of U.S. Energy Policy

Melissa Gallant, *Hydraulic Fracturing: Investigating Water Contamination and Regulation*

June 1, 2011

U.S. Environmental Politics
Environmental Studies Program

Summary

Much debate and contention currently surrounds the use of hydraulic fracturing in natural gas extraction. Stories of families that witness drastic changes in their water quality have been in the media, protests against its use have spread from rural communities to the halls of Congress, and the issue is currently being addressed in both the executive and legislative branches of government. Environmental organizations and communities have raised concerns about water pollution resulting from hydraulic fracturing, particularly from fracturing chemicals and methane. While energy corporations and industry alliance groups insist that it is a safe practice, some studies and several personal testimonies contradict this opinion.

Hydraulic fracturing is a method of extracting natural gas from unconventional sources, which have historically been too difficult or too expensive to obtain. This technology has enabled almost 500 trillion cubic feet of natural gas all over the country to be extracted and used for things like electricity and automobile fuel. The geography of natural gas reserves and hydraulic fracturing has changed the landscape of American fossil fuel extraction from being concentrated along the Gulf Coast and in Alaska, to being spread throughout the continental 48 states.

Policy-making regarding hydraulic fracturing has followed along several pathways. In the main legislative pathway, the Safe Drinking Water Act was amended to exclude hydraulic fracturing wells from being regulated along with other underground injection projects in 2005. The Fracturing Responsibility and Awareness of Chemicals Act was proposed in both Houses (?) in 2009, but it has not been further addressed since its first proposal. Through the budget appropriations process, the EPA is currently undertaking a study examining hydraulic fracturing and its environmental effects, which is scheduled to be published in 2012. State-level legislation has been undertaken in several states, with various regulations and requirements for information provision and well safety. Amidst cases and reports of communities experiencing water contamination and ensuing health effects, a comprehensive and unbiased study is necessary to determine how best to regulate the use of this technology.

TIMELINE

- 1947 Hydraulic fracturing is first used
- 1970s U.S. Department of Energy invests in natural gas extraction technologies – when in 1970s?
- 1980 Section 29 of what gives tax credits to producers of unconventional fuel
- 1992 First commercial hydraulic fracturing well built near Fort Worth, Texas — how different from 1947, then?
- 2005 Amendment added to the Safe Drinking Water Act — more specific...
- 2008 Cabot Oil and Gas begins drilling in Dimock, Pennsylvania

Introduction

In its entire history spanning over half a century, hydraulic fracturing has never been as prominent or controversial a topic as it is today. Economic incentives, technological advancements, and recent media attention to fracturing accidents have led to its becoming a household term. Hydraulic Fracturing, commonly known as ‘hydrofracking,’ is a process using pressurized mud and water to fracture rocks in order to release natural gas. Historically, much of the United States’ natural gas has been impossible or unfeasible to access, but hydraulic fracturing can be used to access these reserves. Although the process has been used for decades, recent developments in technology and several cases of water contamination have brought it to the forefront of environmental discourse.

The spread of hydraulic fracturing has sparked a debate between environmental organizations, affected communities, and energy companies over concerns for the environment and human safety, including air pollution, climate change risks, and other problems, such as the stimulation of small earthquakes and water contamination. There are extensive economic incentives associated with developing America’s natural gas reserves, which currently accounts for almost a quarter of the nation’s energy consumption.¹

Federal legislation currently has little power to regulate hydraulic fracturing. Under an exemption in the Safe Drinking Water Act, there is no legislation currently requiring companies using hydraulic fracturing to reveal the chemical composition of their fluids. The Clean Water Act and state-level legislation show the most promise in regulating the process. A federal bill called the Fracturing Responsibility and Awareness of Chemicals (FRAC) Act was proposed in Congress 2009. It would repeal the exemption and place further restriction on the process of hydraulic fracturing.

America’s Natural Gas Revolution

Developing America’s natural gas reserves has considerable advantages. The United States experienced the highest natural gas production growth rate in 2007 and 2008,² and prices continue

¹ *Annual Energy Review: Total Energy*. Publication. U.S. Energy Information Administration, 2010. Print.

² McNulty, Sheila. "US Production Growth to Be Cut off." *Financial Times*. 17 Feb. 2009. Web. 15 May 2011. <<http://www.ft.com/cms/s/0/e4c191f8-fc8e-11dd-aed8-000077b07658.html#axzz1MRVn6Zqn>>.

to fall relative to oil and other energy sources.³ Hydraulic fracturing has been developed in the past few decades, and has allowed reserves to be extracted that geologists never thought possible. Recent stories have arisen questioning the safety of this relatively new technology, however. Dimock, Pennsylvania is one example of a community bearing the cost of hydraulic fracturing.

Dimock, Pennsylvania

Dimock Township is in the heart of Susquehanna Territory, in Northeastern Pennsylvania. It is located 150 miles from both Philadelphia and New York City. The town is home to 1,400 people, four public schools, one post office, and more than 60 natural gas wells.⁴ Dimock is located on top of the Marcellus Shale, one of the country's largest and richest deposits of natural gas. This previously little-known town has been featured in articles from almost every prestigious news source, including the *Chicago Tribune*, *Wall Street Journal*, and *New York Times* as the poster child for the disastrous effects of hydraulic fracturing.

Cabot Oil and Gas Corporation commenced drilling in Dimock in 2008. Within several weeks, local residents saw their water quality take a nosedive. Tap water turned brown, some reported it catching fire, and several began to see immediate health effects. One man described the effect on his family, saying “It was so bad sometimes that my daughter would be in the shower in the morning, and she'd have to get out of the shower and lay on the floor” because of the dizzying effect the chemicals in the water had on her⁵ and “My son had sores up and down his legs from the water.”⁶ By 2009, faulty pipelines had leaked approximately 8,000 gallons of fracking fluid into wetlands and streams, contaminating the water supply and reeking havoc on local ecosystems. Reports done by the Pennsylvania Department of Environmental Protection (DEP) found major contamination of the aquifer, with high levels of iron, aluminum, and methane.⁶

In September 2009, the Pennsylvania DEP ordered Cabot Oil and Gas to temporarily suspend all drilling until a further agreement had been reached. Two months later, Cabot agreed to release information to the DEP about which families have raised concerns about water quality as well as plans to upgrade and maintain the safety casings on their wells, which was the source of the

³ Norris, Floyd. "Two Directions for the Prices of Natural Gas and Oil." *New York Times*. 25 Feb. 2011. Web. 13 May 2011.

⁴ "United States - Fact Sheet." *American FactFinder*. U.S. Census Bureau. Web. 07 May 2011. <http://factfinder.census.gov/servlet/ACSSAFFFacts?_event=Search>.

⁵ Bateman, Christopher. "A Colossal Fracking Mess." *Vanity Fair*. 21 June 2010. Web. 6 May 2011. <<http://www.vanityfair.com/business/features/2010/06/fracking-in-pennsylvania-201006>>.

⁶ Bateman, Christopher. "A Colossal Fracking Mess." *Vanity Fair*. 21 June 2010. Web. 6 May 2011. <<http://www.vanityfair.com/business/features/2010/06/fracking-in-pennsylvania-201006>>.

water contamination.⁷ They also agreed to provide a long-term solution to populations affected by the drilling, which eventually resulted in providing fourteen affected families with permanent access to clean drinking water.⁸ They were also fined almost a quarter of a million dollars by the DEP, in addition to the \$120,000 that Dimock's residents sued the company for violating the Oil and Gas Act, the Solid Waste Management Act and the Clean Streams Law.⁹ In March, after the company had failed to comprehensively address the security casings on its wells, the DEP ordered that it shut down several of its wells, with ten more undergoing further investigation.¹⁰ Even with these reparations, the residents of Dimock are left with the realities of having a contaminated water source. Much of the town is employed in agriculture, but the water is not even suitable for irrigation. Real estate values in the area have fallen so dramatically that moving is not a realistic option. As one local resident says, “‘Our land is worthless,’ says Craig. ‘Who is going to buy this house?’”¹¹

This township displays the potentially devastating effects of hydraulic fracturing, when it is not properly controlled and regulated, that could happen in any community located above any unconventional gas deposit in the country. The events that have taken place in Dimock have been described as a “black eye” for the oil and gas industry as well as the state of Pennsylvania, and have raised concerns in towns across the nation as hydraulic fracturing becomes more widespread. Similar situations have been recorded in Alabama, Colorado, New Mexico, Virginia, West Virginia and Wyoming.¹² These cases of water contamination have received significant press attention, and have contributed to hydraulic fracturing reaching an unprecedented level of public awareness.

Where is hydraulic fracturing taking place?

⁷ "Newsroom: DEP Reaches Agreement with Cabot to Prevent Gas Migration, Restore Water Supplies in Dimock Township." Pennsylvania Department of Environmental Protection, 4 Apr. 2009. Web. 13 May 2011. <<http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=2418>>.

⁸ Lustgarten, Abraham. "Cabot Oil & Gas's Marcellus Drilling to Slow After PA Environment Officials Order Wells Closed." *Propublica*. 16 Apr. 2010. Web. 13 May 2011. <<http://www.propublica.org/article/cabot-oil-and-gas-ordered-to-shut-down-problem-wells-and-pay-massive-fine-a>>.

⁹ "Newsroom: DEP Reaches Agreement with Cabot to Prevent Gas Migration, Restore Water Supplies in Dimock Township." Pennsylvania Department of Environmental Protection, 4 Apr. 2009. Web. 13 May 2011. <<http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=2418>>.

¹⁰ Lustgarten, Abraham. "Cabot Oil & Gas's Marcellus Drilling to Slow After PA Environment Officials Order Wells Closed." *Propublica*. 16 Apr. 2010. Web. 13 May 2011. <<http://www.propublica.org/article/cabot-oil-and-gas-ordered-to-shut-down-problem-wells-and-pay-massive-fine-a>>.

¹¹ Bateman, Christopher. "A Colossal Fracking Mess." *Vanity Fair*. 21 June 2010. Web. 6 May 2011. <<http://www.vanityfair.com/business/features/2010/06/fracking-in-pennsylvania-201006>>.

¹²"EARTHWORKS - Hydraulic Fracturing of Oil and Gas Wells." *EARTHWORKS - Home*. Web. 13 May 2011. <<http://www.earthworksaction.org/hydraulicfracturing.cfm>>.

The United States has the world's sixth largest reserves of known natural gas in the world, after Russia, Iran, Qatar, Saudi Arabia, and the United Arab Emirates.¹³ Many of these countries, as well as India, China, and members of the European Union are also investing in hydraulic fracturing technology. While it ranks sixth in terms of known reserves, the North America is home to 85% of the world's hydraulic fracturing facilities.¹⁴

Within the U.S., natural gas reserves are located throughout the country in relatively well-defined formations. Conventional sources have been accessed most in Texas and Oklahoma, but unconventional sources are located in additional states, from New York to Alaska to Arkansas.¹⁵ Hydraulic fracturing has opened fields in west Texas, Louisiana, Oklahoma, New Mexico, Colorado, Wyoming, and all over the Northeast that would not have been possible to access without this technology.¹⁶ Some of the biggest formations include Barnett Shale in Texas, Antrim Shale in Michigan, and Fayetteville Shale in Arkansas. Marcellus Shale, which reaches from western New York west to Ohio and south along the Appalachian Mountains, is one of the biggest natural gas deposits in the country. See Appendix I for a map showing natural gas reserves.

The geography of natural gas reserves and hydraulic fracturing has drastically changed the landscape of American energy production. Historically, oil extraction has been mostly limited to the Gulf Coast and Alaska. Coal has been more widespread, but still limited to relatively isolated regions. Hydraulic fracturing is now expanding natural gas production to states like Pennsylvania and New York, that have never before been the site of major geologic resource extraction.

What is Hydraulic Fracturing

The process of hydraulic fracturing takes place in several stages. First, a wellbore is dug vertically into the ground, until it reaches the shale, at which point it is reoriented horizontally and extended several hundred feet to access as much gas as possible. Next, small explosive charges create fractures in the rock layer. These fractures are then pumped full of a mixture of sand, water and various chemicals, replacing the impermeable shale with more porous materials, allowing

¹³ "The U.S. Ranks 6th in Natural Gas Reserves « Ranking America." *Ranking America*. Web. 08 May 2011. <<http://rankingamerica.wordpress.com/2009/01/12/the-us-ranks-7th-in-natural-gas/>>.

¹⁴ Montgomery, Carl T., and Michael B. Smith. *Hydraulic Fracturing: History of an Enduring Technology*. Rep. NSI Technologies, 2010. Print.

¹⁵ *NaturalGas.org*. Web. 08 May 2011. <<http://www.naturalgas.org/overview/resources.asp>>.

¹⁶ "NETL: News Release - DOE's Early Investment in Shale Gas Technology Producing Results Today." *DOE - National Energy Technology Laboratory: Home Page*. Web. 08 May 2011. <http://www.netl.doe.gov/publications/press/2011/11008-DOE_Shale_Gas_Research_Producing_R.html>.

natural gas to flow to the well and be collected at the surface.¹⁷ One of the major concerns is groundwater contamination, but groundwater wells are generally less than 1000 feet in depth, whereas shale deposits exist mostly between 6000 and 8000 feet,¹⁸ leaving 5000 to 7000 feet of earthen buffer between the fracturing and water sources.

Natural gas sources can be categorized as ‘conventional’ or ‘unconventional.’ Conventional gas currently accounts for 74 percent of US production, but by 2035, the DOE predicts that shale gas, one of several types of unconventional gas, will account for 45 percent.¹⁹ Conventional fuel is found in highly porous materials, most often sandstone, and can be extracted using traditional well methods. The most common unconventional gas resources are tight sands, coalbed methane, and shale gas. By definition, unconventional fuel is found in less porous rock formations, which is why it is often referred to as “tight” gas. The density of the rock makes the gas inside more difficult to extract and requires more sophisticated extraction methods.²⁰ Conventional and unconventional reserves are often found in the same vicinity, but without adequate technology unconventional sources have historically been impossible or economically unfeasible to access. Hence, conventional sources still make up the vast majority of natural gas production, with unconventional sources currently accounting for 26%.²¹

Hydraulic fracturing is the leading technology in accessing these unconventional deposits, which contain much of the untapped natural gas resources in the United States.

Total natural gas estimates range from 1451 trillion cubic feet (tcf), in a 2007 study by the National Petroleum Council to 2586.9 tcf in a 2010 report from the Energy Information Association (EIA). The EIA study estimated that, of that 2586.9 tcf, roughly one quarter (493tcf) was unconventional. However, research is still in progress and estimates continue to climb. One recent study estimated

¹⁷ "How Natural Gas Works." UCS: *Citizens and Scientists for Environmental Solutions*. Union of Concerned Scientists, 2010. Web. 7 May 2011. <http://www.ucssusa.org/clean_energy/technology_and_impacts/energy_technologies/how-natural-gas-works.html>.

¹⁸ "Hydraulic Fracturing Facts: The Process." *Hydraulicfracturing.com*. Web. 08 May 2011. <<http://www.hydraulicfracturing.com/Process/Pages/information.aspx>>.

¹⁹ "NETL: News Release - DOE's Early Investment in Shale Gas Technology Producing Results Today." *DOE - National Energy Technology Laboratory: Home Page*. Web. 08 May 2011. <http://www.netl.doe.gov/publications/press/2011/11008-DOE_Shale_Gas_Research_Producing_R.html>.

²⁰ "Unconventional Gas | Non-conventional Resources." *Unconventional Resources | Unconventional Gas | Coalbed Methane*. Advanced Resources International, Inc. Web. 07 May 2011. <<http://www.adv-res.com/unconventional-gas-nonconventional-resources.asp>>.

²¹ Montgomery, Carl T., and Michael B. Smith. *Hydraulic Fracturing: History of an Enduring Technology*. Rep. NSI Technologies, 2010. Print.

that Marcellus Shale alone contains up to 489 tcf of accessible natural gas.²² Hydraulic fracturing has allowed these unconventional deposits to become accessible, greatly increasing the United States' potential natural gas supplies.

Concerns for water pollution spring from two main sources: fracturing chemicals and methane escaping from the rock. Fracture fluids can be either acid, gel, or water based. Hydraulic fracturing refers specifically to fracturing using water-based fluids. Water-based fracturing is the most common method, but requires several other inputs to make extraction effective. Hydraulic fluids are typically 60% water, 39.5% of proppants like sand or concrete to hold the fractures open, and 0.5% chemicals.²³ While oil and gas companies are not currently required to reveal the chemical composition of their fracturing fluids, the Pennsylvania Department of Environmental Protection compiled a list of 78 chemicals known to be in use in the state (See Appendix II).²⁴ The mixtures contain several types of chemicals, including: friction reducers, which limit the resistance of the fluid as it moves through the casing; biocides, which prevent bacterial growth; and corrosion inhibitors, which prevent corrosion in the pipes.²⁵

Methane is also a major concern for water pollution in hydraulic fracturing areas. A recent study conducted by researchers at Duke University found that within one kilometer of natural gas wells, methane levels were 17 times higher than in non-drilling areas. Methane is highly flammable, and the levels at which methane was found in the affected areas are higher than the levels at which regulators of the coal mining industry recommend taking immediate action, like ventilating the area and possibly changing the water supply. The study found that the methane was leaking from the wellbore, not through the rock layers, indicating that the contamination is a result of leaks in the well, as opposed to an inevitable result of fracturing.²⁶

History

²² Stouffer, Rick. "Marcellus Shale Estimated Natural Gas Yield Rises to Nearly 500 Trillion Cubic Feet." *TribLive - Business*. 28 July 2009. Web. 06 May 2011. <http://www.pittsburghlive.com/x/pittsburghtrib/business/s_635579.html>.

²³ "Chemical Use In Hydraulic Fracturing | FracFocus Chemical Disclosure Registry." *Home | FracFocus Chemical Disclosure Registry*. Web. 06 May 2011. <<http://fracfocus.org/water-protection/drilling-usage>>.

²⁴ "List of 78 Chemicals Used in Hydraulic Fracturing Fluid in Pennsylvania." *Marcellus Drilling News*. Web. 06 May 2011. <<http://marcellusdrilling.com/2010/06/list-of-78-chemicals-used-in-hydraulic-fracturing-fluid-in-pennsylvania/>>.

²⁵ Office of Fossil Energy, National Energy Technology Laboratory. *State Oil and Natural Gas Regulations Designed to Protect Water Resources*. Rep. U.S. DOE, 2009. Print.

²⁶ Soraghan, Mike. "Study Finds Methane Contamination Rises near Shale Gas Wells." *Greenwire*. 9 May 2011. Web. 13 May 2011. <<http://www.eenews.net/Greenwire/2011/05/09bn>>.

Hydraulic fracturing has been used since the early twentieth century and was first used to obtain natural gas in 1947.²⁷ In the 1970s, catalyzed by oil crises and ensuing rising gas prices, the U.S. Department of Energy (DOE) formed a partnership with the Gas Research Institute as well as private corporations to develop technologies to improve natural gas extraction methods. The group invested a total of \$92 million in developing technology to improve natural gas extraction methods, which resulted in significant developments in several key technologies, including horizontal wells.^{28,29} In 1980, Congress passed the Internal Revenue Code (IRC). Section 29 of the IRC created tax exemptions for unconventional gas extraction, which, coupled with the continuing gas prices in the 1970s, jump-started U.S. tight gas exploitation.³⁰ By the 1980s, enough supporting technology had been developed that, when combined with the 1980 tax credits to unconventional fuel producers, investors were attracted to the sector and natural gas production began to increase.

In 1992, the first commercial horizontal well was built near Fort Worth, Texas, where large-scale hydraulic fracturing was already taking place. Horizontal drilling became key to the profitability of hydraulic fracturing. Until horizontal drilling, natural gas extraction was significantly less profitable, and hence, less popular. Before this technique was developed, wells were built vertically, and each well was limited to a small area surrounding the pipes. The costs of constructing each individual well as well as purchasing the land made extraction extremely expensive. Horizontal drilling allows the well to be drilled vertically, then extended parallel to the ground when it reaches natural gas formation, allowing each well to access a much greater area.³¹ Since then, natural gas production, particularly from unconventional sources, has increased dramatically and today natural gas accounts for almost 25 percent of the United States' energy.³²

Economic Incentives

Major economic benefits from natural gas extraction include increased jobs, reduced dependence on foreign oil, royalties that benefit local communities, and increased tax revenue for

²⁷ History of Hydraulic Fracturing, An Enduring Technology

²⁸ "World Shale Gas Resources: An Initial Assessment of 14 Regions Outside the United States." U.S. Energy Information Administration, 5 Apr. 2011. Web. 7 May 2011. <<http://www.eia.gov/analysis/studies/worldshalegas/>>.

²⁹ "NETL: News Release - DOE's Early Investment in Shale Gas Technology Producing Results Today." DOE - National Energy Technology Laboratory: Home Page. 2 Feb. 2011. Web. 08 May 2011.

<http://www.netl.doe.gov/publications/press/2011/11008-DOE_Shale_Gas_Research_Producing_R.html>.

³⁰ Perry, Kent F. *Rationale For Section 29 Non-Conventional Gas Tax Credit Extension*. Rep. Gas Technology Institute. Print.

³¹ Hoye, Sarah, and Steve Hargreaves. "'Fracking' Yields Fuel, Fear in Northeast." *The New York Times*. 3 Sept. 2010. Web. 8 May 2011. <<http://edition.cnn.com/2010/US/09/02/fracking/index.html>>.

³² *Annual Energy Review: Total Energy*. Publication. U.S. Energy Information Administration, 2010. Print.

federal and state governments. One publication from the Independent Petroleum Association of America claims that developing Barnett shale in Texas "has brought literally thousands of jobs into the area."³³ One recent study estimated that in 2009, development of Marcellus Shale brought 44,000 jobs and \$4 billion in investments to Pennsylvania, and \$1 billion in federal tax revenue.³⁴

Natural gas has become an increasingly significant part of the United States' energy production, and hence its economy. Throughout most of the past two decades natural gas prices have been similar to an equivalent amount of crude oil. In the past six years, however, crude oil prices have continued to rise while natural gas prices have decreased to roughly 1992 levels. In February 2011, crude oil prices were four times that of natural gas.³⁵ See Appendix III for a more detailed view of natural gas prices compared with crude oil.

In 2008, natural gas provided almost a quarter of the United States energy, amounting to 23.2 trillion cubic feet, the equivalent of 190 billion gallons of gasoline.³⁶ Historically, industry has been the largest consumer of natural gas (34%), followed by electric power (29%), residential uses (21%), and commercial (13%). In recent years, electricity production has become the largest consumer of natural gas. In 2003, natural gas-fired power plants became the energy source with the highest electricity generation capacity, surpassing coal-fired power plants.³⁷ Domestic production continues to increase steadily (production in December 2010 was the highest it had been since 1973) while imports continue to decrease.³⁸

Regulation I: Encouraging Hydraulic Fracturing

The current state of U.S. regulation of hydraulic fracturing reflects the federal government's divided interests. It appears torn between the economic incentives of developing the natural gas industry and the safety concerns associated with the process. The result is intercurrence. Tax codes

³³ "Independent Petroleum Association of America (IPAA) - About IPAA." *Independent Petroleum Association of America (IPAA) - Home Page*. Web. 08 May 2011. <<http://www.ipaa.org/about/index.php>>.

³⁴ Timothy J. Considine, *The Economic Impacts of the Marcellus Shale: Implications for New York, Pennsylvania, and West Virginia*, Natural Resources, Inc., July 14, 2010, <http://www.api.org/policy/exploration/hydraulicfracturing/upload/API%20Economic%20Impacts%20Marcellus%20Shale.pdf>.

³⁵ Norris, Floyd. "Two Directions for the Prices of Natural Gas and Oil." *New York Times*. 25 Feb. 2011. Web. 13 May 2011.

<http://www.nytimes.com/2011/02/26/business/global/26charts.html?_r=2&scp=1&sq=natural+gas+prices&st=nyt>.

³⁶ *Annual Energy Review: Total Energy*. Publication. U.S. Energy Information Administration, 2010. Print.

³⁷ "How Natural Gas Works." UCS: *Citizens and Scientists for Environmental Solutions*. Union of Concerned Scientists, 2010. Web. 7 May 2011. <http://www.ucsusa.org/clean_energy/technology_and_impacts/energy_technologies/how-natural-gas-works.html>.

³⁸ "EIA - Short-Term Energy Outlook." *Independent Statistics and Analysis*. U.S. Energy Information Administration, 12 Apr. 2011. Web. 08 May 2011. <<http://www.eia.doe.gov/emeu/steo/pub/contents.html>>.

that provide financial incentives to natural gas producers and exemptions for hydraulic fracturing in the Safe Drinking Water Act contest the environmental safeguards in place under the Clean Water Act and state legislation.

Tax codes. Throughout the history of gas production in the United States, various tax exemptions have been used to encourage drilling and exploration of oil and natural gas. Intangible Drilling and Development Cost tax treatment was first implemented in 1913 to attract investment to the oil and gas production industry. Geological and Geophysical Expenditures are aimed at developing new domestic oil and gas sources. Marginal Well Tax Credits create a safety net for marginal wells when prices are low.³⁹

A tax credit that was particularly influential for unconventional natural gas extraction is Section 29 of the 1980 Internal Revenue Code (IRC). In the wake of oil crises in the 1970s, Congress passed the 1980 IRC, which applied specifically to unconventional fuel producers. The code gave tax exemptions to producers of various unconventional fuels, including oil from shale and tar sands; gas from geopressurized brine, Devonian shale, coal seams, tight formations, and biomass; synthetic fuels from coal; fuel from biomass; and steam from agricultural products. For oil and gas producers, the credits were available until 2002 for sites that were put in service between 1980 and 1992.⁴⁰ A study conducted by the Independent Petroleum found that Section 29 resulted in a 300 percent increase in unconventional gas production, in addition to further developing extraction technologies.⁴¹ In 2003, Section 29 was extended and modified by Section 1345 of the Conference Energy Bill, which granted tax credits of \$3 per barrel of unconventional fuel. The credits were applied to wells for four years, for wells put in service prior to 2006.⁴² The last of these tax credits for unconventional fuel sources were distributed in 2010, and no further credits have been established.

When the tax credit was first enacted in 1980, there were still relatively few companies producing unconventional fuels. As more energy companies entered the market and have claimed the credit in the 1990s, energy tax expenditures by the government rose until revenue loss reached

³⁹ *Timeline History of Natural Gas and Oil Tax Provisions*. Rep. IPAA, 2009. Print.

⁴⁰ Energy Information Administration, Office of Integrated Analysis and Forecasting. *Analysis of Five Selected Tax Provisions of the Conference Energy Bill of 2003*. Rep. Washington DC: U.S. DOE, 2004. Print.

⁴¹ *Nonconventional Fuels Tax Credit*. Rep. IPAA, 2005. Print.

⁴² "Analysis of Oil and Gas Production in the Arctic National Wildlife Refuge." *Energy Information Administration (EIA)*. Feb. 2004. Web. 14 May 2011. <<http://www.eia.doe.gov/oiaf/servicert/ceb/fuel.html>>.

\$4.5 billion in 2007.⁴³ See Appendix IV for more detailed information about energy tax expenditures. The unconventional fuel tax credits were discontinued in 2009.

The Safe Drinking Water Act was originally passed in 1974 to protect the quality of drinking water resources. It establishes federal minimum standards for water quality that are to be enforced and potentially amended at the state level.⁴⁴ One of the primary means of protecting water quality under the SDWA is the Underground Injection Control (UIC) program, found in Section 1421 (d)(1). The program controls fluids injected into the ground to prevent drinking water contamination. In 2005, under the Energy Policy Act, Congress passed exclusions from the UIC program to the natural gas industry. The addition excludes “underground injection of natural gas for purposes of storage” as well as “underground injection of fluids or propping agents (other than diesel fuels) pursuant to hydraulic fracturing operations related to oil, gas, or geothermal production activities.”⁴⁵

The revision to Section 1421 was originally proposed by Senator James Inhofe (R-OK), who proposed exempting hydraulic fracturing from the definition of “underground injection,” functionally allowing it to be excluded from underground drinking water protection under the SDWA.⁴⁶ Senator Inhofe has a strong record of voting in favor of domestic energy production, supporting drilling in the ANWR and developing ethanol, and against environmental regulations.⁴⁷ Democrats contested the proposal, citing two federal court decisions that ruled in 1997 and 2001 that hydraulic fracturing wells should be regulated as standard Class II wells, one of the five categories of wells that require a permit under the SDWA. An alternative amendment was proposed by Representative Diana DeGette (D-CO), which preserved the federal government’s ability to regulate hydraulic fracturing and protect underground drinking water sources while soothing

⁴³ Sherlock, Molly F. *Energy Tax Policy: Historical Perspectives on and Current Status of Energy Tax Expenditures*. Publication no. 7-5700. Washington DC: Congressional Research Service, 2010. Print.

⁴⁴ "Summary of the Safe Drinking Water Act | Laws and Regulations | US EPA." *US Environmental Protection Agency*. 2 Mar. 2011. Web. 08 ay 2011. <<http://www.epa.gov/regulations/laws/sdwa.html>>.

⁴⁵ "Regulation of Hydraulic Fracturing by the Office of Water | Hydraulic Fracturing | US EPA." *Index | Water | US EPA*. 9 Sept. 2010. Web. 08 May 2011. <http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/wells_hydroreg.cfm>.

⁴⁶ Tiemann, Mary. *Safe Drinking Water Act: Implementation and Issues*. Rep. Washington DC: Library of Congress, 2005. Print. CRS Issue Brief for Congress.

⁴⁷ Whitlock, Carolyn. *First Issue Brief - Senator Jim Inhofe's Voting Record*. Rep. 1st ed. Vol. 1. Wellesley, MA: ES 381, 2011. Print.

industry fears by preventing lawsuits that would force state regulation. The amendment was defeated by a vote of 16 to 30.⁴⁸

Environmentalists have dubbed this revision to the SDWA the “Halliburton Loophole” and claim that it is a result of political corruption.⁴⁹ Halliburton is one of the largest producers of natural gas from hydraulic fracturing, and stands to gain the most from loose regulation. Claims have been made that Dick Cheney, the Vice President in 2005 and former CEO of Halliburton, was responsible for the bill.⁵⁰ The 16 companies that stood to gain the most from this legislation donated a total of \$15 million to federal candidates (three quarters of whom were Republican) and spent \$70 million on lobbying.⁵¹ Given the exemption from the SDWA, the Clean Water Act and state regulation are important potential pathways to address pollution from hydraulic fracturing.

Stakeholders’ Positions

Concerns about pollution have led **environmental organizations and environmentalists** to lead the opposition to hydraulic fracturing. Energy companies are currently not required to reveal the exact chemical compositions of their hydraulic fracturing fluids, as they are protected by intellectual property rights laws. Each well typically uses between 12 and 80 individual chemicals,⁵² and the industry uses over 200 total. Halliburton, one of the largest energy companies in the country, uses chemicals like formaldehyde, which the federal government considers “reasonably anticipated to be a human carcinogen.”⁵³ Other chemicals include endocrine disruptors such as ammonium chloride, xylene, and boric acid as well as neurotoxins like toluene and ethylene glycol.⁵⁴

⁴⁸ "Dissenting Views Energy Policy Act of 2005 Title III, Oil and Gas Provisions." Committee on Energy and Commerce, 2005. Web. 16 May 2011. <<http://archives.energycommerce.house.gov/legviews/109lvr1640-oilgas.shtml>>.

⁴⁹ "Hydraulic Fracturing FAQs." *Gasland: A Film by Josh Fox*. 2010. Web. 14 May 2011. <<http://www.gaslandthemovie.com/whats-fracking>>.

⁵⁰ "Our Look at the HALLIBURTON LOOPHOLE - 2005 Energy Act." *Marcellus Shale Gas Drilling - Photos of Marcellus Shale Gas Wells in Pennsylvania at Marcellus-shale.us*. Web. 14 May 2011. <<http://www.marcellus-shale.us/2005-Energy-Act.htm>>.

⁵¹ *ibid*.

⁵² "How Natural Gas Works." *UCS: Citizens and Scientists for Environmental Solutions*. Union of Concerned Scientists, 2010. Web. 7 May 2011. <http://www.ucsusa.org/clean_energy/technology_and_impacts/energy_technologies/how-natural-gas-works.html>.

⁵³ "Halliburton Begins Disclosing Hydrofracking Chemicals Used in Pennsylvania on New Website | Syracuse.com." *Syracuse NY Local News, Breaking News, Sports & Weather - Syracuse.com*. 15 Nov. 2010. Web. 08 May 2011. <http://www.syracuse.com/have-you-heard/index.ssf/2010/11/halliburton_begins_disclosing.html>.

⁵⁴ Len, Marita. "Endocrine Disruptors in Hydrofracking Fluids (Hydrofracking Hysteria Part 2) - New York Massage Therapy | Examiner.com." *Spokane News, Spokane Information, Spokane Events - Examiner.com | Examiner.com*. 30

Additional concerns have been raised over violations by hydraulic fracturing companies. The Pennsylvania Land Trust Association reviewed the actions of shale drillers in Pennsylvania and found a total of 1614 violations of state oil and gas laws between January 2008 and August 2010, 1056 of which impacted the environment.⁵⁵ In response to reports like this, the Executive Director of the Sierra Club has said, "If we can't protect our communities and treasured landscapes, then we should not drill for natural gas. I am cautiously hopeful, however, that strong regulation and government oversight will make drilling safe, because we sure could use the help of natural gas as we push quickly and aggressively toward a truly clean energy future powered by wind, solar, and other renewable resources."⁵⁶

Constituents and landowners in regions with natural gas deposits are most directly affected by hydraulic fracturing. Many of the areas affected are rural and lie outside of public water supply areas. Shallow wells into surrounding aquifers are the most common sources of water, making inhabitants extremely vulnerable to the dangers of contamination. Land rights and regulations vary depending on the state, but most states divide rights between surface and mineral owners. Mineral owners have access to any subsurface resources while surface owners maintain rights to use the land and use resources necessary for having a home or a farm, including surface water, shallow wells, riparian water rights, and air rights.⁵⁷ Specific requirements and rights of the owners vary depending on the state's specific regulations, and transactions between fracturing companies and landowners are normally done on a case-by-case basis.

Many surface landowners who have sold their mineral rights to energy companies have had negative experiences with energy companies.⁵⁸ One New York landowner, whose five-year drilling lease ended in 2010 claims, " ‘It ruins people’s property values, it ruins their land. It makes some people sick...I don’t want anything to do with it.’"⁵⁹ These concerns have led citizens to create local action groups across the country. Gas Drilling Awareness for Cortland Country is a group of

Mar. 2010. Web. 08 May 2011. <<http://www.examiner.com/massage-therapy-in-new-york/endocrine-disruptors-hydrofracking-fluids-hydrofracking-hysteria-part-2>>.

⁵⁵ "Marcellus Shale Drillers in Pennsylvania Amass 1614 Violations since 2008 - 1056 Identified as Most Likely to Harm the Environment." *Conserve Land. Org.* Pennsylvania Land Trust Association, 1 Oct. 2010. Web. 8 May 2011. <<http://conserveland.org/violationsrpt>>.

⁵⁶ "Frack Attack - Coming Clean: Michael Brune's Blog." *The Green Life: Tips for Living Well and Doing Good from Sierra Magazine*. Web. 08 May 2011. <<http://sierraclub.typepad.com/michaelbrune/2010/08/frack-attack.html>>.

⁵⁷ "Land Rights in the United States." Florida Land Rights. Web. 08 May 2011. <<http://land-rights.com/index.html>>.

⁵⁸ *Gasland*. Dir. Josh Fox. 2010. DVD.

⁵⁹ Alfonso III, Fernando. "Central New York Landowners Rally in Syracuse against Hydrofracking | Syracuse.com." *Syracuse NY Local News, Breaking News, Sports & Weather - Syracuse.com*. 23 Mar. 2011. Web. 13 May 2011. <http://www.syracuse.com/news/index.ssf/2011/03/landowners_rally_against_hydro.html>.

concerned residents of Cortland, NY dedicated to education and promotion of a safe and clean environment.⁶⁰ Keuka Citizens Against Hydrofracking is an organization of concerned Kansan citizens working to gain and share information about hydraulic fracturing and similar technologies.⁶¹ One rally in April 2011 gathered over 8,000 New York citizens in Albany. They brought three requests to the state legislature: 1) full disclosure of the chemicals used in the fracking fluids 2) home-rule zoning laws which would give communities more say in statewide decision-making processes, and 3) requirements that waste from the energy facilities be categorized and handled as hazardous.⁶²

Hydraulic fracturing has enabled vast amounts of natural gas extraction, and as such, **energy companies and the associations representing them** highlight the benefits of fracturing, contest the claims of their opponents, and defend against further regulation. Three companies, BJ Services Company, Halliburton Energy Services, and Schlumberger Technology Corporation, account for 95 percent of all the hydraulic fracturing that takes place in the United States.⁶³ Various associations are in favor of hydraulic fracturing, including the Independent Petroleum Association of America (IPAA) which represents oil and gas producers, and the Interstate Oil and Gas Compact Commission (IOGCC), which represents states, and “works to ensure our nation's oil and natural gas resources are conserved and maximized while protecting health, safety and the environment.”⁶⁴

In addressing concerns over water contamination, these companies and organizations generally claim that the chemicals are extremely unlikely to reach groundwater, and that if they do, they are not hazardous or potent enough to cause serious harm. The IPAA cites a 2004 study from the EPA that found, "no significant environmental risks as a result of proper hydraulic fracturing."⁶⁵ It further defends hydraulic fracturing, saying "current industry well design practices ensure multiple levels of protection between any sources of drinking water and the production zone of an oil and gas well."⁶⁶ One website titled 'Hydraulic Fracturing Facts,' sponsored by Chesapeake

⁶⁰ "About Us." *GDACC*. Web. 13 May 2011. <<http://gdacc.wordpress.com/about/>>.

⁶¹ "Business Overview." *Keuka Citizens Against Hydrofracking*. Web. 13 May 2011. <<http://www.keukacah.org/>>.

⁶² "CCE Press Center - Citizens Campaign for the Environment." *Citizens Campaign for the Environment - New York and Connecticut Environmental Protection Preservation and Advocacy*. Web. 13 May 2011. <<http://www.citizenscampaign.org/press-releases/release.asp?id=55>>.

⁶³ Office of Fossil Energy, National Energy Technology Laboratory. *State Oil and Natural Gas Regulations Designed to Protect Water Resources*. Rep. U.S. DOE, 2009. Print.

⁶⁴ "About Us | Interstate Oil and Gas Compact Commission." *Interstate Oil and Gas Compact Commission*. Web. 08 May 2011. <<http://www.iogcc.state.ok.us/about-us>>.

⁶⁵ "Independent Petroleum Association of America (IPAA) - About IPAA." *Independent Petroleum Association of America (IPAA) - Home Page*. Web. 08 May 2011. <<http://www.ipaa.org/about/index.php>>.

⁶⁶ *ibid*.

Energy (the most active driller of new wells in the United States)⁶⁷ describes the distance and multiple rock layers between the water and fracturing that sites protect the water source from contamination. The wellbores are also constructed with multiple safety guards. Steel casing lines the entire wellbore, with additional steel and cement layers at groundwater levels (Appendix V). Even if the fluids did leak, companies claim that chemicals pose no threat, as they compose only 0.5 percent of the total fluid volume and the chemicals are mostly not harmful. Halliburton's fluids disclosure web page lists the name of the chemicals used as well as common household uses, claiming that as the chemicals are approved for everyday uses, they do not pose threats to water sources.⁶⁸ They also contest findings that hydraulic fracturing is responsible for methane pollution, like the recent Duke University study. A spokesman for Energy in Depth, a drilling industry group, called it, "a paper that draws pretty firm conclusions without much data at all to back any of them up."⁶⁹

The EPA's main power to regulate fracking was retracted under the exemption in Section 1421 of the SDWA. The EPA is currently focusing on other pathways, particularly conducting studies and regulating under the Clean Water Act and state legislation. In response to recent controversy and discrepancy between hydraulic fracturing supporters and opponents, the Appropriations Committee in the House of Representatives included in its FY 2010 budget report funding for the EPA to undertake a study investigating hydraulic fracturing. It is designed to be a full-scale, unbiased study about the effects of hydraulic fracturing on drinking water supplies. In the first part of the study, the EPA gathered information about the chemical composition of fracking fluids, the impacts of these chemicals on human health, and what procedures are being used on the hydraulic fracturing sites. As of December 2010, all nine of the companies that received information requests have made information available to the EPA and the public, allowing the EPA to continue with its report. A draft study plan was submitted and reviewed by the Scientific Advisory Board in March 2011 and the results are scheduled to be available by late 2012.⁷⁰

Regulation II: Tightening Controls

⁶⁷ "About | Chesapeake Energy - America's Champion of Natural Gas." *Chesapeake Energy - America's Champion of Natural Gas*. Web. 08 May 2011. <<http://www.chk.com/About/Pages/Default.aspx>>.

⁶⁸ "Halliburton - Fluids Disclosure." *Solutions for Today's Energy Challenges - Halliburton*. Web. 08 May 2011. <http://www.halliburton.com/public/projects/pubsdata/Hydraulic_Fracturing/fluids_disclosure.html>.

⁶⁹ Soraghan, Mike. "Study Finds Methane Contamination Rises near Shale Gas Wells." *Greenwire*. 9 May 2011. Web. 13 May 2011. <<http://www.eenews.net/Greenwire/2011/05/09bn>>.

⁷⁰ "Hydraulic Fracturing | Hydraulic Fracturing | US EPA." *Index | Water | US EPA*. Web. 08 May 2011. <<http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/index.cfm>>.

Clean Water Act. The Clean Water Act (CWA) is another tool that can be used to regulate natural gas production, but it is not the most effective, as it applies primarily to surface waters like lakes and rivers. Under the CWA, states or the EPA have the authority to regulate discharge water into surface waters, and administer the National Pollutant Discharge Elimination System (NPDES). The NPDES began in 1972 and requires point source polluters to obtain permits if their discharge goes directly into surface waters.⁷¹ Individual states are responsible for administering the program, and hence determine how it is used to regulate hydraulic fracturing facilities.

State-level Actions. Although there is no overarching federal legislation that controls hydraulic fracturing, none of the loopholes restrict the abilities of individual states to regulate the process of natural gas extraction. Pennsylvania has set several regulations for oil and gas drilling. The Department of Environmental Protection (DEP) regulates well bonding, permitting, and identification; as well as environmental requirements for drilling operations, cementing and safety casings, waste disposal, and plugging wells after they are discontinued. Under the CWA's NPDES, each new oil or gas well must apply for a permit, which requires the applicant to show the distance from surface waters and other water supplies. That information is then analyzed by the regional DEP offices, where potential environmental impacts are taken into account. Well sites are also inspected by the DEP, and investigated in the event of public safety complaints.⁷²

Numerous states have also implemented laws requiring oil and gas companies to release information about the chemicals they use. In Texas, Republican representative Jim Keffer presented a bill in March 2011 that would require public disclosure of the chemicals used in fracking operations. It has gained support from environmental groups like the Sierra Club and Texas League of Conservation Voters as well as members of the natural gas industry, who believe it would improve public opinion of hydraulic fracturing chemicals. Several other states, including Wyoming, Arkansas, Colorado, and Pennsylvania, have adopted similar requirements.⁷³

New York has taken a stronger approach, issuing a temporary ban on hydraulic fracturing until May 2011. Only vertical drilling will be allowed until the state has completed its draft Supplemental Generic Environmental Impact Statement (SGEIS), which analyzes the potential environmental and human impacts of natural gas extraction from Marcellus Shale, which covers

⁷¹ "National Pollutant Discharge Elimination System (NPDES)." U.S. EPA. 12 Mar. 2009. Web. 15 May 2011. <<http://cfpub.epa.gov/npdes/>>.

⁷² *Oil and Gas Well Drilling and Production in Pennsylvania*. Rep. Pennsylvania Department of Environmental Protection, 2011. Print.

⁷³ Galbraith, Kate. "Hydraulic Fracturing Bill Could Force Disclosure." *New York Times*. 24 Mar. 2011. Web. 8 May 2011. <http://www.nytimes.com/2011/03/25/us/25tfracking.html?_r=1>.

much of the state. The SGEIS will also propose safety standards, including protection measures to prevent contamination as well as mitigation strategies.⁷⁴

FRAC Act. The federal legislative pathway is being addressed again, with the proposal of the Fracturing Responsibility and Awareness of Chemicals (FRAC Act). In 2009, two identical bills were proposed in House of Representatives and the Senate. The FRAC Act would repeal the exemptions in the Safe Drinking Water Act and require oil and gas companies to fully disclose the chemicals used in fracking fluids. The bills were proposed in the 111th Congress on June 9, 2009 by Representative Diana DeGette (D-CO) in Congress and Senator Robert Casey (D-PA) in Senate. Both were referred to committees within one day of their proposal, but no further action has yet been taken.⁷⁵

Recommendation

Natural gas has become increasingly essential to the United States' energy sector, and hydraulic fracturing is increasingly essential to the natural gas industry. This technology has enabled trillions of cubic feet of natural gas to be accessed, but it is far from a 'silver bullet.' Its harmful environmental impacts have been observed by several communities across the country. In order for it to become the flawless technology that the natural gas industry claims it is, it must be properly regulated so that no more people experience what has already happened to the residents of Dimock, Pennsylvania.

The first thing that is needed is more information about how hydraulic fracturing impacts the environment, particularly surrounding aquifers. There are already several accounts of water pollution surrounding hydraulic fracturing wells. Unbiased research must be conducted to find exactly what the pollutants are and what their impacts are on humans. It should also investigate what part of the fracturing process the pollutants are a result of, and how it can be prevented. We need to know if hydraulic fracturing is inherently flawed or if improved regulation could prevent water contamination. Hopefully the EPA study that is to be released in late 2012 will provide this information.

⁷⁴ "Draft Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program - NYS Dept. of Environmental Conservation." *New York State Department of Environmental Conservation*. 5 Oct. 2009. Web. 08 May 2011. <<http://www.dec.ny.gov/energy/58440.html>>.

⁷⁵ "H.R. 2766 [111th]: Fracturing Responsibility and Awareness of Chemicals Act of 2009 (GovTrack.us)." *GovTrack.us: Tracking the U.S. Congress*. Web. 08 May 2011. <<http://www.govtrack.us/congress/bill.xpd?bill=h111-2766>>.

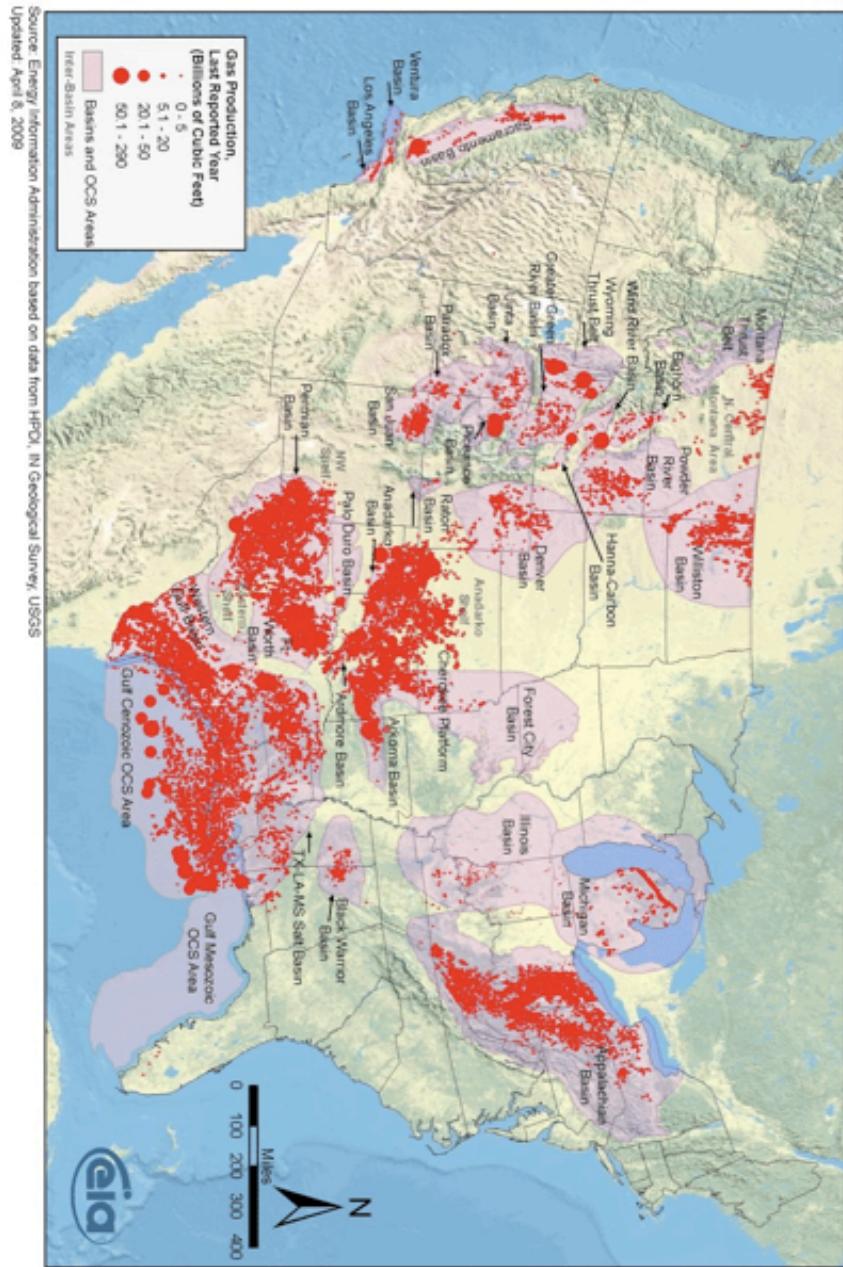
Information from a comprehensive, unbiased study will shed light on how to best regulate hydraulic fracturing. Currently the strongest restrictions are applied at the state level. While these regulations are useful for protecting water quality, there must also be a stronger minimum standard set at the federal level. The states with the strongest regulations are those with communities that have already been negatively affected by hydraulic fracturing. Instead of allowing each state to experience the impacts on an individual basis, federal legislation should establish a high national safety standard.

Regardless of what the EPA's findings are, the FRAC Act should be passed to ensure transparent and responsible mining practices. Natural gas companies have responded to public demands as well as requests for information from the EPA, but so far these have been done on a voluntary basis with no legal method of enforcement. Federal regulations need to be in place to set standards and make sure that they are being enforced. If the natural gas companies are really taking the precautions they claim to be, and hydraulic fracturing is as safe as their spokespeople suggest, then federal regulation should not be an insurmountable barrier.

Appendices

I. Map detailing United States natural gas reserves

How Natural Gas Works." UCS: *Citizens and Scientists for Environmental Solutions*. Union of Concerned Scientists, 2010. Web. 7 May 2011.
<http://www.ucsusa.org/clean_energy/technology_and_impacts/energy_technologies/how-natural-gas-works.html>.



II. Full list of Fracturing Chemicals used in Pennsylvania

Bureau of Oil and Gas Management. *Chemicals Used in the Hydraulic Fracturing Process in Pennsylvania*. Rep. Pennsylvania Department of Environmental Protection, 2010. Print.

Chemicals Used in the Hydraulic Fracturing Process in Pennsylvania Prepared by the Department of Environmental Protection Bureau of Oil and Gas Management Compiled from Material Safety Data Sheets (MSDS) obtained from Industry	
Chemical	Product Name
2,2-Dibromo-3-Nitrilopropionamide	Bio Clear 1000/Bio Clear 2000/ Bio-Clear 200/ BioRid20L/ EC6116A
2-methyl-4-isothiazolin-3-one	X-Cide 207
5-chloro-2-methyl-4-isothiazolin-3-one	X-Cide 207
Acetic Acid	Fe-1A Acidizing Composition/ Packer Inhibitor
Acetic Anhydride	Fe-1A Acidizing Composition
Acetylene	GT&S Inc./ Airco
Alcohol Ethoxylated C12-16	NE-200
Alkyl benzene sulfonic acid	Tetrolite AW0007/ FR-46
Ammonia (aqueous)	FAW-5
Ammonium Bifluoride	ABF 37%
Ammonium Persulfate	AP Break
Ammonium Bisulfite	Techni-Hib 604/ Fe OXCLEAR/ Packer Inhibitor
Ammonium chloride	Salt Inhibitor
Ammonium Salt (alkylpolyether sulfate)	Tetrolite AW0007
Amorphous silica	TerraProp Plus/ Bituminous Coal Fly Ash ASTM C618
Benzoic Acid	Benzoic Acid
Boric Acid	BC-140/ Unilink 8.5
Boric Oxide	XLW-32
Calcium Chloride	Dowflake
Calcium Oxide	Bituminous Coal Fly Ash ASTM C618
carboxymethylhydroxypropyl guar blend	Unigel CMPHG
Choline Chloride	Clay Treat-2C
Cinnamaldehyde	ENVIROHIB 2001
Citric Acid	Ferrotrol 300L/ IC-100L
Complex polyamine salt	Clay Master-5C
Crystalline Silica: Cristobalite	
Crystalline Silica: Quartz	Silica Sand/ / Atlas PRC/ Best Sand/ Bituminous Coal Fly Ash ASTM C618
Cupric chloride dihydrate	Ferrotrol 280L
Cured resin	LiteProp 125
Cyclohexanes	CS-2
Dazomet	ICI-3240
Diethylene Glycol	Scalretrol 720/ Scalretrol 7208
d-Limonene	MA-844W

Enzyme	GBL-8X
EO-C7-9-iso-, C8 rich-alcohols	NE-940/ NE-90
EO-C9-11-iso-, C10-rich alcohols	NE-940/ NE-90
Ethoxylated Alcohol	FRW-14/ SAS-2/ Flomax 50/ WFR-3B
Ethyl Acetate	Castle Thrust
Ethyl Alcohol	FAW-5/ Castle Shop Solv/ Dallas Morris
Ethylbenzene	NDL-100/ PARANOX/ Uniflo II
Ethylene Glycol	ENVIROHIB 2001/ ICA-2/ LEB 10X/ Scaletrol 720/ Sceletrol 7208/ CC 300/ Clachek A/ Clachek LP/ Ironsta II B/ NCL-100/ BC 140/ NCL-100/ Flomax 50/ NCL/ Scalehib 100/ Unihib O/ Unilink 8.5
Formic Acid	ENVIROHIB 2001
Gluconic Acid	Interstate ICA-2
Glutaraldehyde	Alpha 114/Alpha 125/ ICI-150
Glycerol	Bio Sealers
Glycol Ethers	ENVIROHIB 2001/AMPHOAM 75/ PARANOX/ Uniflo II/ Unifoam/ WNE-342LN
Guar Gum	PROGUM 19 GUAR PRODUCT/ Unigel 19XL/ Benchmark Polymer 3400/ WGA-15/ Unigel 5F
Hydrochloric Acid	Hydrochloric Acid (HCL)/ TETRAClean 542/ Muriatic Acid
Hydrochloric Acid 3% - 35%	Hydrochloric Acid 3% - 35%
Isopropanol	AFS 30 Blend/ FAC-1W/ FAC-3W/ MA-844W/ NE 23/ NE-940/ Flomax 50/ Tetrolite AW0007/ FMW25 Foamer/ CS-2
Isopropyl Alcohol	NFS-102/ WFT-9511/ LT-32/ AR-1/ Flomax 50/ NDL-100/ Unibac/ Uniflo II/ Uniflo/ Unihib O/ WNE-342LN
Methanol	AFS 30 Blend/ NE-200/ Activator Superset-W/ CI-14/ FAW-5/ GasFlo/ Inflo-250W/ LT-32/ NE-940/ XLW-32/ Tetrolite AW0007/ FMW25 Foamer/ 40 HTL Corrosion Inhibitor/ NE 100/ HAI-OS Acid Inhibitor/ Unibac/ NE-90/ Packer Inhibitor
Methyl Alcohol	Clearbreak 400/ Super Surf/ Castle Shop Solv
Methyl Salicylate	Bio Sealers
n-butanol	AirFoam 311
Nitrilotriacetamide	Salt Inhibitor
Phenolic Resin	Atlas PRC
Polyethylene Glycol	NE-940/ EC6116A/ NE-90
Polyethylene Glycol Mixture	Bio Clear 2000/ Bio-Clear 200
Polyoxylalkylene sulfate	FMW25 Foamer
Polysaccharide Blend	GW-3LDF

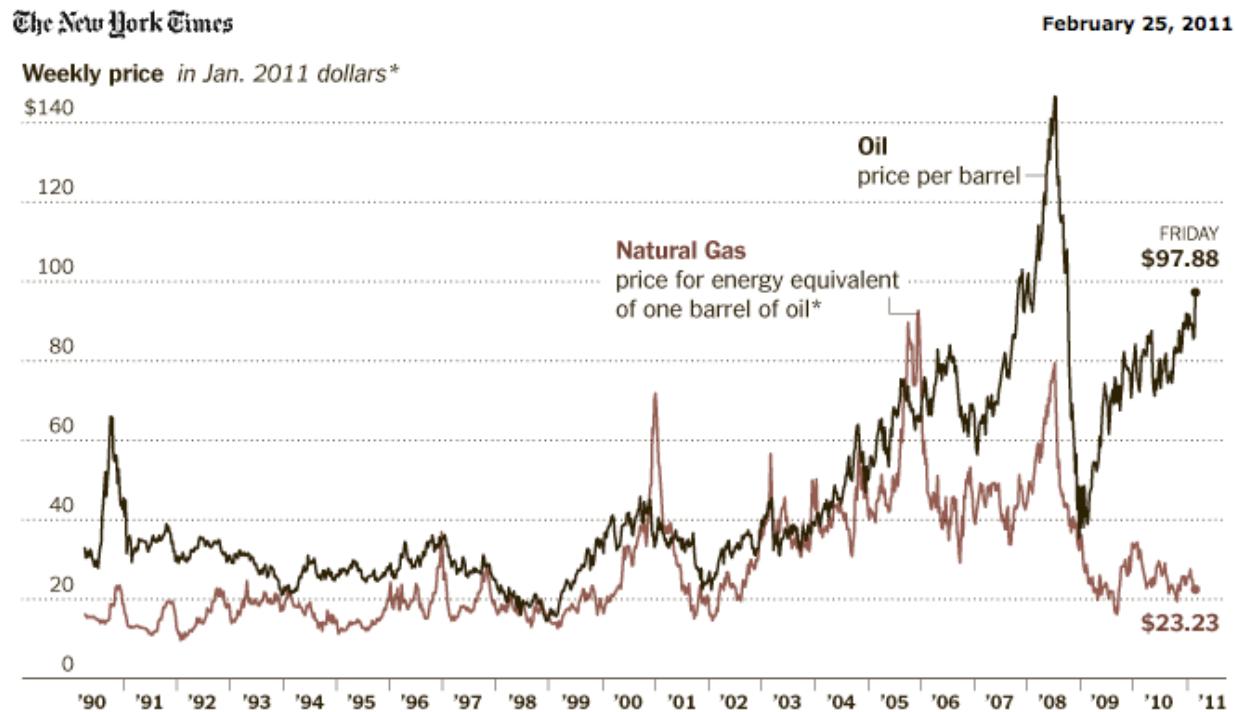
Potassium Carbonate	BF-7L
Potassium Chloride	Dowflake
Potassium Hydroxide	B-9, pH Increase Buffer/ BXL-2
Propargyl Alcohol	CI-14/ HAI-OS Acid Inhibitor
Propylene Glycol	SAS-2/ WFR-3B
Silica	S-8C, Sand, 100 mesh/ Montmorillonite clay
Sodium Bicarbonate	K-34
Sodium Bromide	BioRid 20L
Sodium Hydroxide	Caustic Soda/ ICI-3240/ BioRid B-71
Sodium Persulphate	High Perm SW-LB
Sodium Xylene Sulfonate	FAC-2/ FAC-3W
Sulfuric Acid	Sulfuric Acid
Surfactants	AFS-30/ GasFlo/ Inflo-250W
Talc	Adomite Aqua
Tetrakis(hydroxymethyl)phosphonium sulfate	Magnacide 575 Microbiocide
Tetramethyl ammonium Chloride	Clay Treat-3C
Trimethyloctadecylammonium chloride	FAC-1W/ FAC-3W

6/10/2010

III. Natural Gas prices compared with oil

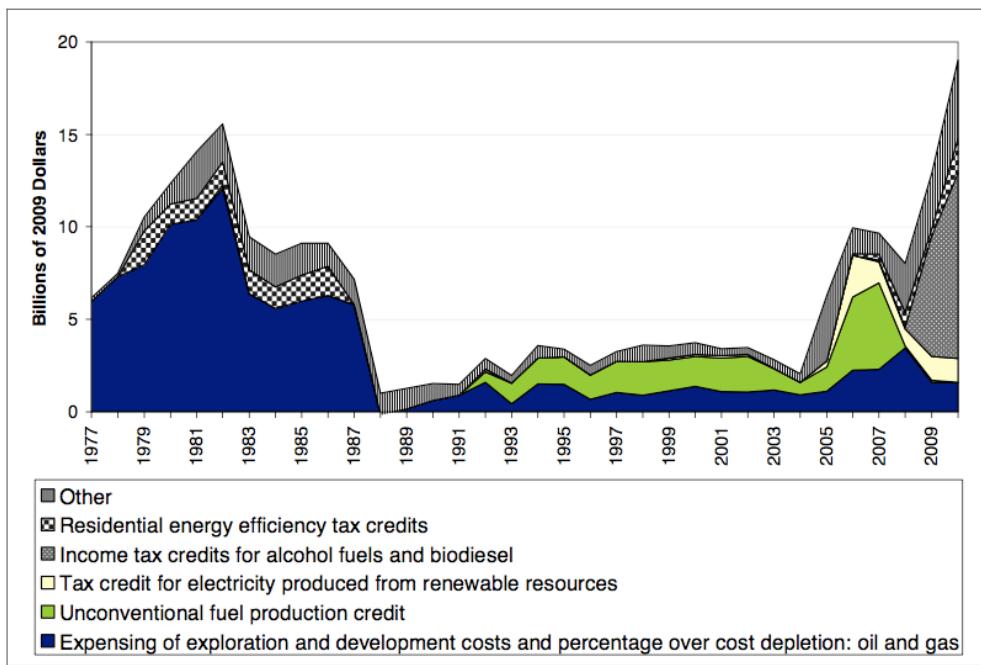
Norris, Floyd. "Two Directions for the Prices of Natural Gas and Oil." *New York Times*. 25 Feb. 2011. Web. 13 May 2011.

<http://www.nytimes.com/2011/02/26/business/global/26charts.html?_r=2&scp=1&sq=natural+gas+price+s&st=nyt>.



IV. Energy tax expenditure: 1977 to 2010

Sherlock, Molly F. *Energy Tax Policy: Historical Perspectives on and Current Status of Energy Tax Expenditures*. Publication no. 7-5700. Washington DC: Congressional Research Service, 2010. Print.

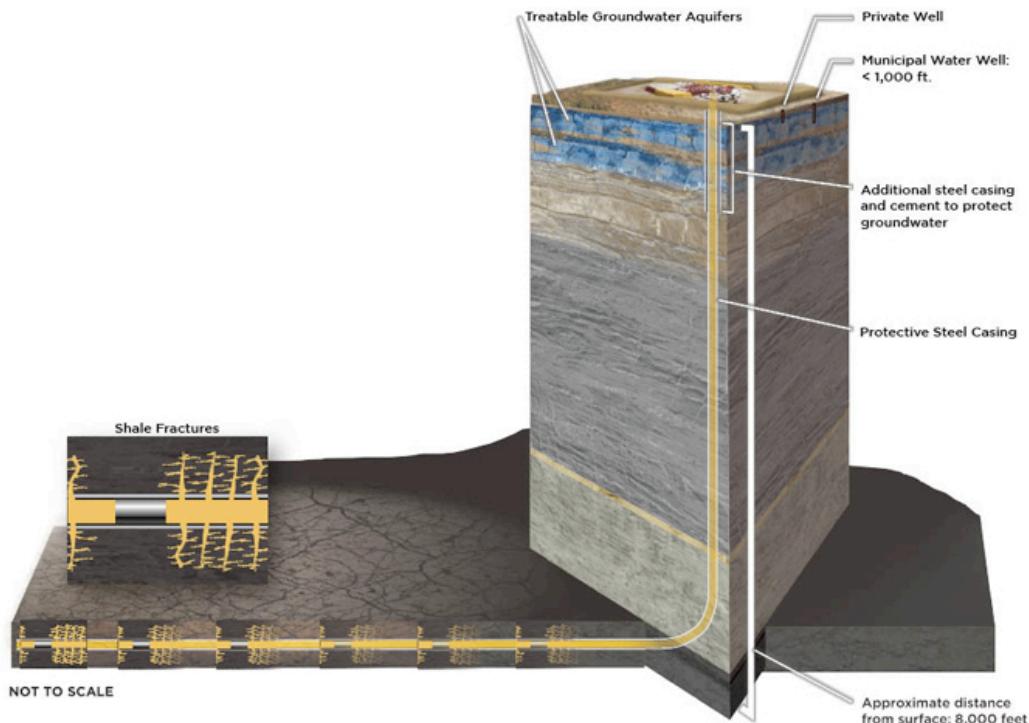


Source: CRS calculations using JCT tax expenditure estimates and data from the OMB.

Notes: Tax expenditures beyond 2009 are estimates and do not reflect legislation enacted after September 30, 2009. Values are adjusted to 2009 dollars using the OMB's GDP price index.

V. Diagram of hydraulic fracturing well

"Hydraulic Fracturing Facts: The Process." *Hydraulicfracturing.com*. Web. 08 May 2011. <<http://www.hydraulicfracturing.com/Process/Pages/information.aspx>>.



Section 2.2

Local Consequences of U.S. Energy Policy

Elli Blaine, *The Arctic National Wildlife Refuge: Should ANWR be Opened Up for Oil and Gas Extraction?*

June 1, 2011

U.S. Environmental Politics
Environmental Studies Program

Summary

With rising world oil prices and increased focus on national security, oil and gas extraction in the Arctic National Wildlife Refuge (ANWR) in northeastern Alaska has resurfaced in political debates centered on domestic energy production. ANWR constitutes one of the largest protected Wilderness area in the United States, and provides protection for crucial ecosystems. At the same time, the U.S. has become dependent on Alaska as a source of domestic petroleum production, and has many incentives to pursue increased extraction.

The Federal government and the U.S. Fish and Wildlife Service presently prohibit any oil extraction in the Refuge. However, the 1002 Area on the Refuge's Coastal Plain is not designated as Wilderness due to its economically valuable petroleum reserves. The Alaskan state government's recently renewed push to open the 1002 Area to oil exploration prompts a close look at the major issues important to the ANWR debate, including the economic costs and benefits of development, the degree of environmental impacts associated with increased infrastructure, and relevant stakeholders' positions on the issue.

Primary stakeholders in the debate include the state of Alaska, the energy industry, Native communities, and environmental groups; together, these stakeholders demonstrate a range of positions on the debate of ANWR oil extraction. A brief look at past political pathways that have been pursued surrounding this issue provides a context for current Federal actions, resting predominantly on Congressional decision-making. It remains important to consider that any movement on the issue of ANWR development will likely be included in a larger, more comprehensive, national energy bill.

TIMELINE

- November 1957 State of Alaska pursues withdrawal of lands in northeastern Alaska to create an “Arctic National Wildlife Range.”
- December 1960 Under President Eisenhower, Secretary of the Interior issues Public Land Order 2214 reserving the area.
- 1967 Oil discovered at Prudhoe Bay, Alaska, on state-owned portion of coastal plain west of ANWR.
- 1971 Congress passes the Alaska Native Claims Settlement Act, authorizing 44 million acres of federal lands to Native corporations, providing for monetary payments, and directing the Secretary of the Interior to withdraw 80 million acres from development in the national interest.
- 1973 Congress passes legislation allowing construction to begin on the Trans-Alaska pipeline. Construction begins the following year. Construction takes 39 months and costs \$8 billion.
- December 1980 Under President Carter, Congress enacts the Alaska National Interest Lands Conservation Act (ANILCA), expanding the Range to 19 million acres, and renaming it the Arctic National Wildlife Refuge. 40% of ANWR is designated as Wilderness Area. 1.5 million acres on the coastal plain, the “1002” area is left open for oil and gas development studies.
- 1995 Congress attempts to authorize opening of ANWR in the FY1996 reconciliation bill; Clinton vetoes the omnibus measure.
- 1998 USGS publishes National Oil and Gas Assessment on ANWR oil and gas reserves.
- May 2001 George W. Bush releases his National Energy Policy; includes using ANWR lease bonuses to fund research in renewable and alternative fuels.
- June 2001 The National Energy Security Act is dropped.
- 2005 Senator Joe Lieberman (ID-CT) introduces the Arctic Wilderness Act as an ANWR Wilderness bill into the U.S. Senate, proposing that it be closed off to all resource development use and subject to strict access and usage laws.

- 2011 Senator Lisa Murkowski (R-AK) introduces the “No Surface Occupancy Bill” and “American Energy Independence and Security Act of 2011” in the Senate to open up ANWR to drilling and exploration.
- 2011 House Representative Devin Nunes (R-CA) introduces H.R. 909 “All of the Above” Energy Solution, incorporating ANWR development within a broader national energy plan including the promotion of oil from the Outer Continental Shelf (OCS), oil shale, coal to liquid, and nuclear power.

Introduction

Policy surrounding energy production has been at the center of much U.S. political debate and legislation efforts. U.S. energy production methods and oil consumption have received increased attention with Japan's recent Fukushima nuclear crisis, the U.S. Gulf Coast's BP oil spill, and political unrest in the Middle East, which have contributed to the sharp rise in world oil prices. Although efforts have been made to increase regulations in the energy sector based on human health, environmental, and social justice concerns, the United States still lacks a comprehensive energy policy.

With rising world oil prices, politicians and petroleum industries have recently made another push for domestic energy production. Great concern has been centered around the issue of national security; increased domestic production is framed as a means of protecting the US from international oil disputes, rising prices, and foreign oil dependency. Sparked in 2008 due to rising oil prices, Republicans began to use the slogan "Drill, Baby, Drill" as a campaign endorsing increased U.S. oil development; Alaskan political officials continue to use this slogan to push for in-state development. At the center of the domestic oil production debate is the question of whether to drill for oil in the Arctic National Wildlife Refuge (ANWR), located in northeastern Alaska⁷⁶.

ANWR drilling has been subject to significant partisan controversy since the 1980s, but has received recent renewed debate.⁷⁷ In February, The Alaska State House of Representatives passed resolution HJR9, urging Congress to open the 1002 Area to "responsible" oil exploration and development.⁷⁸ The resolution passed by a vote of 34 to one, and has moved to the Alaska Senate for consideration. This action highlights the resurgence in political support of opening ANWR for oil and gas exploration in Alaska. As a pressing issue in the political energy debate, potential drilling in ANWR deserves renewed attention, with a particular focus on the current regulatory status of the area, economic considerations, environmental concerns, and stakeholder's positions.

ANWR constitutes one of the largest protected wilderness in the United States – larger than the states of New Hampshire, Vermont, and Massachusetts combined – and has significant biological

⁷⁶ "Arctic National Wildlife Refuge Update." *American Geological Institute - Government Affairs Program*. 19 Nov 2002. 16 May 2011.

⁷⁷ "In Wake of Gulf Oil Spill, Shell Quits Arctic Drilling For Summer | Earthjustice." *Earth Justice* 3 Feb 2011. 8 May 2011.

⁷⁸ Jenna Crouse. "Press Release: 2011-02-28 - House Urges Feds to Open ANWR for Exploration & Leasing -- 27th AK Legislature House Majority." 28 Feb 2011. 8 May 2011.

value and untapped economic value from its large oil and natural gas reserves.⁷⁹ The primary debate focuses on whether to open 1.5 million acres, the “1002 Area,” on Alaska’s northern coastline for drilling, an area *not* protected under federal wilderness designations. This paper will address important considerations on both sides of the debate to pursue energy development in ANWR, with the final recommendation that ANWR *not* be opened and for continued focus on domestic renewable energy sources.

OVERALL REGULATORY STRUCTURE AND POLICIES

ANWR

The Arctic National Wildlife Refuge is in large part preserved as wilderness and restricted to oil and gas development. In 1980, Congress enacted the Alaska National Interest Lands Conservation Act (ANILCA) expanding the former Arctic National Wildlife Range to 19.6 million acres, and renaming it the Arctic National Wildlife Refuge.⁸⁰ The Wilderness Area of the Refuge is administered by the U.S. Fish and Wildlife Service (USFWS) in accordance with provisions of the Wilderness Act of 1964 and ANILCA, as well as state and federal laws⁸¹. The USFWS is charged with maintaining the area’s “wilderness character,” including the land’s natural conditions, the functioning of ecological processes, and wildlife’s numbers and interactions.⁸² The rest of the Refuge is managed under “Minimal Management” classification; the lands remain suitable for Wilderness designation, though under the Obama administration Congress has not taken steps towards this decision⁸³(5a). Activities related to oil and gas extraction, transportation, and research are not allowed in the area, unless conducted by the Department of the Interior.⁸⁴

⁷⁹ US Department of the Interior. “Facts: Environmentally Responsible Energy Production in Alaska’s ANWR.” 16 May 2011.

⁸⁰ USFWS. “Arctic Refuge: Wilderness Stewardship.” 16 May 2011.

⁸¹ USFWS. “Arctic Refuge: Wilderness Stewardship.” 16 May 2011.

⁸² USFWS. “Arctic Refuge: Wilderness Stewardship.” 16 May 2011.

⁸³ USFWS. “Arctic Refuge: Management of Refuge Additions.” 16 May 2011.

⁸⁴ USFWS. “Arctic Refuge: Wilderness Stewardship.” 16 May 2011.



Figure 1. Arctic National Wildlife Refuge (ANWR) as the area compares to the rest of Alaska. (USGS)

1002 Area

The “1002 Area” is the portion of ANWR under contention in debates over opening ANWR for oil exploration and development. In Section 10002 of ANILCA, Congress deferred a decision on the management of oil and gas exploration and development of 1.5 million acres in the coastal plain.⁸⁵ This area, now referred to as the “1002 Area” was not included in the larger Range’s Wilderness Area, despite its importance as a wildlife habitat, due to its potentially enormous oil and gas resources.⁸⁶ When considering opening the area for development, all 1.5 million acres are being considered (See Figure 2). The small amount of surface area is mandated in order to encourage the consolidation of leasing operations,⁸⁷ whereby the production and support facilities necessary for oil extraction and processing will be limited to an above-ground area of 2,000 acres. This area represents only 0.01% of ANWR’s total acreage.⁸⁸ This aims to reduce the environmental impacts of drilling. However, significant concerns remain surrounding the issue of environmental impacts of oil development. It is important to first consider the amount of oil available in the 1002 Area and to evaluate the feasibility of oil extraction as an option for increased domestic energy production.

⁸⁵ USFWS. “Arctic Refuge: 1002 Area Management.” 16 May 2011.

⁸⁶ USGS. “Alaska Studies - Arctic National Wildlife Refuge (ANWR) 1002 Area.” USGS: *Energy Resources Program*. 16 May 2011.

⁸⁷ “Arctic National Wildlife Refuge (ANWR).” *Almanac of Policy Issues*. 16 May 2011.

⁸⁸ US Department of the Interior. “Facts: Environmentally Responsible Energy Production in Alaska’s ANWR.” 16 May 2011.

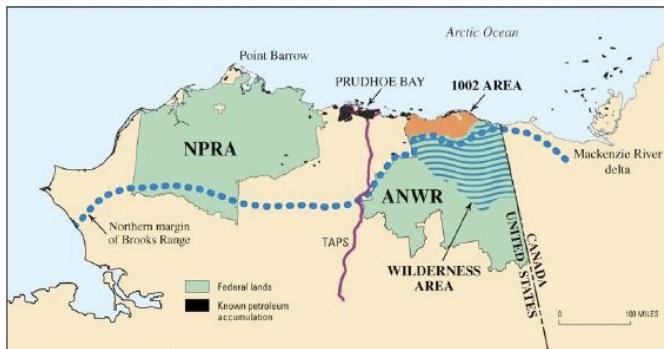


Figure 2. 1002 Area “Coastal Plain” as it compares to the rest of ANWR and the northwest coast of Alaska (USGS).

ECONOMICS

Economy and Jobs

There are many economic arguments presented in favor of opening ANWR’s 1002 Area for development, although uncertainty about the actual economic benefits remains. One supporting argument is that exploration, development, and production will stimulate the economy and job growth, both directly and indirectly. The U.S. government, Alaska’s citizens, and the lower 48 states will benefit economically from increased Alaskan oil development: primarily through mineral lease revenues including cash bonuses, lease rentals, and royalties.⁸⁹ The 2002 “ANWR and the Alaska Economy” economic impact assessment of ANWR oil reserves predicted the potential lease bonus revenue from ANWR at \$1.5 billion, with royalty rates between 12.5% and 16.7% - bringing millions of dollars in revenue to the state and federal government.⁹⁰ The Congressional Budget Office estimates that energy companies would pay the government around \$5 billion to receive leases in the 1002 Area. Oil prices, geological characteristics (permeability and porosity), cash flow, and transportation or infrastructure constraints are the major factors affecting projected development rates and production levels for the 1002 Area.⁹¹

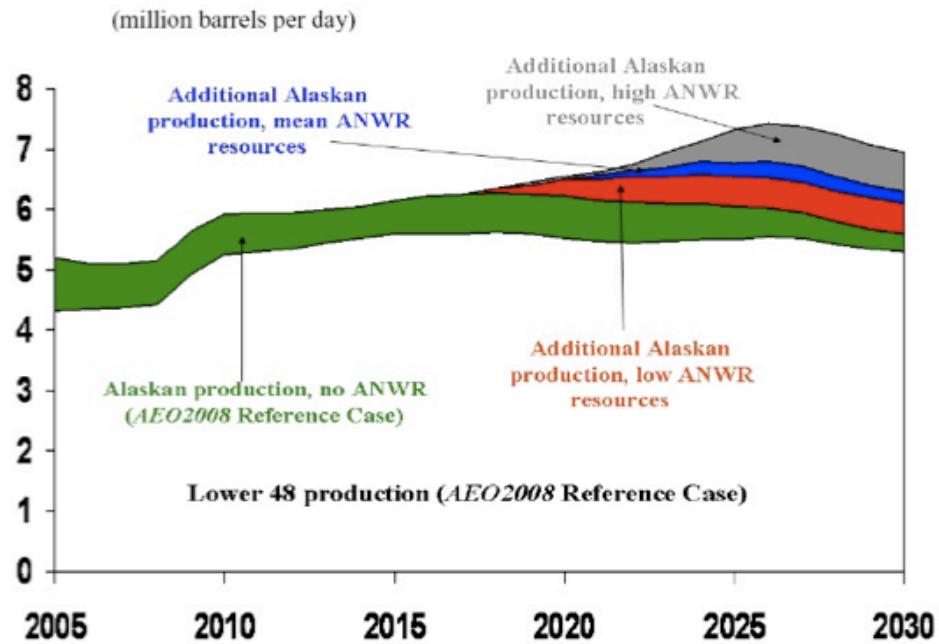
The price of oil is another key factor in determining how much oil is economically recoverable in ANWR. Major swings in oil prices change the amount of oil that is “economically” feasible to extract. Alaska already provides the lower 48 states with a notable amount of oil: averaging 1 million barrels of crude oil per day, and representing 15-20% of U.S. domestic energy production (See Figure 3). Yet, the U.S. consumes around 19.4 million barrels of oil per day, the majority

⁸⁹ McDowell Group. “ANWR and the Alaska Economy: An Economic Impact Assessment.” Sept 2002. 16 May 2011

⁹⁰ McDowell Group. “ANWR and the Alaska Economy: An Economic Impact Assessment.” Sept 2002. 16 May 2011

⁹¹ “Arctic National Wildlife Refuge (ANWR).” *Almanac of Policy Issues*. 16 May 2011.

(58%) of which comes from foreign sources.⁹²⁹³⁹⁴ The recent drastic increase in crude oil barrel price (total world averages hover around \$117), coupled with the United States' significant reliance on foreign oil imports greatly accounts for the resurfaced political action on ANWR development. U.S. officials and citizens see domestic production as a method of cushioning and preventing future extreme price shocks.



Source: National Energy Modeling System runs - aeo2008.d030208f, anwr2008.d031008a, anwr2008HRref.d040308c and anwr2008LRref.d040308d

Figure 3. Domestic Crude Oil Production, current and projected under three different scenarios (1a).

⁹² US Department of the Interior. "Facts: Environmentally Responsible Energy Production in Alaska's ANWR." 16 May 2011.

⁹³ Mitchell, John. "Rich in Caribou and in Oil, Alaska's Coastal Plain is a Hot Topic in the Nation's Energy Debate." *National Geographic*. 16 May 2011.

⁹⁴ McDowell Group. "ANWR and the Alaska Economy: An Economic Impact Assessment." Sept 2002. 16 May 2011

Alaska Revenues from ANWR Oil Production
Peak Annual Values (millions of dollars)

West Coast Price (\$/bbl)	\$20.00	\$22.00	\$24.00
Royalties (50/50 state/federal split)	\$130	\$200	\$320
Royalties (90/10 state/federal split)	230	360	570
Severance Taxes	270	420	660
Corporate Income Taxes	60	100	160
Property Taxes	80	100	140
Total Alaska Revenues (50/50 royalty split)	\$540	\$830	\$1,280
Total Alaska Revenues (90/10 royalty split)	\$650	\$990	\$1,530

Table 1. Alaska Revenues from ANWR Oil Production Annual Values (\$millions). Projected estimates for Alaskan revenue generated from opening ANWR to drilling. *Note: revenues are likely much *larger* currently due to the increased price of oil.

Oil and Gas Reserves

Subsequent to a 1987 report to Congress by the Department of the Interior on the Refuge's resources, numerous wells have been drilled and oil fields discovered near ANWR⁹⁵. Alaska's North Slope (ANS) coastal plain already provides the states with a large amount of oil (634, 776 BBLs as of April, 2011). The USGS estimates that the 1002 Area contains the largest single conventional oil reserve in the nation, at a mean average of 10.4 billion barrels (BBO).⁹⁶ This represents a sizable reserve, containing enough oil to produce about one million barrels of oil per day – about 20% of our domestic daily production (See Figure 3).⁹⁷ This would add to the 20% that is already currently being produced in Alaska. With the amount of oil reserves estimated and current oil consumption patterns, ANWR resources could supply petroleum for the entire state of Florida for 29 years, Arkansas for 146 years, or Hawaii for 249 years.⁹⁸ A study performed in 2010 on the National Petroleum Reserve found that the reserve contained less oil than previously expected (about 896 million barrels)⁹⁹. The presumed oil reserves were actually natural gas. Such a

⁹⁵ USGS. "Alaska Studies - Arctic National Wildlife Refuge (ANWR) 1002 Area." USGS: *Energy Resources Program*. 16 May 2011

⁹⁶ US Department of the Interior. "Facts: Environmentally Responsible Energy Production in Alaska's ANWR." 16 May 2011.

⁹⁷ US Department of the Interior. "Facts: Environmentally Responsible Energy Production in Alaska's ANWR." 16 May 2011.

⁹⁸ US Department of the Interior. "Facts: Environmentally Responsible Energy Production in Alaska's ANWR." 16 May 2011.

⁹⁹ USGS. "Alaska Studies - National Petroleum Reserve, Alaska (NPRA)." USGS: *Energy Resources Program* 2010. 16 May 2011.

finding raises the question of whether all the oil expected from the 1002 Area is actually representative of existing amounts.

Technologies and Infrastructure

ANWR holds promise both for its oil reserves and also because the infrastructure for oil extraction in Alaska has largely already been built. Through current Alaskan oil extraction, the U.S. has become dependent on Alaska as a source of domestic energy. This increases the political support for opening up the 1002 Area for further development.

In 1977, the \$8 billion dollar, 800-mile Trans-Alaska Pipeline was completed, and is now operated by the Alyeska Pipeline Service Company; it serves as a means of transporting 20% of the U.S. annual crude oil production from Alaska's North Slope fields to fuel tankers in Valdez, Alaska.¹⁰⁰ It appears to make economic sense to pursue drilling in the 1002 Area: the major pipeline for transporting oil is already in place, and the endeavor would employ many Alaskan citizens (the company currently employs more than 2,000 people).

One must also consider needs for additional infrastructure to make extraction possible, and the time-scale of the project. It is estimated that it will be 12 years from the outset of ANWR oil development approval before drilling takes place; the economic benefits experienced from development are also spread over the long term.¹⁰¹ But these economic arguments for ANWR development fail to recognize key external costs, such as those from environmental degradation.

Supporters argue that modern technologies and increased efficiency will make drilling in ANWR economically feasible, as well as ecologically sensible. Changes in production drilling techniques are a way to “decrease the footprint [of oil extraction], reduce waste, and increase recovery of hydrocarbons per well.”¹⁰² According to the USGS, “new geologic and geophysical data have become available, [and] seismic processing and interpretation capabilities have improved”.¹⁰³ Also, new field development practices, based on horizontal development wells and alternative area development, have resulted in marked improvements in productivity and a decreased number of

¹⁰⁰ “The Trans-Alaska Pipeline.” *Fairbanks-Alaska.com*. 16 May 2011.

¹⁰¹ “Gasoline turmoil spurs new ANWR legislation.” *Arctic Power, anwr.org*. 16 May 2011.

¹⁰² “Arctic National Wildlife Refuge (ANWR).” *Almanac of Policy Issues*. 16 May 2011.

¹⁰³ USGS. “Alaska Studies - Arctic National Wildlife Refuge (ANWR) 1002 Area.” *USGS: Energy Resources Program*. 16 May 2011

needed wells.¹⁰⁴ Supporters of opening ANWR state that these technologies would mitigate the environmental impact of petroleum operations.

ENVIRONMENTAL CONDITIONS AND IMPACTS

Opening the 1002 Area for oil extraction has incurred strong opposition from environmentalists, as well as most congressional Democrats, since development was first proposed due to its significant biological value to wildlife. It is likely that the “required network of oil platforms, pipelines, roads and support facilities, not to mention the threat of foul spills” would have immediate negative impacts on the area’s existing wildlife. The 1002 Area’s “biological resources” include polar bears, caribou, musk oxen, and approximately 135 species of migratory birds.¹⁰⁵ The US Fish and Wildlife Service report that the cumulative biological consequences of oil field development that may be expected in the Arctic Refuge include the following:¹⁰⁶

- Blocking, deflecting or disturbing wildlife
- Loss of subsistence hunting opportunities
- Increased predation by arctic fox, gulls and ravens on nesting birds due to introduction of garbage as a consistent food source
- Alteration of natural drainage patterns, causing changes in vegetation
- Deposition of alkaline dust on tundra along roads, altering vegetation over a much larger area than the actual width of the road
- Local pollutant haze and acid rain from nitrogen oxides, methane and particulate matter emissions
- Contamination of soil and water from fuel and oil spills

Considerations of ANWR development are important for these general reasons, and I will focus primarily on the first concern in this brief: the possible disturbance of wildlife.

The 1987 Final Legislative Environmental Impact Statement (FLEIS) reported that “The Arctic Refuge is the only conservation system unit that protects, in an undisturbed condition, a complete spectrum of the arctic ecosystems in North America” and that “the 1002 Area is the most biologically productive part of the Arctic Refuge for wildlife, and is the center of wildlife activity.”¹⁰⁷ Conducted by the Biological Research Division of the USGS, an updated assessment of the coastal plain’s biological resources (including caribou, musk oxen, snow geese, and other

¹⁰⁴ Attanasi, E.D. “Undiscovered oil resources in the Federal portion of the 1002 Area of the Arctic National Wildlife Refuge: an economic update.” 1998. Print.

¹⁰⁵ “Arctic National Wildlife Refuge (ANWR).” *Almanac of Policy Issues*. 16 May 2011.

¹⁰⁶ “The Arctic National Wildlife Refuge.” *USFWS*. 16 May 2011.

¹⁰⁷ “Arctic National Wildlife Refuge (ANWR).” *Almanac of Policy Issues*. 16 May 2011.

species) concluded that development impacts *would be significant*. The Department of the Interior's Environmental Impact Statement (EIS) reported that the "expected displacement and reduction of wildlife populations and natural processes would cause a major reduction in the value of the area as a pristine, natural scientific laboratory." The wilderness values within the 1002 Area "would be eliminated," the report concluded.¹⁰⁸

Although technological advances in oil and gas exploration have decreased some of the harmful impacts of the development process, oil and gas exploration remains an industrial process that would have considerable negative environmental consequences for both vegetation and wildlife. It is likely that development in the 1002 Area could require a large number of small production sites connected by an infrastructure of roads, pipelines, power plants, processing facilities, loading docks, dormitories, airstrips, utility lines, and landfills (See Figure 4, below) (6a). This development would bring people and machines, consequently disrupting the current habitat. A significant amount of water will also be necessary for the development of oil and gas fields, construction of ice roads, and drilling itself; yet, water is limited in the 1002 Area. According to the Bureau of Land Management, the water needed for full development ranges from 8-15 million gallons over a 5-month period; however, only 9 million gallons are assessed as available in the whole 1002 Area, only enough to freeze and maintain 10 miles of ice roads.¹⁰⁹ As a result, gravel and pads and roads will likely be used as an alternative, causing much environmental damage.

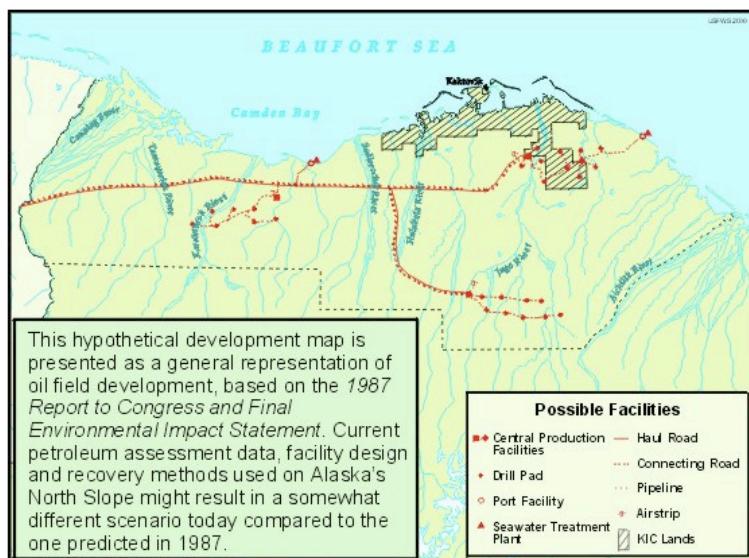


Figure 4. Map of hypothetical development and infrastructure needed for oil and gas exploration in the 1002 Area (USFWS).

¹⁰⁸ McDowell Group. "ANWR and the Alaska Economy: An Economic Impact Assessment." Sept 2002. 16 May 2011

¹⁰⁹ Habiger, Geoff. "Arctic National Wildlife Refuge - Part 2 - Page: 2." Suite101 1 Oct 2001. 16 May 2011.

Migratory Species

The 1002 Area represents a unique location where three important ecological systems intersect: the costal plain, mountains, and boreal forest; as such, the 1002 Area specifically provides essential habitat for internationally significant migratory species.¹¹⁰ It is said to be “critically important to the ecological integrity of the whole Arctic Refuge.”¹¹¹ The 1002 Area thus plays a critical role in the biodiversity of the Americas as a whole; the negative environmental effects on wildlife and habitat will not solely be localized if ANWR oil development goes through. This further complicates the political debate around oil extraction from the 1002 Area, for development would have environmental impacts beyond Alaska’s coastal plain. In the face of global climate change and threats of widespread biodiversity loss, this lends further argument to extending wilderness protections to the 1002 Area, or at least the continued prohibition of oil extraction.

Porcupine Caribou Herd (PCH)

Arguments against ANWR drilling have primarily focused on the effects of development on caribou herds, as opening the 1002 Area for oil exploration may disrupt the caribou’s natural patterns. The Central Arctic Caribou Herd and the Porcupine Caribou Herd indicate use of the 1002 Area for breeding¹¹²; the Porcupine Herd represents largest population of caribou in ANWR; the population is estimated to be around 130,000 individuals, and they are an important food source to Native people. Native peoples (especially the Gwich’in Indians)¹¹³ and environmental groups fear that development in the 1002 Area could have negative impacts on the herd’s fertility¹¹⁴. Arctic Power states that caribou would be in no way threatened by oil exploration efforts. They cite that after 30 years of the Prudhoe Bay oil field 50 miles west of ANWR, the Central Caribou Herd population has actually increased from 5,000 in 1977 to over 32,000 animals.¹¹⁵ The Biological Research Division of the USGS’ report found that if development were restricted to the western portion of the Refuge, then the Herd would not be affected during the early calving period.¹¹⁶

Yet, it would be unlikely that development and infrastructure would be limited to one location within the 1002 Area (See Figure 3). Cows with young calves take longer to habituate to

¹¹⁰ Ingram, Chris. “Drilling the Arctic National Wildlife Refuge.” 7 May 2001. 16 May 2011

¹¹¹ Ingram, Chris. “Drilling the Arctic National Wildlife Refuge.” 7 May 2001. 16 May 2011

¹¹² US Department of the Interior. “Facts: Environmentally Responsible Energy Production in Alaska’s ANWR.” 16 May 2011.

¹¹³ “Arctic National Wildlife Refuge.” *Alaska Trekker*. 16 May 2011.

¹¹⁴ Chance, Norman. “ANWR - The Arctic National Wildlife Refuge - A Special Report.” *Arctic Circle*. 16 May 2011.

¹¹⁵ Arctic Power, anwr.org. “ANWR Wilderness Legislation Initiated in Congress.” 16 May 2011.

¹¹⁶ “Arctic National Wildlife Refuge (ANWR).” *Almanac of Policy Issues*. 16 May 2011.

disturbance, and the 1002 Area is imperative to cows during the calving period; though natural, cows are experiencing displacement and reduced calving success due to being slowed in their migration by late thaws and heavy snows. Opening ANWR for drilling would result in negative consequences for the Arctic environment and general ecosystem functioning: for wildlife populations, for vegetation and habitat, and for other resources such as water.

Polar Bears and the ESA

Polar bear populations may experience significant impacts on denning behavior were ANWR development to take place. The 1002 Area is a region known for significant polar bear denning. Between 1981 and 2000, a significant percentage of the 53 maternal dens on the mainland coast of Alaska and Canada were within the bounds of the 1002 Area (42%).¹¹⁷ A 1992 study indicated that of the 44 dens located, 34% were within the 1002 Area.¹¹⁸ In 2008, polar bears were listed as “threatened” by the Secretary of the Interior under the 1973 Endangered Species Act, yet the tangible protections this affords the bears is limited. In 2010, the Interior Department designated 120 million acres in Arctic Alaska critical habitat for the polar bear. This met with political contention from the Alaska Oil and Gas Association and the state of Alaska, who challenged the Department on the grounds that protections for the polar bear will significantly impede oil drilling in the arctic; the company believes granting polar bears protections will have substantial negative social and economic impacts.^{119 120}

On April 20th, 2011 the Center for Biological Diversity, the Defenders of Wildlife, and Greenpeace intervened in a lawsuit in order to defend the polar bear and argue for protection of the larger Arctic ecosystem through the critical habitat designations.¹²¹ While, although the bears rely heavily on the 1002 Area for denning. Yet, were policy to be pushed through on both issues of the bears’ critical habitat *and* ANWR development, intercurrence between the ESA and energy policies may impede movement on both wildlife protections and oil extraction efforts.

¹¹⁷ U.S. Fish and Wildlife Service. “ANWR Polar Bear Denning Map.” *Arctic National Wildlife Refuge* 2001. 16 May 2011.

¹¹⁸ Amstrup, Steven. “Human Disturbances of Denning Polar Bears in Alaska.” 16 May 2011.

¹¹⁹ Arctic Power, anwr.org. “Polar Bears Are Now Political Animals.” 16 May 2011.

¹²⁰ Arctic Power, anwr.org. “Polar Bear Listing to Affect ANWR and Alaskan Arctic.” 16 May 2011.

¹²¹ Noblin, Rebecca. “Conservationists Intervene in Lawsuit That Aims to Take Away Polar Bear Habitat.” 20 Apr 2011. 16 May 2011.

STAKEHOLDERS' OPINIONS

Like many current environmental problems, there exists a spectrum of stakeholder positions on the contended issue of development in ANWR's 1002 Area. This spectrum exists due to groups' varying values and hopes for the Area. On the two ends of the divide are the State of Alaska and environmental groups, strongly for and strongly against ANWR development, respectively. Energy industries predominantly align with the State of Alaska, largely endorsing development, though some companies do have reservations, especially due to the recent BP Deepwater Horizon Gulf spill. Native communities also represent a large stakeholder group, and generally align closer to environmental groups, expressing great concern with ANWR development. However, Native people *also* stand to benefit economically from oil exploration, and thus remain somewhat divided on the issue. Another dimension that is significant to aspects of the ANWR debate is that of environmental justice concerns related to the disproportionate effects of ANWR development on Native communities; however, I will not address this topic significantly in this brief.

State of Alaska

Alaska's citizenry and government officials greatly support opening up ANWR for oil and gas development.¹²² Polling conducted in December 2009 by the Dittman Research Corporation shows that over 78% of Alaskans support exploration and production on the Coastal Plain of ANWR.¹²³ One fifth of our domestic oil production is extracted primarily from the Alaska National Petroleum Resource Area (see Figure 2). All Alaskan citizens receive dividend checks from the sale of this oil; 2010 dividends reached \$1,964 per resident.¹²⁴ It is clear that Alaskans have an economic stake in ANWR development. Issues have arisen over the disposition of possible revenues coming from oil extraction. In the National Petroleum Reserve-Alaska, revenue sharing is 50/50 between Congress and the State; Alaska officials promote a similar ratio of revenue sharing were ANWR to be opened up. A current proposal provides that 50% of adjusted revenues be paid to Alaska, with revenues from bonus payments going into a Renewable Energy Technology Investment Fund. However, it is also possible that Alaska could receive 90% of the revenues from ANWR, thus increasing

¹²² Arctic Power, anwr.org. "Alaska Legislature Votes for ANWR." 16 May 2011.

¹²³ Arctic Power, anwr.org. "Alaskans Strongly Support ANWR Development." 16 May 2011.

¹²⁴ McDowell Group. "ANWR and the Alaska Economy: An Economic Impact Assessment." Sept 2002. 16 May 2011

Alaskans' push for development.¹²⁵ The Alaskan congressional delegation and Legislature currently support drilling and push for quick federal approval of oil exploration efforts in the 1002 Area.

Energy Industry Position

As a primary stakeholder and representative of energy industries, the American Petroleum Institute is highly supportive of domestic oil exploration, viewing ANWR's oil reserves as a "vital national energy resource."¹²⁶ The API focuses on strengthening the nation's economy and job sectors through wider exploration of our oil and gas reserves. The API contends that development of these reserves could generate upwards of \$1.7 trillion in government revenue, provide thousands of jobs, and bolster our nation's energy security.¹²⁷ They assert that advanced technologies, such as smaller production pads, greatly reduce the environmental impacts of energy exploration in the 1002 Area, making development more feasible.¹²⁸

Arctic Power is a "grassroots" non-profit citizen's organization centered around "expediting congressional and presidential approval of oil exploration and production within the Coastal Plain of ANWR."¹²⁹ The Alaska congressional delegation, Alaska Governor Sarah Palin, and the Alaska Legislature have all endorsed Arctic Power and work closely with the organization. Arctic Power frames opening the 1002 Area for oil drilling as the best way of decreasing our imports of increasingly expensive foreign oil.¹³⁰ They also directly counter environmentalists' claims that wildlife populations would be threatened by oil exploration measures: "The fact is not one species of animal, fish, bird or plant has shown signs of, or has been reported by US Fish and Wildlife Service, the Environmental Protection Agency or the Alaska Department of Fish and Game as declining, or being harmed by oil production on the North Slope of Alaska."¹³¹ Further, the American Association of Petroleum Geologists have developed a position statement formally expressing their support of oil exploration.¹³² On the other hand, many other strict geoscientists oppose drilling on the grounds that it may have a significant negative impact on wilderness.

¹²⁵ "Arctic National Wildlife Refuge (ANWR)." *Almanac of Policy Issues*. 16 May 2011.

¹²⁶ "Policy Issues." *American Petroleum Institute*. <http://www.api.org/policy/>. 16 May 2011.

¹²⁷ "Policy Issues." *American Petroleum Institute*. <http://www.api.org/policy/>. 16 May 2011.

¹²⁸ API. "Strategic Energy Resources: ANWR, Alaska." *Exploring for America's Energy Future* (2008)

¹²⁹ Arctic Power, anwr.org. "Arctic Power." 16 May 2011.

¹³⁰ Arctic Power, anwr.org. "ANWR Wilderness Legislation Initiated in Congress." 16 May 2011.

¹³¹ Arctic Power, anwr.org. "ANWR Wilderness Legislation Initiated in Congress." 16 May 2011.

¹³² Arctic National Wildlife Refuge Update." *American Geological Institute - Government Affairs Program*. 19 Nov 2002. 16 May 2011.

¹³³Energy industries remain largely in favor of oil development in ANWR, though some continue to hold reservations (of which this brief does not address fully).

Native Tribes: Athabaskan Indians and Kaktovic Tribe

The Native American community in Alaska is deeply divided on the issue of ANWR development; there is a divide primarily between the economic incentives of drilling versus concerns surrounding the environmental impacts of development. The Alaska Inter-Tribal Council, representing 229 Native Alaskan tribes, officially opposes development in ANWR.¹³⁴ In 2005, the executive director of the steering committee for the Native Alaskan and Canadian Gwich'in tribe, speaking for a unified group of 55 Alaskan and Canadian indigenous peoples, presented that drilling in ANWR is both “a human rights issue and a basic Aboriginal human rights issue.”¹³⁵ The Gwich'in and Athabaskan peoples have been particularly outspoken in their opposition of ANWR development. Both of these groups depend on the caribou for subsistence, and are concerned by the possible impacts of development. They also view the coastal plain as sacred ground and oppose drilling as a result.¹³⁶ On the other hand, the Inupiat Eskimos in Kaktovic support on-shore drilling (though not off-shore) and oil leasing due to the economic opportunities it provides.¹³⁷ However, a recent petition in Kaktovic showed 62 people opposed ANWR drilling; this is significant when only 98 voters turned out in the last election.¹³⁸ The Kaktovic position has been used by the energy industries to demonstrate Native support for development in an attempt to hasten oil exploration approval. However, it remains that the majority of Native peoples *oppose* ANWR development.

Environmental Groups

Significant to the debate is that all recognized environmental groups in the United States oppose ANWR oil extraction and exploration. These groups reference the possible impacts on wildlife and natural ecosystems in the short-term, but also highlight that by opening ANWR the United States continues to support fossil fuel consumption, and does not demonstrate a clear commitment to

¹³³ Arctic National Wildlife Refuge Update.” *American Geological Institute - Government Affairs Program*. 19 Nov 2002. 16 May 2011.

¹³⁴ “Argument: ANWR drilling is opposed by the majority of tribes in Alaska.” *Debatepedia*. 16 May 2011.

¹³⁵ “Argument: ANWR drilling is opposed by the majority of tribes in Alaska.” *Debatepedia*. 16 May 2011.

¹³⁶ McDowell Group. “ANWR and the Alaska Economy: An Economic Impact Assessment.” Sept 2002. 16 May 2011

¹³⁷ McDowell Group. “ANWR and the Alaska Economy: An Economic Impact Assessment.” Sept 2002. 16 May 2011

¹³⁸ “Arctic National Wildlife Refuge.” *Alaska Trekker*. 16 May 2011.

shifting our energy production sources from “dirty” to “clean” and “green” renewable and alternative sources. Primary environmental groups that oppose ANWR development include the Sierra Club, Greenpeace, the NRDC, CBD, Defenders of Wildlife, Earthjustice, and others. The Sierra Club has a petition urging citizens to sign in order to “Tell the Obama administration to protect the Arctic National Wildlife Refuge,” and referencing ANWR as the “final frontier of American conservation.”¹³⁹ The NRDC calls ANWR an “American Serengeti,” and appeals to patriotic values when they claim that “conserving nature in its wild state is a core American value.” The NRDC promotes the position that the U.S. would actually get very little for their money, economically speaking, by opening the 1002 Area (due to the amount we use from foreign oil imports); once the Arctic Refuge oil actually hits the markets (about 10 years after production begins), it is projected to only account for 3% of Americans’ daily oil consumption.¹⁴⁰ Thus, by opening the 1002 Area, the government will show a lack of attention to the larger issue of meeting America’s future energy needs. The NRDC further claims that we as Americans have a duty to hand down a wild, pristine arctic to our future generations.¹⁴¹

POTENTIAL POLICY PATHWAYS

Differences in stakeholders’ positions have shaped the political landscape of the issue of oil development in ANWR; policy options related to ANWR have been shaped by political action on different alternative policy pathways that characterize the modern Green State. There exists a history of political controversy surrounding ANWR drilling, from the 1980s when ANWR was created until the present; this controversy has lead stakeholders to pursue political action on multiple pathways, including the appropriations process, administrative action, and congressional decision-making. Much of the political action during the Clinton administration with regard to ANWR occurred through the appropriations process. Specifically, in 1995 Congress attempted to authorize the opening of ANWR via the FY1996 reconciliation bill.¹⁴² However, attempts to use this alternative policy pathway for opening ANWR were retracted or vetoed by President Clinton.

¹³⁹Sierra Club. “Chill the Drills! Protect America’s Arctic.” *Sierra Club*. 16 May 2011.

¹⁴⁰Natural Resources Defense Council. “NRDC: Arctic National Wildlife Refuge: Why Trash an American Treasure for a Tiny Percentage of Our Oil Needs?” 16 May 2011.

¹⁴¹Natural Resources Defense Council. “NRDC: Arctic National Wildlife Refuge: Why Trash an American Treasure for a Tiny Percentage of Our Oil Needs?” 16 May 2011.

¹⁴²Gillis, Anne. “CRS Report for Congress: ANWR Legislative Actions Through the 110th Congress, First Session.” 10 Jan 2008. 16 May 2011.

President George W. Bush similarly pursued the appropriations process, as well as administrative action. Bush included ANWR in various proposed legislation and worked strongly to approve development. Bush included a provision in his Fiscal Year 2002 budget that would use monetary bonuses (paid by successful bidders) to explore ANWR as a means of funding research in alternative energy technology.¹⁴³ In 2001, Bush released his National Energy Policy, which included using ANWR lease bonuses to fund research in renewable and alternative fuels as well. However, his actions in both of these alternative paths were ultimately unsuccessful, and ANWR remained closed to oil extraction.

Currently, it is most likely that political action on the issue of ANWR will take place along the traditional path of Congressional decision-making. Recently, Senator Murkowski (R-AK) has introduced two bills in the U.S. Senate promoting ANWR oil exploration. The “No Surface Occupancy Bill,” which would allow the petroleum industry to use sideways directional drilling techniques to explore for oil from outside the refuge boarders, and the “American Energy Independence and Security Act of 2011,” which would allow complete exploration of the 1002 Area, while limiting surface occupancy to 2,000 acres, and providing for the use of tax revenues from production for national alternative energy development and towards a “local impact fund” for native communities and land holders.¹⁴⁴ The Obama administration is not showing support for these bills, and it is unlikely that they will pass in both the House and the Senate. Other policy decisions, such as the Endangered Species Act, could further constrain development in ANWR, for our government remains characterized largely by gridlock and intercurrence between policies. The controversy over ANWR remains an important one on the current administration’s political agenda. Strong stakeholder positions and arguments have been advanced on both sides of the divisive issue of opening ANWR’s 1002 Area for drilling and oil exploration, which have in turn shaped political action around the issue.

POLICY RECOMMENDATION

There remain strong economic and national security arguments *for* opening ANWR to development, as well as significant environmental concerns associated with development, supporting arguments *against* oil exploration in the 1002 Area. Considering the two sides of the

¹⁴³ “Arctic National Wildlife Refuge Update.” *American Geological Institute - Government Affairs Program*. 19 Nov 2002. 16 May 2011.

¹⁴⁴ “Gasoline turmoil spurs new ANWR legislation.” *Arctic Power, anwr.org*. 16 May 2011.

debate, I recommend that the 1002 Area of ANWR not be opened to oil and gas development, at least for the time being. Considering long-term environmental concerns and the long-term economic factors related to the debate, I do not believe that ANWR represents a feasible solution to substantially increasing our domestic energy security. Oil and gas exploration will likely take up to decades to achieve high-output production: “Between the highly unreliable and politically and legally challenged federal and state permitting processes, to the actual seismic work, the building of infrastructure, and the exploratory well drilling, oil and gas exploration as a long term endeavor is not suited towards the result of next week price reductions at the pump.”¹⁴⁵ Even though much of the needed infrastructure is already in place, it would still take a significant amount of time and investments to finish building what is necessary for extraction and production, as well as conduct further research on the existing reserves.

Thus, I recommend that instead of opening the 1002 Area for oil development, that our government make a strong commitment to researching and developing long-term solutions to our energy crisis and providing domestic energy security through more sustainable means. I urge the Obama administration to pursue further investments in energy conservation strategies, efficient and renewable technologies, and securing alternative “green” sources of domestic energy. Following from Obama’s State of the Union Address, I believe in coupling these measures with a focus on shifting subsidies from fossil fuel industries to renewable energy industries. I strongly encourage too that all of ANWR be preserved as an intact ecosystem by means of a Wilderness Area designation. If Wilderness designations are not pursued, ANWR should stay undeveloped; the 1002 Area’s oil reserves remain in case this source of fossil fuels becomes imperative in the future.

In light of these recommendations, it is important to frame the issue once again in the context of our current political atmosphere. It is likely that any movement on ANWR development will be included as only a component of energy production measures in a larger, more comprehensive energy bill for the U.S. As a result, ANWR will likely be used as a sort of “bargaining chip” in the political game of energy policy. If ANWR is approved for oil development, then the larger policy package will likely include many other provisions promoting alternative energy sources. This inclusion of energy production measures having environmental benefits *and* costs within the same bill adds another degree of complexity to the issue of opening ANWR for drilling, not uncommon within our political system.

¹⁴⁵ “Gasoline turmoil spurs new ANWR legislation.” *Arctic Power*, anwr.org. 16 May 2011.

Section 3

Agricultural Reform in a Climate of Agency Capture

Shilpa Idnani, *Regulating Genetically Engineered Food Organisms: Unprecedented Genetically Engineered Salmon*

Betsy Riley, *Concentrated Animal Feeding Operations: The issue of waterway reform*

Julie Vining, *FDA Labeling for Genetically Engineered Foods*

June 1, 2011

Executive Summary

The agricultural industry in the United States provides food to billions of people domestically and abroad. The products of this industry are everywhere, ranging from grains to poultry to fish. With an estimated population increase of 392 million new Americans by 2050, these industries (already the backbone of the nation) are becoming even more important as it becomes necessary to feed more and more mouths. This increasing demand has led to innovation in the industry as new technologies and methods become available that increase production while keeping costs low. And with any new, large scale change in methodology, federal and state regulations become increasingly important to regulate the effects that the changes will have on the land, the people, and the environment.

Agricultural reform, however, is a very slow process. Key stakeholders include proponents of big agriculture and public health and environmental interest groups. There is also, of course, the ultimate target interest group: the consumers. Each of these groups draws attention to its interests. Big agriculture emphasizes the need to feed a rapidly growing population and insists that its methods are not responsible for adverse pollution or health impacts. Public health and environmental interest groups argue that current conventional agricultural practices are unsustainable and unsafe. Each side lobbies for laws and regulations accordingly, leading to intense debate and slow moving reform, exacerbated by a hyper partisan Congress. This process is further impeded by intercurrence with older and overlapping laws.

In the following issue briefs, we are going to explore some of the issues that these types of challenges present in terms of regulation and environmental health. First we will look at Concentrated Animal Feeding Operations, or CAFOs, and the effects they have on the environment, as well as the strengths and weaknesses of current regulations. Next we'll focus in on one particular type of large scale animal production operation, currently on the cutting edge of food production technology—genetically modified salmon. In this section, we will discuss how biotechnology works, some of the risks associated with it, and the current debate surrounding regulations. For our final section, we will look into whether the government has the right and responsibility to keep customers informed of the production history of food, even if it doesn't noticeably change the final product.

These three case studies raise key concerns and questions about the current agricultural regulatory system. Pushing regulatory agencies forward to adapt to technology is key. In the current state of gridlock, new regulation spurring action on these issues is difficult and almost impossible as the agencies remain in the control of the industries they are supposed to be regulate. How does reliance on biotechnology and CAFOs impact the land and environment? Is human health affected? These issues highlight the need for greater transparency and stricter regulations.

Section 3.1

Agricultural Reform in a Climate of Agency Capture

Shilpa Idnani, *Regulating Genetically Engineered Food Organisms: Unprecedented Genetically Engineered Salmon*

June 1, 2011

U.S. Environmental Politics
Environmental Studies Program

Summary

Genetic Modification technology continues to advance as regulatory structures remain the same. One of the most recent developments is the creation of Genetically Engineered Salmon designed to reach market size in half the time it takes traditional aquaculture Atlantic Salmon. The production method used in Genetic Engineering is designed to introduce the beneficial traits of another fish species into the target organism. In order to test the efficacy of the cross and ensure that the GE trait passes to the new organism, the desired trait is coupled with an antibiotic resistance gene. This genetic coupling process can cause antibiotic resistance in the target organism that can spread to other organisms. Non-GE Aquaculture Salmon are treated with antibiotics on a regular basis to keep disease at bay and promote growth. In GE Salmon aquaculture, this antibiotic resistance will necessitate the use of even larger quantities of antibiotics. The bacteria exposed to these antibiotics could become resistant. If the resistant bacteria infect the humans ingesting the GE salmon, the treatment of these people will be extremely difficult.

The current regulatory structure for Genetically Modified Organisms is limited in its power and can hinder the efforts of stakeholders to limit possibly harmful GE animal production. Currently, the FDA regulates the proteins modified in order to create the GE animal. The proteins are treated like any other new drug with complete confidentiality in order to protect the creator. Thus stakeholders like the Union on Concerned Scientists and Oceana cannot bring up many of the concerns associated with aquaculture production of this GE animal as food.

The Ecosystem effects of aquaculture production are well understood, but the effects of introducing a GE organism to this production method are limited and merit further research in the form of an Environmental Impact Statement. The current Environmental Assessment is designed to explain the creation of the proteins introduced to Atlantic Salmon and to ensure the safety of the protein in human consumption. While Aqua Bounty, the Company producing the GE Salmon, has outlined a plan to ensure infertility and prevent escape into the ocean, these plans are contingent on the purchasers of the Salmon Eggs. Should the GE eggs be sold in countries with less strict regulations regarding the production of aquaculture salmon, the GE animal could decimate local populations with antibiotic resistant disease and could breed with local populations destroying the genetic diversity of the local fish population. Further research into the possible ecological effects of the transgene in wild stocks is necessary in order to ensure the viability of GE Salmon as a food

source. Ensuring the safety of this Salmon could set a precedent ensuring further regulation of any other new GE livestock animals.

ACRONYMS

FDA – Food and Drug Administration
EA – Environmental Assessment
EIS – Environmental Impact Statement
APHIS – Animal and Plant Health Inspection Service
FONSI – Finding of No Significant Impact
GE – Genetically Engineered
GM – Genetically Modified
GMO – Genetically Modified Organism
USDA – US Department of Agriculture
EPA – Environmental Protection Agency
NEPA -- National Environmental Policy Act

Introduction

Genetically Modified (GM) food has been a constant topic for debate for many individuals and countries. Producers due to inherent disease resistance, herbicide tolerance, and higher yield prefer GM foods. Crops like Round-up Ready soybeans and corn, reduce the labor required and therefore reduce prices. Disease and pest resistant crops increase yields and can reduce the amount of chemicals required in production. However, GM crops are often patent protected which creates monopolies. Regions such as the EU and South Korea remain skeptical to the benefits of GM crops and have limited their production in order to limit the power of seed producers. The US has embraced GM crops as a means to increase production and profits without increasing the price of the crop. This technology is on the cusp in meat production. Aqua Bounty Advantage is working on a Genetically Engineered Salmon designed to grow more quickly in aquaculture facilities.

Background and Current Regulatory Structure

The current regulatory structure for Genetically Modified Organisms (GMOs) is not appropriate for monitoring and regulating unprecedented technologies like Genetically Engineered animals. GMOs are regulated under the 1986 Coordinated Framework on the Regulation of Biotechnology that utilizes older legislation to regulate GMOs in only a select circumstances. The Environmental Protection Agency under the Federal Insecticide, Fungicide, and Rodenticide Act and Toxic Substances Control Act can regulate GMOs that produce pesticides to protect themselves like Bt Corn and plants that produce previously untested chemical compounds. The Food and Drug Administration under the Food, Drug, and Cosmetic Act can regulate food additive concentrations, including proteins produced after genetic modification, present in finished goods and GMO labeling regulations. Finally, the Animal and Plant Health Inspection Service (APHIS), under Federal Plant Protection Act of 2000 can prevent the creation of “GMO plant pests” or super weeds that pose the risk of destroying local ecosystems.¹

AquAdvantage Salmon are one such Genetically Engineered animal. In 1995, Aqua Bounty Technologies of Waltham, Massachusetts submitted an application for an Investigational New Animal Drug exemption from the Center for Veterinary Medicine of the US FDA in order to

¹ Belson, Neil. 2000. “US REGULATION OF AGRICULTURAL BIOTECHNOLOGY: AN OVERVIEW.” *AgBio Forum* 3(4): 268-280.

produce AquAdvantage Salmon. These salmon have been engineered to reach marketable size in a shorter period of time. Under the Federal Food, Drug, and Cosmetic Act the FDA can regulate any “article intended to alter the structure or function of the body of man or animal” including recombinant or engineered genetic material. Aqua Bounty Technologies has submitted a New Animal Drug Application in order to affirm the efficacy and safety of their transgene. As part of the New Animal Drug Application, the FDA must comply with NEPA and create an Environmental Assessment in order to ascertain the threat the genetic modification could pose if the salmon were to escape or breed with the native population. Until it is assured that fish produced through this method do not contain any harmful residues in significant quantity, and do not exhibit any differences from non-transgenic aquaculture salmon, the FDA cannot release a Finding of No Significant Impact statement (FONSI) or request that an Environmental Impact Statement (EIS) be created in order to conduct further investigation.^{2 3}

While Genetically Engineered animals have already been approved for the production of medicine, none of these animals have been approved for consumption as a food source.⁴ Genetically Engineered meat sources are unprecedented and, as such, have never been regulated. AquAdvantage Salmon is a test case that must be examined as carefully as possible, because it will serve as a precedent for any new GE meat sources. As such, if the genetic modification is approved as a drug, AquAdvantage Salmon must also have an EIS to ensure all the consequences of GE meat products are deliberated upon.

Genetically Modified vs. Genetically Engineered

Genetically Engineered foods are one subset of Genetically Modified Organisms. Even though the terms are often used interchangeably, the procedures used to produce GE food vs. GM food are different resulting in some confusion.

² Center for Veterinary Medicine. “Veterinary Medicine Advisory Committee - An overview of Atlantic salmon, its natural history, aquaculture, and genetic engineering.”

http://www.fda.gov/AdvisoryCommittees/CommitteesMeetingMaterials/VeterinaryMedicineAdvisoryCommittee/ucm222635.htm#Section_4:_Genetic_Engineering (Accessed April 5, 2011).

³ Aqua Bounty Technologies, Inc. 2010. “Environmental Assessment for AquAdvantage® Salmon: An Atlantic salmon (*Salmo salar* L.) bearing a single copy of the stably integrated α-form of the opAFP-GHc2 gene construct at the α-locus in the EO-1α line.”.

⁴ Center for Veterinary Medicine. “Genetically Engineered Animals.”

<http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/GeneticEngineering/GeneticallyEngineeredAnimals/default.htm> (Accessed May 16, 2011).

Genetic modification and engineering use two different methods to modify the characteristics of foods in ways generally beneficial to humans. The difference in production methods means different consumer risks. Genetically modified food means that previous cultivars or varieties both exhibiting favored characteristics like high yield, drought resistance, or high feed to protein conversion rates have been bred together in order to produce hybrid organisms containing the best genes of both their parents. In this way almost all foods are genetically modified, since almost all foods including vegetables, grain or stock animals have been selected for favorable characteristics. All foods farmed today have been genetically modified or bred at one point or another.⁵ ⁶

Genetic engineering is another way to select for favorable characteristics in food sources. Geneticists select organisms with favorable physical traits and then comb their genome for the specific genes that code the proteins for that trait. They use chromosomal markers to mark these genes and then search for other organisms that might all contain favorable pieces of genetic code. Once the favorable pieces of code are identified and assembled, genetic engineers breed specialized bacteria or viruses that can implant these changes into the target organism's reproductive cells. Then the animal or plant is allowed to reproduce normally and their offspring are observed and tested for the modification.⁷ ⁸

Since GE crops and animals use proteins from species other than their own, the possible allergenic and environmental impacts increases, because proteins operate synergistically with the surrounding tissues of an organism. Previously, Soybeans crossed with Brazil Nuts to increase protein quality showed one such allergenic affect. Subjects allergic to Brazil Nuts reacted unfavorably to the GE soybeans. As such, production of the new GE soybean was cancelled. The study of soybeans shows that allergic effects of one food can be transferred to another food via GE methods.⁹

In order to test for a specific modification, genetic engineers modify two pieces of genetic code: the first is the desired gene modification they wish to implant and the second is a paired

⁵ Campbell, Neil A. 2005. *Biology*. 7th ed. San Francisco: Pearson, Benjamin Cummings.

⁶ Center for Veterinary Medicine. "Veterinary Medicine Advisory Committee - An overview of Atlantic salmon, its natural history, aquaculture, and genetic engineering."

http://www.fda.gov/AdvisoryCommittees/CommitteesMeetingMaterials/VeterinaryMedicineAdvisoryCommittee/ucm222635.htm#Section_4:_Genetic_Engineering (Accessed April 5, 2011).

⁷ Ibid.

⁸ Campbell, *Biology*.

⁹ Nordlee, J A et al. 1996. "Identification of a Brazil-nut allergen in transgenic soybeans." *The New England Journal of Medicine* 334(11): 688-692.

genetic modification for resistance to a specific type of antibiotic. To test for genetic modification, engineers expose organisms to the antibiotic to determine the state of the modification. If the target organism is resistant to the antibiotic, they have also successfully incorporated the desired trait.^{10 11} Genetic coupling of selectable markers is a standard testing method that might prove problematic in the long run in GE meat products that use antibiotics in production.¹² Concerns regarding the genetic coupling will be discussed further into this brief.

Aquaculture Production of GE Salmon

World capture fishery yields for all species have stopped growing and have started to fall in over-fished populations. Salmon aquaculture was developed to meet rising demand as populations increase and global wild fisheries fail to meet this demand. Capture fishery yields have plateaued at one million metric tons while aquaculture has continued to grow. By 2009, the salmon aquaculture industry was providing 2.4 million metric tons of salmonids, valued at 11.4 billion dollars.¹³ Such a large market provides ample opportunities should Aqua Bounty succeed.

Atlantic Salmon is the most popular species for aquaculture. Prized for their docile behavior and adaptability, they are raised predominantly in Norway, Chile, Canada and Scotland due to the favorable ocean water temperatures and the abundance of waters protected from both weather and predators.^{14 15 16}

Salmon life cycles are controlled in aquaculture to minimize the amount of time necessary for growth in valuable ocean pens. Salmon eggs and sperm are collected from stunned or anaesthetized mature males and females, then bred in freshwater, and then moved to netted open-ocean penned or netted facilities when they have space for new salmon. The salmon spend anywhere from 12 to 24 months in the interior freshwater growing facilities, and then are moved to

¹⁰ Campbell, *Biology*.

¹¹ Bevan, Michael W., Richard B. Flavell, and Mary-Dell Chilton. 1983. "A chimaeric antibiotic resistance gene as a selectable marker for plant cell transformation." *Nature* 304(5922): 184-187.

¹² "Risks of Genetic Engineering | Union of Concerned Scientists."

http://www.ucsusa.org/food_and_agriculture/science_and_impacts/impacts_genetic_engineering/risks-of-genetic-engineering.html (Accessed April 5, 2011).

¹³ "FAO Fisheries & Aquaculture - Global Statistical Collections." <http://www.fao.org/fishery/topic/16140/en> (Accessed May 15, 2011).

¹⁴ Ibid.

¹⁵ Pollack, Andrew. 2010. "Genetically Altered Salmon Set to Move Closer to Your Table." *The New York Times*. http://www.nytimes.com/2010/06/26/business/26salmon.html?_r=2&pagewanted=all (Accessed April 4, 2011).

¹⁶ "Online Extra: Salmon That Grow Up Fast." http://www.businessweek.com/magazine/content/06_03/b3967111.htm (Accessed April 4, 2011).

open-ocean facilities for the final 12 to 18 months of their life. AquAdvantage Salmon is designed to further minimize the time required.^{17 18}

If the GE salmon can reduce the cultivation time, it can reduce the associated food costs tremendously. The diet the Salmon are fed changes depending on the salmon's life stage and the amount of time before they are to reach market. Salmon are fed pellets containing fishmeal, soybean meal, corn meal, and feather meal. Farm raised salmon are usually deficient in many of the carotenoids and oils necessary to produce the vibrant orange color and Omega-3s of their wild counterparts. Salmon do not produce the Omega-3s themselves, but collect them over their lifetime from their food. In order to combat these deficiencies, fish-food pellets contain supplemental carotenoids like beta-carotene and additional oils. The type oil used in production can affect the flavor of the fish. Initially, aquaculture producers use vegetable oils like canola and soybean. In order to prevent the flavor transfer of these inferior oils, for the last twelve months of their life salmon are fed a diet containing supplemental fish oil. Currently, about 66 percent of the global fish oil production is used in salmon farming operations. Aquaculture Salmon production is resource intensive and expensive.¹⁹

Salmon farms are densely populated facilities with thousands of salmon living in extremely close proximity to one another. Like the modern CAFO, aquaculture salmon populations face large disease and parasite problems and create tremendous amounts of wastes. In some operations, antibiotics are mixed into feed in order to prevent illness and promote growth. Some aquaculture operations also use anti-foulants designed to clear the water of excess food or fecal matter. However, unlike the CAFO, where fecal matter and other wastes are removed to sludge ponds for storage, salmon aquaculture takes advantage of their open-ocean locations. The wastes, rich in nitrogen and other nutrients, usually leave the containment areas and end up on the seafloor and in the water. GE salmon can reduce the population density and impact of this industry by reducing the number of fish a producer must keep at any given time.^{20 21}

¹⁷ "Aquaculture of salmon - Wikipedia, the free encyclopedia."

http://en.wikipedia.org/wiki/Aquaculture_of_salmon#cite_note-45 (Accessed April 4, 2011).

¹⁸ (Aqua Bounty Technologies, Inc. 2010)

¹⁹ Bell, J.G. et al. 2010. "Growth, flesh adiposity and fatty acid composition of Atlantic salmon (*Salmo salar*) families with contrasting flesh adiposity: Effects of replacement of dietary fish oil with vegetable oils." *Aquaculture* 306(1-4): 225-232.

²⁰ "Risks of Genetic Engineering | Union of Concerned Scientists."

http://www.ucsusa.org/food_and_agriculture/science_and_impacts/impacts_genetic_engineering/risks-of-genetic-engineering.html (Accessed April 4, 2011).

²¹ "WWF - Aquaculture - Salmon." <http://www.worldwildlife.org/what/globalmarkets/aquaculture/dialogues-salmon.html> (Accessed May 16, 2011).

The first GE food animal, AquAdvantage salmon, is genetically engineered Atlantic salmon modified to reduce the length of time it takes for the fish to reach market size during development. Salmon are highly sensitive to temperature and sunlight as they grow. If the water temperature falls too low, eat less food, which in turn reduces metabolic activity. Sunlight also modifies the salmon growth patterns. Without adequate sunlight, salmon stop producing the growth hormones that help them reach market size.^{22 23} Current non-GE Aquaculture Atlantic salmon reach market size in three years due to temperature and sunlight variation. AqaAdavantage salmon have been modified to produce their growth hormones all year long in unfavorable temperatures cutting production from three years to eighteen months.²⁴ Reducing the production time can reduce the environmental and economic effects of salmon production.

Atlantic Salmon has been crossed with the genes of two species to accomplish this goal: the Pacific Chinook salmon and the Ocean Pout. The Pacific Chinook salmon produces larger amounts of growth hormones and produces them all year round as opposed to seasonally, like the Atlantic salmon. If farmed, Chinook Salmon can reach market size in less time than Atlantic Salmon, however they are much harder to contain, which can render Chinook aquaculture unpractical in some situations.^{25 26}

The Ocean Pout gene modifies temperature sensitivity. Atlantic salmon feed only in a specific temperature range. Water temperatures below .5 degree above 27 degrees Celsius for periods of time over a week in length are fatal for Salmon. Optimum growth occurs only between 6 and 22.5 degrees Celsius.²⁷ Controlling this response, would make salmon farming more efficient as the salmon would continue to feed and grow even in temperature too cold for the traditional Atlantic breed. The Ocean Pout is a bottom dwelling fish, similar in shape to an eel, which produces proteins that work as anti-freeze in the blood stream. This allows them to survive in the extremely cold ocean waters of the Northern Atlantic and Arctic ocean. The GE salmon would create these

²² Wood, Chris M., and D. Gordon McDonald. 1997. *Global warming: implications for freshwater and marine fish*. Cambridge University Press.

²³ BRETT, JOHN R. 1971. "Energetic Responses of Salmon to Temperature. A Study of Some Thermal Relations in the Physiology and Freshwater Ecology of Sockeye Salmon (*Oncorhynchus nerka*)."*American Zoologist* 11(1): 99 -113.

²⁴ (Aqua Bounty Technologies, Inc. 2010)

²⁵ Knapp, Gunnar. 2007. *The great salmon run : competition between wild and farmed salmon*. Washington DC: TRAFFIC North America.

²⁶ (Aqua Bounty Technologies, Inc. 2010)

²⁷ "Water Temperature and Gulf of Maine Atlantic Salmon."

http://www.krisweb.com/krissheepscot/krisdb/html/krisweb/stream/temperature_sheepscot.htm (Accessed May 14, 2011).

proteins in their blood stream enabling them to be grown all-year round in current aquaculture facilities without the temperature limitations aquaculture producers currently face.^{28 29}

Aqua Bounty Technologies is working alone to promote their temperature tolerant Salmon. Funded primarily through private investors, this company has created, what it believes, to be an almost foolproof system for keeping its salmon from many of the pitfalls that other GE crops are prone. Since GE meat is unprecedent in food markets, its goal is to convince consumers and legislative bodies that transgenic meat is a safe and useful technique in modern meat production as opposed to an ecologically disruptive and destructive one.^{30 31}

Keeping reproduction opportunities to a minimum is a priority for AquAdvantage. To reduce the possibility of mixing between wild populations of Salmon and AquAdvantage fish, the GE fish have been made sterile in a few different ways. Wild Salmon are diploid: they have two sets of identical chromosomes containing their genetic material. Aqua Bounty has pressure treated all eggs for aquaculture production to induce triploidy, three sets of identical chromosomes, in their eggs. Since the species is diploid in nature, the triploid reproductive cells will be unviable as breeding stock and the eggs of these fish will not hatch. This is not a perfect solution, because only 99 percent of the eggs end up being triploid in nature.^{32 33}

In the wild, females usually can produce only one set of eggs during spawning before they die or return to the sea. Males can usually fertilize anywhere from one to three sets of eggs. To keep reproductive opportunities to a minimum, all AquAdvantage salmon, in the lab and for sale, are female. Aqua Bounty creates female eggs for sale by hormonally inducing a genotypic female with male hormones over the course of their entire lives so that they produce male sex organs. These “neomales” can then mate with another female to produce 100 percent female eggs.^{34 35 36} Since there are no genotypic males produced reproduction is limited.

Escape hazards have also pose a threat to aquaculture. To prevent the GE salmon from escaping containment, Aqua Bounty has proposed a two-step production process. GE salmon eggs will be produced in a facility on Prince Edward Island in Canada and then raised in an area such that

²⁸ (Aqua Bounty Technologies, Inc. 2010)

²⁹ (Aqua Bounty Technologies, Inc. 2010)

³⁰ “AquAdvantage Fish.” <http://www.aquabounty.com/products/aquadvantage-295.aspx> (Accessed April 4, 2011).

³¹ (Aqua Bounty Technologies, Inc. 2010)

³² “AquAdvantage Fish.” <http://www.aquabounty.com/products/aquadvantage-295.aspx> (Accessed April 4, 2011).

³³ (Aqua Bounty Technologies, Inc. 2010)

³⁴ “AquAdvantage Fish.” <http://www.aquabounty.com/products/aquadvantage-295.aspx> (Accessed April 4, 2011).

³⁵ (Aqua Bounty Technologies, Inc. 2010)

³⁶ “Salmon: Reproduction.” <http://www.marinebio.net/marinescience/05nekton/sarepro.htm> (Accessed April 4, 2011).

any escaping fish fry will be subject to water salinity beyond tolerable limits. Any escapees would die before they can reach freshwater and grow to any appropriate size.^{37 38 39} Before the fish can grow large enough to survive in salt water, they will be transferred to an indoor growing facility in Panama. In Panama, the fish will be contained both physically using barriers, mainly nets and filtration systems and chemical barriers such as using chlorine on escapees. If the fish manage to escape to ocean waters, the waters around Panama are far too warm for the fish to survive longer than seven days.^{40 41}

Aqua Bounty has worked hard to make their product as safe as possible, in part to convince the public that GE food is safe, and to turn a profit. Currently, its only source of funding is private investment into the firm. It is about 5.5 million dollars in debt and unless AquAdvantage salmon becomes the industry norm, the company might not be able to escape that debt.⁴²

Aquaculture has become an increasingly large part of salmon production and GE salmon can further improve production values. Aquaculture salmon has been growing steadily over the last 30 years from 25% of total production to 69% of total salmon production. The industry's worth has grown from 8.5 hundred million in 1983 to \$11.4 billion dollars in 2008. Since Non-GE salmon reach market size in approximately 3 years, while AquAdvantage Salmon reach marketable weight in a mere 18 months, salmon yields from a typical aquaculture production facility would double should GE salmon be approved for general aquaculture production.⁴³

Stakeholders' Concerns

AquAdvantage salmon lies at the meeting point of two different practices both opposed by many environmental groups. Most groups oppose either Genetic Engineering of food sources or aquaculture and, as such, object to both parts of Aqua Bounty's salmon production model and the management of the GE Salmon.

Oceana, the Union for Concerned Scientists and Greenpeace object to the regulatory pathway the GE salmon is on despite the fact that the Coordinated Framework on the Regulation of Genetically Modified Organism forces the Aqua Bounty to apply for permits through the FDA, if

³⁷ "AquAdvantage Fish." <http://www.aquabounty.com/products/aquadvantage-295.aspx> (Accessed April 4, 2011).

³⁸ (Aqua Bounty Technologies, Inc. 2010)

³⁹ "Salmon: Reproduction." <http://www.marinebio.net/marinescience/05nekton/sarepro.htm> (Accessed April 4, 2011).

⁴⁰ "AquAdvantage Fish." <http://www.aquabounty.com/products/aquadvantage-295.aspx> (Accessed April 4, 2011).

⁴¹ (Aqua Bounty Technologies, Inc. 2010)

⁴² "Online Extra: Salmon That Grow Up Fast."

http://www.businessweek.com/magazine/content/06_03/b3967111.htm (Accessed April 4, 2011).

⁴³ ("FAO Fisheries & Aquaculture - Global Statistical Collections" n.d.)

the company wants permission to produce and market the fish commercially as part of the US Food supply. Since the genetic modification is technically an animal drug as defined by the Federal Food, Drug, and Cosmetic Act, the FDA treats it as a confidential manner. There is no release of the specifics allowed until the results are released from the Center for Veterinary Medicine, which could be available as early November 2011. Despite the legality of this procedure, groups like Oceana, the Union for Concerned Scientists and Greenpeace feel like this process is not thorough enough to determine all the consequences of GE meat. Given the confidential approval process, opponents of the GE fish feel that they were not given sufficient input to comment on the amount of information released and would like a complete EIS on GE salmon.^{44 45}

Some of the general concerns of environmental groups raise include the large amount of chemicals use, the concentrated waste streams entering ocean waters, and the possible reduction in biodiversity should GE fish escape. Oceana is one group especially concerned with the damage caused to ecological systems that contain one or more aquaculture facilities. If indoor aquaculture of transgenic salmon proves to be successful and marketable, then regular aquaculture facilities in dominant producer nations of Chile, Norway, and Canada could be host to these new GE salmon.⁴⁶

⁴⁷ Another concern voiced by environmentalists and opponents to aquaculture consists of the unusually large amounts of chemicals to prevent the spread of disease and help fish stocks grow larger. Some common chemicals include antibiotics, parasiticides, pesticides, growth hormones, anesthetics and dyes. The net pen structure of most operations offers no resistance or containment of these chemicals so operators have to use large quantities in feed or in the water in order to observe their desired effects. Species in the surrounding waters and on the sea floor are exposed to these chemicals, which destroy the local flora and fauna.⁴⁸

Another threat to the local ecology is the waste generated by these facilities. Farming large predators like salmon creates large streams of nitrogen wastes which can create dead zones and eutrophic environments similar to those observed in the Gulf of Mexico due to agricultural run-off. Salmon farms holding 3.5 million fish produce as much waste as 169 thousand people. Since

⁴⁴ Pollack, Andrew. 2010. "Genetically Altered Salmon Set to Move Closer to Your Table." *The New York Times*. http://www.nytimes.com/2010/06/26/business/26salmon.html?_r=2&pagewanted=all (Accessed April 4, 2011).

⁴⁵ See Appendix I

⁴⁶ Pollack, Andrew. 2010.

⁴⁷ "Online Extra: Salmon That Grow Up Fast."

http://www.businessweek.com/magazine/content/06_03/b3967111.htm (Accessed April 4, 2011).

⁴⁸ "Nutrient and Chemical Pollution." <http://na.oceana.org/en/our-work/stop-ocean-pollution/aquaculture/learn-act/nutrient-and-chemical-pollution> (Accessed April 5, 2011).

AquAdvantage salmon consume more feed in shorter periods of time in order to reach their adult size, waste streams from these facilities could be even larger than traditional aquaculture. Often this waste collects below the facilities themselves and destroys the sea floor environments below the pens.⁴⁹

While the two previous problems can be remediated if the operation is shut down and the area is left alone to allow for recovery time, if a specially bred aquaculture salmon does escape confinement, as many are apt to do, local salmon populations could disappear as the new species displaces native populations. In Chile it is estimated that 10 million Atlantic Salmon escape into the Pacific Ocean each year. These fish escape during storms or predator attacks that damage their containment nets. They compete for food and reproductive space with the wild populations and eventually, due to sheer numbers, could replace wild salmon populations with a much less genetically diverse population.⁵⁰

The final issues environmentalists from the Union of Concerned Scientists have with GE food sources are the antibiotic resistance that is bred into the fish during the engineering process and the potential for new allergens to enter the food supply. If a food containing antibiotic resistant proteins is consumed at the same time as an antibiotic for human illness, portions of the antibiotic could be rendered useless by the proteins in the food. These proteins can build up in the body for short periods of time rendering some antibiotic treatments ineffective. The transgenic food could also transfer DNA to pathogenic populations creating bacteria resistant to antibiotics.⁵¹

Some of the consequences of aquaculture production of seafood can be remediated in the future. However, the risks posed by Antibiotic resistance are multiplied when put into the context of GE animals as opposed to crops. Since the animals are themselves fed antibiotic laden feed, antibiotic resistant bacteria could develop in the animals and then infect humans through uncooked dishes like sushi and ceviche. When faced with risks that have no solution, fixing the consequences is often times impossible, and can outweigh the benefits of this type of production.

Recommendation on AquAdvantage Salmon

⁴⁹ “Nutrient and Chemical Pollution.” <http://na.oceana.org/en/our-work/stop-ocean-pollution/aquaculture/learn-act/nutrient-and-chemical-pollution> (Accessed April 5, 2011).

⁵⁰ “Farmed Salmon Escapes.” <http://na.oceana.org/en/our-work/protect-marine-wildlife/salmon/learn-act/farmed-salmon-escapes> (Accessed April 5, 2011).

⁵¹ (“Risks of Genetic Engineering | Union of Concerned Scientists” n.d.)

Minimizing the possible health and environmental risks from GE salmon will require a stronger regulatory framework designed specifically for GE livestock animals. Since the regulatory structure is not designed to regulate GE livestock animals, the problems associated with their production can compound themselves. The transgene presented in the EA is regulated as a drug and the limited data available to stakeholders on production methods and locations for productions is not sufficient to draw complete conclusions on the ecological effects GE Salmon. Since the gene is regulated as a drug and treated as such in the Environmental Assessment, the environmental concerns are not taken into account, including those concerns surrounding the aquaculture method.

If produced in accordance with the guidelines enumerated in the EA, AquAdvantage Salmon could be a viable solution to the rising seafood prices as wild supplies continue to fall. They require 35 percent less feed than traditional aquaculture salmon and require less time in saltwater feeding pens allowing producers to use less resources per fish.⁵² However, the EA does not take into account any of the allergenic effects that the proteins may cause. Despite the fact that all salmon are bled out prior to preparation for sale, hypothetically if any of the anti-freeze proteins remain in the meat of the fish, any consumers sensitive to the protein could experience deadly allergic reactions similar to the subjects exposed to the Brazil Nut – Soybean cross.

In the EA, Aqua Bounty focused mainly on ensuring that the transgenes were identical in all samples and ensuring that the production as enumerated could be safe. However, countries such as Panama, (where they plan to have their indoor facilities), and Chile do not have the same regulations for GE foods as the USA. Countries, like Chile and Panama, with less strict regulations could decide to produce this fish outside of the regulated indoor facilities in traditional aquaculture operations. If this happens, than the EA is useless for determining the potential for ecological damage the GE salmon could cause. Yet if the fish is approved in a limited capacity and then sold to countries without our regulatory structure, the processed GE salmon will be produced in a manner not as ecologically safe and could be sold to countries other than the US for profit despite the environmental damage this would cause.

In addition, Aqua Bounty has not considered the complication of genetic coupling of antibiotic resistance in the GE process. Most producers of aquaculture salmon use low-level broad-spectrum antibiotics in feed to treat their stocks for illness and aid in growth.⁵³ These AquAdvantage Salmon are already resistant to some low-level antibiotics, thus producers are going

⁵² (Aqua Bounty Technologies, Inc. 2010)

⁵³ (“Risks of Genetic Engineering | Union of Concerned Scientists” n.d.)

to be forced to use more expensive and powerful antibiotics than the industry standard. If the pathogens develop resistance to these higher-level broad-spectrum antibiotics, they could decimate wild salmon stocks and other aquaculture operations.⁵⁴ Since the salmon are a food source, if any of the salmon stocks bear a superbug or resistant infection it could be passed on directly to a wide human population totally unwary to the bacteria's resistance, further complicating treatment of infection.

AquAdvantage Salmon, while a worthwhile pursuit of more ecologically friendly salmon, has plausible situations in which the production process could be compromised. Unless a more thorough investigation into the human, ecological, and pathological consequences is completed, this product remains potentially unsafe. Even if the data passed over to the FDA is sufficient to guarantee the safety of the genes and proteins used, the EA is insufficient in its current form because it does not take into account the broader safety issues of the production of GE meat. An Environmental Impact Statement, at the very least, will be necessary to determine the safety of this food for consumers.

If no Environmental Impact Statement is completed, GE meat products will be free to enter the marketplace uncontested in the future. The regulation of GE Salmon could set a precedent for the treatment of other GE meat animals. This could flood the market with GE animals whose impacts have not been adequately studied. Each species poses its own risks to an ecosystem. While Aqua Bounty is trying to minimize these risks, regulation of GE meat products should be put into place to keep up with new technology.

⁵⁴ See Appendix

Appendix

November 8, 2010

Commissioner Margaret Hamburg, M.D.
U.S. Food and Drug Administration
10903 New Hampshire Avenue
Silver Spring, MD 20993

Cc: Secretary Kathleen Sebelius, U.S. Department of Health and Human Services
Dr. Jane Lubchenco, Administrator, National Oceanic and Atmospheric Administration
Rowan W. Gould, Acting Director, U.S. Fish and Wildlife Service

Dear Commissioner Hamburg:

On behalf of our millions of members and activists, we are writing to urge the U.S. Food and Drug Administration (FDA) to fully assess the impacts of genetically engineered (GE) Atlantic salmon before acting on AquaBounty Technologies' application for the first ever approval of a GE animal for human consumption. Currently, the only environmental analysis before FDA consists of an environmental assessment prepared by AquaBounty that sidesteps the weighty issues FDA must address. We ask that FDA conduct a full environmental impact statement (EIS) and consult with NOAA Fisheries on the impacts on wild Atlantic salmon which have been listed as an Endangered Species since 2000. This EIS must evaluate a realistic range of potential production scenarios for this fish given the company's clear intention to expand production well beyond the scenarios proposed in the current application. Only then will FDA have the information it needs to decide whether to approve or deny AquaBounty's application. We anticipate that a comprehensive EIS will show that AquaAdvantage salmon pose a threat to wild salmon populations and the health of marine and freshwater ecosystems around the world.

GE salmon could pose serious threats to biodiversity and, in particular, to the viability of wild Atlantic salmon should they escape from production facilities. We already have extensive experience with salmon escaping from aquaculture facilities, interbreeding with wild salmon, and diminishing the fitness of the wild populations. In fact, Atlantic salmon were placed on the endangered species list, in part, due to genetic and fitness impairments caused by inbreeding with farmed salmon escaping from net pens.ⁱ If salmon genetically engineered to grow faster than wild fish escape confinement, they will threaten the health and survival of wild salmon populations. According to research from Purdue University, if just 60 GE fish were released into a wild population of 60,000, the wild population could be extinct within forty generations. This result is driven by the "Trojan gene effect" in which specific fitness advantages in an otherwise less fit organism result in gene spread and an ultimate weakening and eventual collapse of the species.ⁱⁱ Similarly, another study published by the Canadian government in 2004 has shown that natural and GE salmon located together in the laboratory under conditions of low food availability lead to population collapse and eventual extinction of the entire study population because GE salmon are more aggressive and sometimes resort to cannibalism.ⁱⁱⁱ The effect that hungry and aggressive GE salmon could have on natural ecosystems and local food chains in the wild has not been studied; these types of deleterious effects must be fully considered before GE salmon are approved for sale in the United States.

While steps can be taken to reduce the risks that fertile salmon will escape, these risks cannot be eliminated. For example, AquaBounty proposes to sterilize the salmon eggs before shipment to Panama to be reared in the grow-out tanks, but its own data show their sterilization techniques to induce triploidy are not effective in up to 5% of all eggs treated. Additionally, the company must rely on fertile male and female GE fish to produce eggs in their production facility in Canada. While the application before the FDA only considers growth in these land-based facilities, the global aquaculture industry is dominated by cage culture in open ocean environments. Hundreds of thousands of salmon escape from these aquaculture facilities every year.^{iv} No land-based infrastructure currently exists to accommodate the 15 million eggs for which AquaBounty claims to have orders;^v meaning upwards of 750,000 fertile, genetically engineered salmon could escape from cage culture systems as the farming of GE salmon proliferates. Escaped fish will compete for food and mates with wild populations. Because GE fish may also be more susceptible to diseases and parasites,^{vi} this will increase the likelihood that sick fish, parasites, and pathogens will enter local waterways and infect native fish populations.

Since this is the first application for GE salmon, the FDA should conduct a comprehensive environmental impact statement that goes far beyond what AquaBounty has prepared in support of its application. AquaBounty limits its assessment to its proposed operations in Canada and Panama. At the same time, the company has revealed plans to expand operations to the U.S. FDA should assess the extent to which a successful GE salmon operation might lead to the proliferation of such facilities and the overall risks of escaping GE salmon if the U.S. pursues this path. This type of comprehensive analysis ahead of development is imperative since the FDA can extend an original drug approval to cover new manufacturing facilities with little or truncated public process and environmental review.^{vii}

Given this range of concerns, the FDA must not rush the approval process for AquAdvantage salmon. How FDA approaches this first request for approval of a GE animal for mass production and human consumption will set a precedent for future GE animal applications, including both fish and land animals. The risks to the viability of wild Atlantic salmon and biodiversity are too great to proceed without full identification and mitigation of genetic and environmental risks.

Sincerely,

Rebecca Wodder
President
American Rivers

Carroll Muffett
President & CEO
Center for Int'l Environmental Law

Bob Wendelgass
Executive Director
Clean Water Action

Trip Van Noppen
President
Earthjustice

Margie Alt
Executive Director
Environment America

Erich Pica
President
Friends of the Earth

Phil Radford
Executive Director
Greenpeace

Andrew Sharpless
CEO
Oceana

Vikki Spruill
President & CEO
Ocean Conservancy

Josh Reichert
Managing Director
Pew Environment Group

Michael Brune
Executive Director
Sierra Club

Kevin Knobloch
President
Union of Concerned Scientists

ⁱ McGinnity, P., P. Prodöhl, A. Ferguson, R. Hynes, N. O Maoiléidigh, N. Baker, D. Cotter, B. O'Hea, D. Cooke, G. Rogan, J. Taggart & T. Cross. 2003. Fitness reduction and potential extinction of wild populations of Atlantic salmon, *Salmo salar*, as a result of interactions with escaped farm salmon. *Proceedings of the Royal Society B: Biological Sciences* 270(1532): 2443–2450.

ⁱⁱ Howard, R.D., J.A. DeWoody & W.M. Muir. 2004. Transgenic Male Mating Advantage Provides Opportunity for Trojan Gene Effect in a Fish. *Proceedings of the National Academy of Sciences* 101:9.

ⁱⁱⁱ Devlin, R.H., M. D'Andrade, M. Uh & C.A. Biagi. 2004. Population effects of growth hormone transgenic coho salmon depend on food availability and genotype by environment interactions. *Proceedings of the National Academy of Sciences* 101:9303–9308.

^{iv} Committee on the Biological Confinement of Genetically Engineered Organisms, National Research Council. Biological Confinement of Genetically Engineered Organisms. Rep. National Academies, 2004. Page 35.

^v Kaufman, M. "Frankenfish" or Tomorrow's Dinner? Biotech Salmon Face a Current of Environmental Worry." *Washington Post* 17 Oct. 2000.

^{vi} McKie, R. 2010. "Why the Case for GM Salmon Is Still Hard to Stomach." Latest News, Comment and Reviews from the Guardian. *The Guardian* (27 Aug.). Online: <http://www.guardian.co.uk/environment/cif-green/2010/aug/27/gm-fish-meat-environment>.

^{vii} 21 U.S.C. § 356a(c); 21 C.F.R. § 514.8(b)(3).

Section 3.2

Agricultural Reform in a Climate of Agency Capture

Betsy Riley, *Concentrated Animal Feeding Operations: The issue of waterway reform*

June 1, 2011

U.S. Environmental Politics
Environmental Studies Program

Summary

Able to contain over 125,000 animals in a single location (and sometimes reaching numbers into the millions), the Concentrated Animal Feeding Operations in the United States produces over half of the country's animal products, despite accounting for only 5% of total animal production operations. These CAFOs generate billions of dollars in revenue every year and provide millions of jobs by providing work onsite, as well as contracting out to local businesses around the country. They also provide a much demanded resource in the American economy: meat, a rapidly growing business in the United States and around the world.

Such huge companies produce huge amounts of waste. Estimates on the amount of animal manure and waste products range from 300,000 to 500,000 tons annually, producing not only an enormous problem of space, but issues of health, as the waste contaminates the surrounding water supplies and gets into the drinking water. As companies struggle to find something to do with the manure, the EPA and environmentalists are working to keep the waste out of the water. Apart from a brief revision of the Clean Water Act in 1976, however, very little headway was made on the issue of CAFO regulation since the original law was passed in 1974. Finally, in 2003, the EPA put forth a new rule on the subject, calling for more operations to be considered CAFOs, and increased regulations on the ones that already fell under the title. After a court battle over the new regulations, the EPA put forth its final rule in 2008, which has yet to be overturned.

The renewal of administrative efforts has sparked controversy among environmentalists and the CAFO industry. The environmentalists, emboldened by any political movement on the CAFO front, sued the EPA for stricter regulations, asking for better control technology, better regulation of storm water, and an increase in the number of facilities qualifying as CAFOs. The CAFO industry, in contrast, believes that some types of effluent, such as stormwater runoff, fall outside EPA jurisdiction. In addition, they argue that EPA guidelines are too strict, creating unnecessary paperwork for CAFOs that have no discharge, and requiring regulations on a system that some consider better for the overall environment than the pasture fed counterparts.

With little funding, and even less since the 2011 budget cuts, the EPA is unlikely to make serious headway in terms of increases in regulation in the immediate future. In the final recommendation, a proposal is put forth to increase non-governmental funds for CAFO regulation that wouldn't be reliant on a government budget, including strict fines for operating without a permit, and creating a CAFO specific state loan program like that developed for non-point sources.

Introduction

Concentrated Animal Feeding Operations, or CAFOs, are enormous confined animal facilities that generate enormous amounts of meat in a relatively small amount of space. The types of animals they contain include cattle, swine, turkeys, chickens, fish, and more. CAFOs comprise only 5% of feeding operations in the United States, and yet account for half the production of U.S. food animals. They also account for approximately 65% of manure produced in feeding operations, or around 300,000 tons annually—more than twice the amount produced in the same time by the entire U.S. human population.⁵⁵

Such large-scale operations have sparked arguments about antibiotic resistance, the human health impacts associated with hormone use, air pollution, animal cruelty concerns, and climate change concerns associated with the methane gas created during cattle production. One of the most pressing issues facing the EPA today, however, is the environmental and health risks associated with water pollution, caused by the contamination of local waterways by the huge, concentrated amounts of manure. Unable to cost effectively move the animal waste large distances, CAFOs will attempt to use the largest quantity they can in the immediate area as fertilizers, leading to oversaturation of the surrounding fields and extensive runoff. This contamination can cause an excess of chemicals and pathogens in what will later become drinking water, as well as eutrophication in lakes and ponds.

This issue brief will review current legislation and litigation surrounding CAFOs and look at the social, economic, and environmental consequences of CAFOs as they currently stand, and as they may be regulated in the future. Finally, it will provide a recommendation for what direction CAFO regulation should move in the future.

What is and isn't a CAFO

Before it's possible to understand the arguments for and against CAFO regulation, it's necessary to first understand the politics and science between what does and does not fall into the category of a Concentrated Animal Feeding Operation. The EPA differentiates between CAFOs and

⁵⁵ Gurian-Sherman, D. "CAFOs Uncovered: The Untold Costs of Confined Animal Feeding Operations: Executive Summary." Union of Concerned Scientists. April 2008. Pg. 2.

AFOs—the difference being over the word “concentrated.” In order to be a CAFO, agricultural operations must both meet the definition of an AFO, and meet additional size criteria.⁵⁶

According to the EPA, an AFO has two specific requirements: first, that the facility confine animals for at least 45 days in a 12-month period, and, second, that the area of confinement not contain any grass or other vegetation during the normal growing period. Once the feeding operation meets the requirements of an AFO, it must meet size-based requirements to be classified a CAFO. The EPA divides CAFOs into three categories: large, medium, and small. These categories are based on multiple factors, including the species of animal, use of animal, type of facility, and, in the case of small CAFOs, pollution emitted. Large CAFOs are designated based on the numbers of animals alone, with the EPA deciding that at a certain number of animals, pollution regulation is necessary regardless of waste handling methods. Medium CAFOs are determined by the number of animals, as well as discharge methods, and small CAFOs are defined as simply having fewer animals than medium CAFOs. These small CAFOs are only designated as such on a case-by-case basis which looks at pollutants being emitted. To better understand number requirements and size, consider that a large cattle CAFO must contain at least 1,000 head of cattle, due to the amount of manure produced per animal. In contrast, a large chicken operation will have a minimum of 125,000 chickens on site, due to smaller quantities of waste per animal and the relative ease of controlling chicken waste in large facilities.⁵⁷

The number of CAFOs in the United States exceeds 19,000.⁵⁸ Figure 1 above shows the concentration of CAFOs in the United States. CAFO type varies by geographic region, with cattle concentrations in Kansas, Nebraska, and the Texas panhandle, dairy operations in southern California and Arizona, and swine operations in Iowa, Illinois, Minnesota and Indiana.

⁵⁶ Environmental Protection Agency (EPA). “What is a CAFO?” Updated April 15, 2011. EPA Website. Electronic Source: <http://www.epa.gov/region7/water/cafo/index.htm>.

⁵⁷ EPA. “Regulatory Definitions of Large CAFOs, Medium CAFO, and Small CAFOs.” EPA Website. Electronic Source: http://www.epa.gov/npdes/pubs/sector_table.pdf.

⁵⁸ EPA, “NPDES CAFO Rule Implementation Status—National Summary, Third Quarter 2010,” Program Status Reports, September 30, 2010.

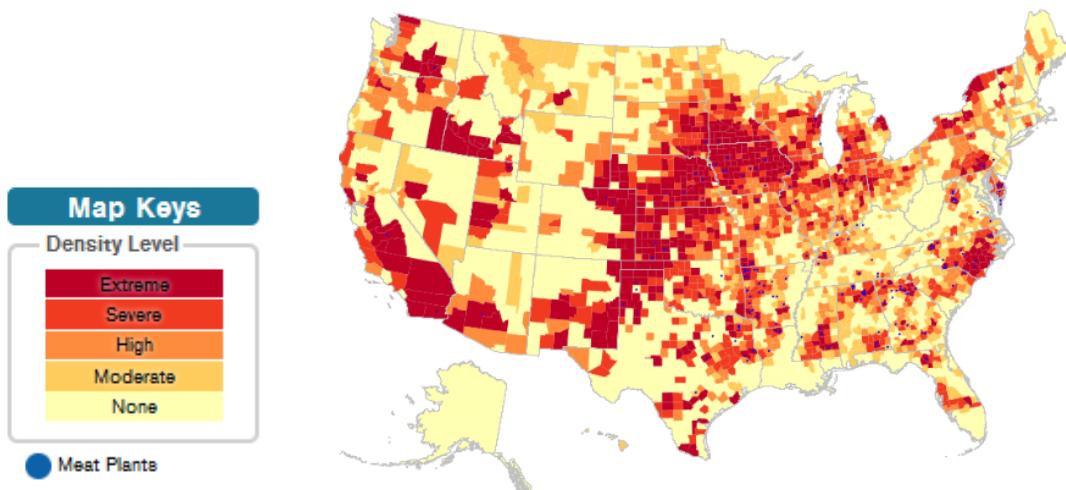


Figure 1: Concentrations of cattle, dairy, swine, broilers, and layers by county. Source: Food and Water Watch. Factory Farm Map. 2007 data. Electronic Source: <http://www.factoryfarmmap.org/>.

What's coming out of CAFOs?

Approximately 300 million tons of manure are generated annually from factory farms in the United States.⁵⁹ Depending on the content and size of the CAFO in question, emission quantity and content can vary dramatically from farm to farm. These contaminants come mainly as a result of the bodily waste produced by a large number of animals in a relatively small area. This waste is high in nutrients, such as phosphorus and nitrogen, but can contain other pollutants such as pathogens, ammonia, hormones, organic matter, sediments and heavy metals. Huge bins of this waste may be kept untreated at feedlots for up to six months before being reused in the form of fertilizers in agricultural fields. This effluent can pollute the waterways through storage container overflows, evaporation and then precipitation, spills and accidental discharge, and mostly importantly, though spreading the waste on fields as agricultural fertilizer, when it is applied in too large a quantity.⁶⁰

There's no doubt that contamination is happening. Extensive studies have been published detailing the sorts of things found in waterways near CAFOs—such as high levels of pharmaceuticals and, albeit less consistently, steroids in groundwater under swine and cattle facilities,⁶¹ unusual levels of antibiotic resistant bacteria downstream from swine CAFO,⁶² as well as

⁵⁹ Gurian-Sherman, 2008, pg. 2.

⁶⁰ United States Court of Appeals for the Second Circuit, *Waterkeeper Alliance et al. vs. EPA*, 399 F. 3d 486. 12/19/2005, pg. 9.

⁶¹ Bartelt-Hunt, Shannon, Snow, Daniel D., Damon-Powell, Teyona, Miesbach, David. 2011. Occurrence of steroid hormones and antibiotics in shallow groundwater impacted by livestock waste control facilities. *Journal of Contaminant Hydrology*, 123: 94-103.

high levels of estrogen in lagoons downstream from beef, poultry, swine and dairy operations.⁶³ Such occurrences are being reported wherever there are CAFOs—from Nebraska, to the south central United States, to the Mid-Atlantic. Particularly troublesome in waterways is nutrient rich-waste such as dairy discharge and ammonia, which can get into waterways and cause eutrophication and dead zones, like that found in the Gulf of Mexico. Such extensive evidence of CAFO related water contamination has raised extensive debate surrounding the nature and scale of federal and state regulations.

The sheer scale of the CAFO industry in the United States, however, is daunting for environmentalists and regulators alike. The EPA currently attempts to regulate approximately 20,700 CAFOs⁶⁴ in 50 different states and territories, with limited success. As of September, 2010, only 8,295 feedlots had received permits for being in compliance with EPA wastewater regulations.

⁶⁵ Unfortunately, the states themselves have had only limited success in regulating the CAFOs within their territory, encountering problems such as understaffed agencies, loss of local control over feeding operations, and the capturing of agencies by the CAFO industry.⁶⁶

Stakeholders

Environmental Advocates

Due to the massive quantities of waste produced and the high likelihood of the substances entering national waterways, environmental advocacy groups are pushing the government for stricter regulations to protect national waterways. Organizations such as the Waterkeeper Alliance, the Natural Resources Defense Council, and the Sierra Club have shown a strong commitment to regulating CAFOs, arguing against CAFO runoff and fighting to prevent the creation of new

⁶² Sapkota, Amy R., Curriero, Frank C., Gibson, Kristen E., Schwab, Kellogg J. July 2007. Antibiotic-Resistant Enterococci and Fecal Indicators in Surface Water and Groundwater Impacted by a Concentrated Swine Feeding Operation. *Environmental Health Perspectives*. 115(7): 1040-1045.

⁶³ Hutchins, Stephen R., White, Mark V., Hudson, Felisa M., Fine, Dennis D. 2007. Analysis of Lagoon Samples from Different Concentrated Animal Feeding Operations for Estrogens and Estrogen Conjugate. *Environmental Science and Technology*, 41(3): 738-744.

⁶⁴ EPA, "Revised National Pollutant Discharge Elimination System Permit Regulation and Effluent Limitations Guidelines for concentrated Animal Feeding Operations in Response for the Waterkeeper Decision; Final Rule," *Federal Register* (November 20, 2008), pg. 70469.

⁶⁵ EPA, 2010, "Third Quarter" Report.

⁶⁶ Peterka, Amanda. 2/23/2011. *States struggling to regulate 'factory farms.'* Greenwire. Electronic Source: <http://www.eenews.net/Greenwire/2011/02/23/archive/18?terms=cafo>.

CAFOs.⁶⁷ The Pew Commission on Industrial Farm Animal Production issued a full report on CAFOs in April, 2008, citing concerns not just about the effluent wastes, but about the location of CAFOs, which are generally near rivers and floodplains. These areas have highly saturated grounds, making them less able to absorb the CAFO fertilizers and turning what could have been valuable fertilizer into harmful runoff.⁶⁸

Environmentalists also maintain that arguments concerning the low production costs of CAFOs are highly exaggerated. In a report put forth by the Union of Concerned Scientists in 2008, the author brings to light the use of both direct subsidies (such as federal and state incentive programs that provide funding for pollution reduction measures) and indirect subsidies (such as those on grains that keep feed prices low) that provide over \$4 billion of taxpayer money towards CAFO production.⁶⁹ And many of the low costs that CAFOs enjoy are in fact due to the unpriced costs of environmental externalities. As long as companies aren't paying the environmental costs of their pollution, it's easy to keep costs low.

Environmentalists, however, are not entirely satisfied with the current turn of events. Lawsuits against individual CAFOs abound, and it's clear that there may be environmental justice issues involved. Currently low income, rural areas are the chief clients of law school environmental advocacy groups that employ law students to keep costs low, while giving a voice to communities directly affected by CAFO pollution. Ironically, the agricultural industry believes exactly the opposite, pointing out that most large-scale meat processing companies employ small, family owned farms to produce their meat, and that frequent lawsuits are forcing many of them to contemplate bankruptcy.⁷⁰

The Consumers

Without a demand, CAFOs wouldn't exist. The average American eats around 8 ounces of meat a day—roughly twice the world average, and in the United States alone, the animal industry processes roughly 10 billion animals a year, producing 15% of the world's meat demand, despite

⁶⁷ The Sierra Club. "Fowl Factory Gets Kibosh in Kentucky." *Sierra Club Scrapbook*. Nov. 27, 2007. Retrieved 5/15/11. Electronic Source: <http://sierraclub.typepad.com/scrapbook/2007/11/fowl-factory-ge.html>.

⁶⁸ Pew Commission on Industrial Farm Animal Production. "Putting Meat on the Table: Industrial Farm Animal Production in America." Executive Summary. A Project of The Pew Charitable Trusts and Johns Hopkins Bloomberg School of Public Health. April, 2008. Page 13.

⁶⁹ Gurian-Sherman, 2008, pg. 3.

⁷⁰ Nelson, Gabriel. 04/08/2010. Students' role in farm pollution suit angers Maryland lawmakers, sparks national debate. *E&E*.

accounting for only 5% of the world population. Demand for meat worldwide is also increasing, doubling in the last 20 years in developed countries.⁷¹ There's really no question: people want meat.

With CAFOs, however, the costs of the meat are unequally distributed, and this unequal distribution may, in fact, be leading to a higher demand than the market would otherwise have created. Government subsidies, as discussed above, decrease the amount that companies have to charge for their product, leading to an increased demand for the good. This means that production facilities that would otherwise not survive on the market are instead going strong, and doing it all on taxpayer money. In addition, the need of these facilities to keep their costs as low as possible can push the most environmentally destructive facilities into states with the most lax enforcement measures, creating pollution havens such as was the case in Illinois as recently as 2010, which forced the federal EPA to threaten a complete takeover of the state enforcement offices.

In these heavily polluted areas, it is often the case that the CAFOs in question have their roots so deep in the community that locals have a hard time speaking up for their rights to clean water. They feel that because they work for the industry, they may sound hypocritical if they speak out against it, or that they may lose their jobs by being too vocal. The public silence, in this case, may not equal consent. Mark Muller, of an Illinois environmental advocacy group, put it best when he said, "...we need farming, but we also need clean water."⁷²

CAFO Industry

No side is arguing that the people want animal waste in their drinking water. As with most environmental problems, the negative health and environmental effects of industry are externalities, which means that industries aren't actually *trying* to cause pollution, it just happens and it costs less for them to do it. While often seen as inconsequential in environmental circles, the costs to business of implementing environmental reform are not insignificant. Despite applying to only 5% of the country's top emitters, the 2008 regulations have cost CAFOs \$53.8 million per year to implement, and that's from paper work expenses alone, without adding in the additional costs of implementing new technologies and methodologies to conform to the rule.⁷³ Extra costs to industry can quickly lead to job losses, which can disproportionately affect unskilled, low income workers.

⁷¹ Bittman, M. "Rethinking the Meat-Guzzler." *The New York Times*. January 27, 2008. Electronic Source: <http://www.nytimes.com/2008/01/27/weekinreview/27bittman.html>

⁷² Peterka, 2011.

⁷³ EPA, 2008, CAFO Final Rule.

CAFOs are frequently criticized for driving local agriculture out of business, but the reality is more complex than it seems. To keep costs low, the animals go through as little transportation as possible in order to prevent harm to them before slaughter. This means that CAFOs contract out to local businesses to produce meat closer to the intended markets. The amount of total contracted production has increased steadily over the last few decades, reaching almost 90% of total CAFO production in the poultry and eggs sector in 2001, and over 50% in swine and dairy.⁷⁴

This extensive use of contracted animal production raises the question of who exactly is being hurt by environmental lawsuits. Although the official defendant in such suits is often large agribusiness, the lawsuits themselves are often fought by the local farm in question, as is currently the case at a Maryland poultry farm, in which a contracted family-owned farm may still be driven out of business by an environmental lawsuit that damaged its reputation, despite public support by the state Agriculture Secretary that the family had gone above and beyond its legal obligations to protect the environment.⁷⁵ Environmental justice concerns, while rarely clear cut, are especially murky on such a high tension issue.

There is some evidence that CAFOs and the environment are not as locked in conflict as it

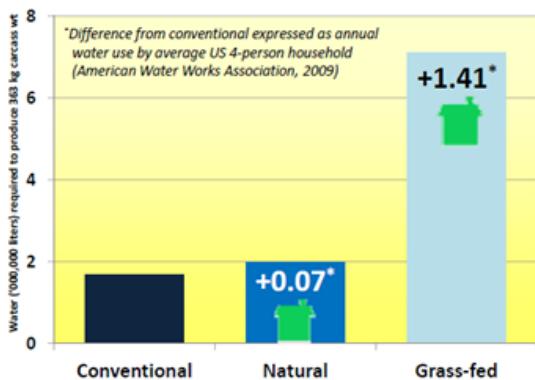


Figure 2: Total Water Required per Unit of Beef Produced in Conventional, Natural, and Grass-fed Cattle Operations. Source: Capper, 2010.

initially appears. In her research presented at an environmental conference in Banff, Canada in October 2010, Dr. Jude Capper from Washington State University presented findings that offered evidence that, in terms of overall environmental impact, Cattle CAFOs were in fact the most environmentally friendly form of production in an objectively un-environmentally friendly industry. Her research included data from what she termed “conventional” farms (feedlot systems that use the full range of technology, including growth hormones), “natural” farms (feedlot systems without

growth enhancing technologies), and “grass-fed” systems (in which cattle are raised on 100% forage diet from birth until slaughter). Figure 2, above, shows a graph of water use that she presented in her findings.

⁷⁴ Gurian-Sherman, D. “CAFOs Uncovered: The Untold Costs of Confined Animal Feeding Operations.” Union of Concerned Scientists. April 2008. Pg. 21.

⁷⁵ Nelson, 2010.

Capper based her results on modeling software that looked at the average nutrition and metabolism of cattle in order to determine inputs, with outputs being waste products and beef (each cow equaled 363kg of beef). She determined that overall, conventional feedlots used less water (as shown in Figure 2) and produced less manure than the two competing systems.⁷⁶

From an economic viewpoint, these results make sense. Decreasing the amount of inputs into a system will decrease the production costs, resulting in lower prices for the customer, which is how prices for CAFO meat and dairy can be so low. Capper is also assuming (and she makes specific note on her poster) that conventional systems will be geographically located in areas that make the best use of resources to support productivity. These conditions are often true in industry, however. Business goes where it is cheapest and easiest to make a product, and that usually means minimizing production inputs. Extensive subsidies for feeding operations, however, may poke holes in this assumption. Many environmental organizations argue that without subsidies, many CAFOs would go out of business.⁷⁷ If, indeed, CAFOs are entirely reliant upon subsidies in order to stay afloat, it is less likely that they are the economic and environmental boon the study implies.

Capper's results make sense in terms of overall quantity of water used for each head of cattle. In terms of wastewater management, however, the CAFOs still present a problem that pasture fed and free range methods of agriculture do not—what do with such high volumes of waste all in one place. Pasture fed animals distribute their waste over a large area and in small enough concentrations to allow time for absorption into the soil, rather than becoming runoff on overly saturated fields. Even if each CAFO cow creates less waste per capita, there are still hundreds of thousands of cattle, all in one place, producing hundreds of millions of tons of concentrated waste. There simply isn't a convenient place to store it all and some of it inevitably winds up in waterways.

Federal Regulations and Litigation

CAFO regulations began in 1974 with the passage of the Clean Water Act, which established effluent limitations on point sources of water pollution, which includes large scale feeding operations. It wasn't until two years later, however, that permitting was developed and real EPA oversight began.⁷⁸ It was quickly realized that there were several issues with effectiveness,

⁷⁶ Capper, J. October, 2010. The Environmental Impact of Conventional, Natural and Grass-fed Beef Production Systems. A poster presented at the Banff conference on Greenhouse Gases in Animal Agriculture.

⁷⁷ The Sierra Club, Michigan Chapter. Facts about CAFOs. Electronic Source:
<http://michigan.sierraclub.org/issues/greatlakes/articles/cafofacts.html#water>

⁷⁸ EPA, 2008, CAFO Final Rule, pg. 70419.

however, including loopholes that allowed feedlots to operate without permits and exemptions that still allowed large amounts of discharge. The issue of effluent management came to a head with the passage of a new rule by the EPA in 2003 in order to better manage public watersheds. The new rule sought to expand the number of operations that required oversight to approximately 11,000 new operations (almost tripling the previous number),⁷⁹ make it more difficult to get exemptions, and create requirements for public participation.⁸⁰

Both environmental organizations and members of the CAFO industry were up in arms over the new regulations. Environmental groups complained that the rules were still too lax, and failed to provide states with the funding to carry out the new enforcements.⁸¹ They argued that the new rules were simply a continuation of the status quo, removing important restrictions put forth in Clinton's version of the rule in 2000 by reducing the number of operations required to seek permitting, scrapping a zero-discharge requirement related to stormwater runoff, and removing penalties for companies that contract out their animal care. In contrast, proponents of the CAFO industry believed the opposite, applauding the decreased requirements, but arguing that the regulations were too strict and manure runoff fell outside the oversight of the EPA. The new restrictions would require CAFOs to reduce their emissions in phosphorus and nitrogen discharge in the amounts of 56 million pounds and 100 million pounds per year, respectively. Seven different suits were filed with different courts, questioning the EPA jurisdiction under the Clean Water Act.⁸² The cases were then consolidated into one lawsuit that was brought before the Second Circuit Court of Appeals in December 2004 in the case *Waterkeeper Alliance et al. v. EPA*.⁸³ Due to the consolidation process, the plaintiff included a strange mix of CAFO supporters who called themselves the Farm Petitioners, including the National Chicken Council, the National Pork Producers Council, and the American Farm Bureau Federation, as well as environmental advocates such as the Sierra Club and the Natural Resources Defense Council, who referred to themselves as the Environmental Petitioners.⁸⁴

⁷⁹ Eichenseher, Tasha. 3/01/2005. Court rules EPA large-farm waste rule violates act. Greenwire. Electronic Source: <http://www.eenews.net/Greenwire/2005/03/01/archive/11?terms=cafo>.

⁸⁰ EPA, "Summary of the Second Circuit's Decision in the CAFO Litigation," 2005.

⁸¹ Franz, Damon. 1/31/2003. EPA should increase CAFO program oversight – GAO. Greenwire Electronic Source: <http://www.eenews.net/Greenwire/2003/01/31/archive/9?terms=cafo>.

⁸² Franz, Damon. 3/11/2003. Seven enviro, ag groups sue to overturn CAFO rules. Greenwire. Electronic Source: <http://www.eenews.net/Greenwire/2003/03/11/archive/1?terms=cafo>.

⁸³ EPA, "Summary of the Second Circuit's Decision in the CAFO Litigation," 2005.

⁸⁴ *Waterkeeper Alliance et al.*, 2005, 399 F. 3d 486.

When the ruling came in, in February 2005, it was as two-sided as its plaintiff. While the court upheld the majority of the EPA's rule, it required several major changes and three smaller clarifications, concerning what constituted "Best Conventional Technology" as it related to effluents and pathogens, a rewrite on the 100-year storm standard, and clarification on water quality effluent limits. One new requirement called for CAFOs to create a Nutrient Management Plan (NMP) to track discharges from the facilities. The NMPs, decreed the Court, must be submitted and approved by the EPA as part of the permit application process and must be made publically available in order to allow the public participation required by the Clean Water Act.⁸⁵

While these were considered victories for the environmentalists, one additional requirement sent up a cheer for the other side. The Court ruled that the EPA did not have the authority to require permits for facilities that could prove that they were not discharging effluent from their facilities. Due to the wording of the rule, waste management practices only qualify as a "discharge" if they are disposed of in a way that makes it in any way likely that the waste will come into contact with bodies of water.⁸⁶ In arid regions such as southern Arizona, such contact is unlikely, meaning dairy and other CAFOs in the region are not regulated by the CWA.

The court ruling sent the EPA back to the drawing board to come up with a revised rule that took into account the court's requirements. On November 20, 2008, they issued their final rule on the subject, following the courts requirements and offering clarifications to ambiguous rules, including removing CAFOs' ability to get around the zero-discharge requirements and creating water-quality based effluent limitations that could be put on all discharge except stormwater, which the court had ruled as being outside the jurisdiction of the CWA, which only gives federal regulatory agencies the ability to regulate navigable waters.⁸⁷ Finally, the revised rule affirmed the previous rule's decision with regards to Best Conventional Technology (BCT).⁸⁸ This rule currently stands today.

For the two-sided plaintiffs, the final rule brought mixed reactions. For CAFOs, this rule legally means that each CAFO, whether discharging or not, is now required to complete a NMP to submit to the EPA every 5 years, along with their permit renewal application—an added business cost. It also means that CAFOs are no longer responsible for stormwater runoff, a major victory for industry, for which stormwater was an unpredictable expense. For environmentalists, the new rule

⁸⁵ EPA, "Summary of the Second Circuit's Decision in the CAFO Litigation," 2005, pg. 2.

⁸⁶ 40 C.F.R. §122.23(d)(2); § 122.23(f)

⁸⁷ *Waterkeeper Alliance et al., 2005, 399 F. 3d 486*, pg. 15.

⁸⁸ EPA, "Concentrated Animal Feeding Operations Final Rulemaking—Fact Sheet" (2008).

meant several victories, in the form of increased oversight in the form of NMPs, and stricter zero-discharge requirements. There were also several setbacks, however, including the stormwater battle and the rule regarding BCT, the 2003 version of which they had challenged as not representing the best technology currently in use. By upholding the 2003 rule in this area, the EPA chose not to increase technology standards.

For environmentalists to claim any sort of victory, however, the new requirements would have to be enforced. As of September 2010, CAFOs across the country are still struggling to meet requirements. Less than half of all CAFOs have received permits from the EPA,⁸⁹ meaning that despite the new regulations, large amounts of effluent are still getting into waterways. In addition, 2011 funding cuts to the EPA in the form of \$1.6 billion, much of which went to water cleanup efforts,⁹⁰ means that it's unlikely that the federal agency is going to have the funds to enforce the stricter regulations in the years to come.

With such a contentious issue and a highly partisan Congress, the Obama administration has made no significant strides in the area of CAFO reform. Despite campaign promises to pass regulations on CAFO air pollution (there are currently none) and increase the voice that communities had in where such operations are placed, almost no reform has been passed in the area of CAFOs during Obama's first term in office. While there has been some movement in Illinois and in terms of enforcement,⁹¹ there have been no new federal regulations passed since the final rule in 2008.

Alternative Policy Pathways: The States

One of the most effective alternative policy pathways has been the empowerment of states to regulate their own waterway pollutants. In 1987, Congress created the Clean Water State Revolving Fund to provide a way for states and local agriculture to overcome the financial barriers to clean water controls. This fund provides billions of dollars annually in the form of low interest or no interest loans for the creation of controls on nonpoint sources of water pollution.⁹² Many state agricultural departments have used these funds to provide farmers with loans for installing water

⁸⁹ EPA, 2010, "Third Quarter" Overview.

⁹⁰ Nelson, Gabriel. April 13, 2011. "EPA Budget Deal Slams State, Regional Programs." *The New York Times*. Electronic Source: <http://www.nytimes.com/gwire/2011/04/13/greenwire-epa-budget-deal-slams-state-regional-programs-26003.html>.

⁹¹ Peterka, 2011.

⁹² EPA. Clean Water State Revolving Fund. EPA Website. Updated July 22, 2010. Retrieved May 9, 2011. Electronic Source: http://water.epa.gov/grants_funding/cwf/cwsrf_index.cfm.

treatment equipment. In particular, Missouri, Minnesota, and Delaware have funded millions of dollars worth of infrastructure improvements for hundreds of AFOs within their states.⁹³

Unfortunately, there are limits on the states' ability to act. Currently the CWSRF only applies to nonpoint sources of water pollution and CAFOs qualify as point sources⁹⁴, making them ineligible for funding and without financial incentive, it is unlikely that they will act voluntarily to restrict their emissions. Even current regulations are not always met. In 2008, the EPA was forced to get personally involved with the state of Illinois, which due to regulatory capture, had some of the worst CAFO-related air and water quality in the United States and had only issued permits to 20 of the nearly 500 CAFOs in the state. After an investigation into the local management practices, the EPA issued an ultimatum, requiring that Illinois bring its CAFOs up to code or risk having the EPA take over their operations.⁹⁵

Recommendation

Despite current regulations on CAFOs, it's clear from the scientific literature⁹⁶⁹⁷⁹⁸ that water contamination is still happening and on a regular basis. The solution, however, is not increased regulation, but rather increased funding. To date, less than half of all CAFO's under EPA jurisdiction are in line with current regulations,⁹⁹ and while some of this can be attributed to captured agency, it's more likely that lack of funding is playing a major role.¹⁰⁰ Fortunately, a funding structure for water pollution has been in place since the Clean Water Act amendments in the form of the CWSRF, which has been shown to be not only effective in providing manufacturers with a way of financing otherwise prohibitively costly pollution control technology, but also provides a source of income for states and federal lenders in the form of interest repayments. By 2000 alone, over \$2 billion in revenue have been raised through the CWSRF program¹⁰¹, which is

⁹³ EPA. Animal Feeding Operations—Best Management Practices (BMP). EPA Website. Updated November 3, 2010. Retrieved May 9, 2011. Electronic Source: <http://www.epa.gov/agriculture/anafobmp.html>.

⁹⁴ EPA, 2008, CAFO Final Rule.

⁹⁵ Peterka, 2011.

⁹⁶ Bartelt-Hunt, et al. 2011.

⁹⁷ Sapkota, et al. 2007.

⁹⁸ Hutchins, 2007.

⁹⁹ EPA, 2010, "Third Quarter" Overview.

¹⁰⁰ Peterka, 2011.

¹⁰¹ EPA. Financing America's Clean Water Since 1987: A Report of Progress and Innovation. Office of Water. EPA-832-R-00-011. May 2001. Electronic Source: http://water.epa.gov/grants_funding/cwsrf/upload/2002_06_28_cwfinance_cwsrf_progress.pdf.

then funneled back into the program to provide more funding for water quality projects.¹⁰² Should a similar program be provided for point sources as well, it is likely that CAFOs could share in the program's success story.

Federal regulations and programs are not foolproof, however. While the CWSRF has been extremely successful, it remains a voluntary program, leaving hundreds of thousands of AFOs to decide whether or not to install a clean water infrastructure. While CAFOs certainly provide a significant amount of pollution into waterways, regulating them will not solve the problem of water contamination. In the state of Missouri alone, only between 500 and 550 out of 100,000 farming operations in the state qualify as a CAFO.¹⁰³ Non-CAFO farms do not qualify as pollution point sources under the CWA,¹⁰⁴ but they still pose significant problems in terms of manure runoff and groundwater contamination.

With the EPA experiencing budget cuts and the Obama administration's attention elsewhere, one of the most effective courses of action is for the current administration to cut loose the statutes tying state and local regulations to federal ones, by creating federal minimum standards, instead of federal maximum standards. So long as there are requirements in place preventing states from passing more stringent environmental laws than current federal regulations,¹⁰⁵ the weight of enforcement is going to be on the shoulders of the understaffed and underfunded EPA. In addition, creating incentive programs that provide funding, without relying on government grants, or perhaps levying strict fines for noncompliance, would provide income to the underfunded agencies, while helping to internalize business environmental externalities.

¹⁰² EPA. Animal Feeding Operations—Best Management Practices (BMP). EPA Website. Updated November 3, 2010. Retrieved May 9, 2011. Electronic Source: <http://www.epa.gov/agriculture/anafobmp.html>.

¹⁰³ Peterka, 2011.

¹⁰⁴ Clean Water Act. 33 U.S.C. §1251 et seq. (1972)

¹⁰⁵ Peterka, 2011.

Section 3.3

Agricultural Reform in a Climate of Agency Capture

Julie Vining, FDA Labeling for Genetically Engineered Foods

June 1, 2011

U.S. Environmental Politics
Environmental Studies Program

Summary

With the global population continuing to rise, more producers are opting to grow genetically engineered (GE) organisms. GE crops are often designed to be hardier and reliably produce high yields, ideally giving the farmer a more consistent product. American farmers, in particular, have embraced GE crops. The U.S. is the single largest producer of GE crops.¹⁰⁶ Yet, many consumers voice concerns about the safety of these genetically altered foods. In Europe, GE foods, often referred to derogatively as “Frankenfoods,” are strictly regulated and labeled.¹⁰⁷ American consumers and interest groups have demanded that the U.S. Food and Drug Administration (FDA) clearly label GE foods, so that consumers can choose to eat accordingly. The FDA, however, has denied such requests, claiming that the labeling of GEs is not under the FDA’s jurisdiction.¹⁰⁸ This paper addresses the questions of what products the FDA is legally obligated to label and whether GE foods fit into this category.

The FDA claims that it does not possess the authority to require GE labeling, and, under the current understanding of GE crops and interpretation of current laws, it does not. Scientists need to conduct further research and produce conclusive evidence. The likelihood of GE crops negatively impacting humans currently appears low, but, particularly given the prevalence, the impact of such an event would be tremendous. Most importantly, the public has an incredibly poor understanding of GE crops. An overwhelming majority of Americans want GE labels, yet only a quarter of them understand what GE foods are. Identifying and labeling GE foods would be a labor and cost intensive process for producers. In order for a system of GE labeling to be fair to both the producers and consumers, consumers must understand the process and current state of science for GE crops.

Introduction

¹⁰⁶ " Genetically Modified Crops in the United State." *Pew Trusts*. N.p., Aug. 2004. Web. 11 May 2011. <http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Fact_Sheets/Food_and_Biotechnology/PIFB_Genetically_Modified_Crops_Factsheet0804.pdf>.

¹⁰⁷ " U.S. vs. EU: An Examination of the Trade Issues Surrounding Genetically Modified Foo." *The Pew Charitable Trusts*. N.p., n.d. Web. 15 May 2011. <http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Food_and_Biotechnology/vf_biotech_trade_0602.pdf>.

¹⁰⁸ Layton, Lyndsey. "FDA Rules Won't Require Salmon Labels." *The Washington Post*. N.p., 19 Sept. 2010. Web. 16 May 2011. <<http://www.washingtonpost.com/wp-dyn/content/article/2010/09/18/AR2010091803808.html>>.

Consumers are concerned about the potential health hazards of genetically engineered (GE) crops and want foods containing GE crops to be labeled. A 2003 poll conducted by ABC News found that a staggering 92% of its respondents believed that "the federal government should...require labels on food saying whether or not it has been genetically modified or bio-engineered."¹⁰⁹ Consumer interest groups such as the Center for Food Safety (CFS) claim that the FDA's lack of labeling for GE foods disregards the consumer's basic right to know. CFS states that, "The absence of required labeling for GE foods makes it exceedingly difficult, if not impossible, for consumers to decide for themselves whether or not to take on the risks—known and unknown, to themselves or to the environment—associated with GE foods."¹¹⁰

The Food and Drug Administration (FDA) claims that GE labeling is outside of its jurisdiction, however—that such a process would differentiate products that are not significantly different.¹¹¹ Producers argue that consumers demonstrate a complete lack of knowledge in terms of both what GE crops are and how GE crops are tested prior to commercialization.¹¹² The GE crops that are on the market have been evaluated for potential impacts on human health and the environment.¹¹³ While producers support the federal government's stance, consumers and public health and environmental interest groups insist that GE crops present potential risks and need to be labeled accordingly.

Concerns About Genetically Engineered Organisms

What Is a Genetically Engineered Organism?

¹⁰⁹ "Biotechnology." *World Public Opinion*. N.p., 2008. Web. 11 May 2011.

<http://www.americansworld.org/digest/global_issues/biotechnology/biotech3.cfm>.

¹¹⁰ "RE: Docket No. FDA-2010-N-0385 Food Labeling: Labeling of Food Made from AquAdvantage Salmon; Request for Public Comments." *Center for Food Safety*. N.p., 22 Nov. 2010. Web. 11 May 2011.

<<http://stopgefish.files.wordpress.com/2010/11/ge-salmon-labeling-comments-corrected-final.pdf>>.

¹¹¹ Layton, Lyndsey. "FDA Rules Won't Require Salmon Labels." *The Washington Post*. N.p., 19 Sept. 2010. Web. 16 May 2011. <<http://www.washingtonpost.com/wp-dyn/content/article/2010/09/18/AR2010091803808.html>>.

¹¹² Onyango, Benjamin, Rodolfo M. Nayga, Jr., and Ramu Govindasamy. "U.S. Consumers' Willingness to Pay for Food Labeled 'Genetically Modified'." *Agricultural and Resource Economics Review* 35.2 (2006): 299-310. *AgEcon Search*. Web. 15 May 2011. <<http://ageconsearch.umn.edu/bitstream/10210/1/35020299.pdf>>.

¹¹³ "BRS Fact Sheet." *Animal and Plant Health Inspection Service*. U.S. Department of Agriculture, Feb. 2006. Web. 16 May 2011.
<http://www.aphis.usda.gov/publications/biotechnology/content/printable_version/BRS_FS_pharmaceutical_02-06.pdf>.

The FDA defines genetic engineering as a process in which recombinant DNA (rDNA) technology is used to introduce desirable traits into organisms.¹¹⁴ Genetically modified foods are different than genetically engineered foods. For genetically modified crops, plants that display especially valuable traits are selectively bred together in order to produce offspring with those desirable traits. Genetic engineering, through gene-splicing, achieves this goal with greater precision and control.¹¹⁵

Since the introduction of the first commercialized GE crop, the Flavr Savr tomato in 1995, GE crops have become widely used.¹¹⁶ In the United States, especially, GE crops compose a significant portion of farmer's fields. As of 2010, Ninety-three percent of American soybeans are GE.¹¹⁷ Eighty-six percent of America's corn is GE.¹¹⁸

There is considerable debate over whether GE crops may have negative impacts on human health. While the United States has largely embraced GE crops as innovative new technology, much of the world has approached GE crops very differently. Europe, especially, takes a strong stance against GE foods, believing them to present a significant risk to human health and the environment.¹¹⁹

International Labeling

While GE labeling has not been established in the U.S., other members of the international community do require these labels. These include the European Union, Australia, the Czech

¹¹⁴ "Genetic Engineering." *United States Food and Drug Administration*. U.S. Department of Health & Human Services, 30 Apr. 2009. Web. 15 May 2011. <<http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/GeneticEngineering/default.htm>>.

¹¹⁵ "Genetic Engineering." *United States Food and Drug Administration*. U.S. Department of Health & Human Services, 6 Aug. 2009. Web. 15 May 2011. <<http://www.fda.gov/newsevents/testimony/ucm115032.htm>>.

¹¹⁶ Bruening, G., and J. M. Lyons. "The case of the FLAVER SAVR tomato." *California Agriculture*. University of California, July-Aug. 2000. Web. 16 May 2011.

<<http://californiaagriculture.ucanr.org/landingpage.cfm?article=ca.v054n04p6&fulltext=yes>>.

¹¹⁷ "Adoption of Genetically Engineered Crops in the U.S.: Soybeans Varieties." *Economic Research Service*. United States Department of Agriculture, 1 July 2010. Web. 15 May 2011. <<http://www.ers.usda.gov/Data/BioTechCrops/ExtentofAdoptionTable3.htm>>.

¹¹⁸ "Adoption of Genetically Engineered Crops in the U.S.: Corn Varieties." *Economic Research Service*. United States Department of Agriculture, 1 July 2010. Web. 15 May 2011. <<http://www.ers.usda.gov/Data/BioTechCrops/ExtentofAdoptionTable1.htm>>.

¹¹⁹ "U.S. vs. EU: An Examination of the Trade Issues Surrounding Genetically Modified Foo." *The Pew Charitable Trusts*. N.p., n.d. Web. 15 May 2011. <http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Food_and_Biotechnology/vf_biotech_trade_0602.pdf>.

Republic, Hong Kong, Russia, Japan, South Korea, and Taiwan.¹²⁰ As of 2011, 30 countries have banned GEs altogether or have proposed to do so.¹²¹

In Europe, there is an especially strong anti-GE sentiment. France and 5 other countries have banned all GEs. The EU has only approved the cultivation of two GE crops, Monsanto's MON810 corn and the BASF's Amflora potato.¹²² The EU mandated the labeling of GE crops and products containing GE ingredients in 1997.¹²³ Article 12 of the 2003 Regulation (EC) No 1829/2003 of the European Parliament and of the Council states that food and feed must be labeled as "genetically modified" or "produced from genetically modified (name of organism)." These labels must also mention any characteristic or property in which the product differs from the original organism.¹²⁴ The EU justifies these regulations as necessary under consumer right to information and concerns of safety for human health.

GE labeling is also present in Asia. Korea, for example, has required labels on GE products since 2001. Korea's policy focuses only on major ingredients and recombinant DNA. Labeling is only required if GE corn, soybeans, or soybean sprouts are among the top five ingredients of a food. It exempts products that are derived from GE crops other than corn and soybeans or are modified through processes other than recombinant DNA. While these restrictions are considerably looser than rules in the EU, they are still more stringent than the U.S.

¹²⁰ "GMO Testing Requirements and Approaches Worldwide." *European Commission Joint Research Centre*. Institute for Health and Consumer Protection, Sept. 2010. Web. 16 May 2011.

<http://mbg.jrc.ec.europa.eu/capacitybuilding/docsworkshops/Croatia_29_30_Sep_2010/GMO%20testing%20requirements_VandenEede_Croatia.pdf>.

¹²¹ "Banning GMOs." *Voice of the Environment*. N.p., 29 Mar. 2011. Web. 16 May 2011.
<<http://www.voiceoftheenvironment.org/gmos/>>.

¹²² Bloom, Jeremy. "Is Europe's ban on Monsanto's GMO crops illegal?" *Red Green & Blue*. N.p., 23 Mar. 2011. Web. 15 May 2011. <<http://redgreenandblue.org/2011/03/23/is-europe-s-ban-on-monsantos-gmo-crops-illegal/>>.

¹²³ "U.S. vs. EU: An Examination of the Trade Issues Surrounding Genetically Modified Food." *The Pew Charitable Trusts*. N.p., n.d. Web. 15 May 2011.
<http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Food_and_Biotechnology/vf_biotech_trade_0602.pdf>.

¹²⁴ "REGULATION (EC) No 1829/2003 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 22 September 2003 on genetically modified food and feed." *Official Journal of the European Union* (Oct. 2003): n. pag.
Eur-Lex. Web. 15 May 2011. <<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:268:0001:0023:EN:PDF>>.

In May 2010, the Codex Committee on Food Labeling, part of the United Nations food standards agency, convened to discuss GE labeling. Fifty countries attended the meeting.¹²⁵ The U.S. refused to agree to language in the Codex that stated that each country could adopt different label approaches for GEs. Instead, it attempted to establish language did not distinguish GE foods from other foods. Only Mexico, Costa Rica, and Argentina supported this stance.¹²⁶

Genetically Engineered Organism Regulations and Labeling in the United States

Federal Regulations and Labeling

Through the United States Department of Agriculture's (USDA) Biotechnology Regulatory Services (BRS), GE crops must undergo testing and evaluation by the Animal and Plant Health Inspection Service (APHIS) before they can be commercially grown and sold. APHIS is composed of staff of experts who evaluate the risks of contamination and the overall environmental impact in field tests and inspections.¹²⁷ Once a GE crop is approved, however, producers and manufacturers are not required to differentiate the GE product from non-GE products.

In the United States, the Food and Drug Administration regulates the labeling of both processed and whole foods under the Federal Food, Drug, and Cosmetic Act (FD&C Act) of 1938, which granted it the authority to oversee food safety, and the Fair Packaging and Labeling Act (FPLA) of 1967, which required and standardized labels.

The FDA currently does not require all foods that are GE or contain GE crops to be labeled. It only requires genetically engineered foods to be labeled if the nutrition of the food is significantly changed from the non-GE equivalent, if there is an allergen present that would not be expected in the non-GE equivalent, or if there is a toxicant above accepted limits.¹²⁸ The FDA proposed a system of voluntary GE labeling in January 2001 through Guidance for Industry: Voluntary Labeling Indicating Whether Foods Have or Have Not Been Developed Using Bioengineering;

¹²⁵ Bottemiller, Helen. "U.S. Urged to Back GM Labeling Agreement." *Food Safety News*. N.p., 11 May 2010. Web. 15 May 2011. <<http://www.foodsafetynews.com/2010/05/cu-calls-on-obama-to-support-gm-labeling-agreement/>>.

¹²⁶ Ibid.

¹²⁷ "BRS Fact Sheet." *Animal and Plant Health Inspection Service*. U.S. Department of Agriculture, Feb. 2006. Web. 16 May 2011. <http://www.aphis.usda.gov/publications/biotechnology/content/printable_version/BRS_FS_pharmaceutical_02-06.pdf>.

¹²⁸ Byme, P. "Labeling of Genetically Engineered Foods." *Colorado State University*. N.p., Sept. 2010. Web. 15 May 2011. <<http://www.ext.colostate.edu/pubs/foodnut/09371.html>>.

Draft Guidance.¹²⁹ This guiding document outlines acceptable statements about GE content, phrases worded in a way that is not misleading to consumers. Due to this recommendation, companies that do not use GE crops are able to label their products as not produced with biotechnology. However, as this recommendation is non-binding, companies that do use GE crops do not have to label their products as such.¹³⁰

Genetically Engineered Foods Under Current Federal Labeling Law

GE foods could potentially be regulated on the grounds that they have been significantly changed from their original nutrition and form. However, the FDA does not specify what constitutes a significant nutritional change. Additionally, the nutritional value of a GE food can vary from slightly less to more nutritional than its non-GE counterpart. To date, no approved GE crop has been found to be significantly different nutritionally from non-GE crop.

Under the FDA's rules, food items that contain allergens must be marked. Unexpected ingredients appear less of a concern to citizens and scientists than the possibility that GE crops themselves may present new allergens. Genetic engineering creates new proteins, and sometimes these proteins are entirely new to the human diet.¹³¹ These new proteins have the potential to be allergens to humans. Again, however, allergenic potential is an aspect that is tested prior to the approval of a new GE crop.¹³² Further, allergies have not yet arisen as an issue for GE foods already in the market.¹³³

¹²⁹

<http://www.fda.gov/Food/GuidanceComplianceRegulatoryInformation/GuidanceDocuments/FoodLabelingNutrition/ucm059098.htm>

¹³⁰ "Guidance for Industry: Voluntary Labeling Indicating Whether Foods Have or Have Not Been Developed Using Bioengineering; Draft Guidance." *U.S. Food and Drug Administration*. U.S. Department of Health & Human Services, 22 May 2009. Web. 15 May 2011.

<<http://www.fda.gov/Food/GuidanceComplianceRegulatoryInformation/GuidanceDocuments/FoodLabelingNutrition/ucm059098.htm>>.

¹³¹ "Do GMOs Mean More Allergies?" *GMO Compass*. N.p., n.d. Web. 15 May 2011. <http://www.gmo-compass.org/eng/safety/human_health/192.GEs_mean_more_allergies.html>.

¹³² *Ibid.*

¹³³ Bittman, Mark. "Why Aren't G.M.O. Foods Labeled?" *The New York Times*. N.p., 15 Feb. 2011. Web. 15 May 2011. <<http://opinionator.blogs.nytimes.com/2011/02/15/why-arent-g-m-o-foods-labeled/?hp>>.

The introduction of new genes, often including those with pesticide or antibiotic properties, presents a potential risk of elevated toxicity. Part of the FDA required safety assessment for GE foods, however, is to compare the levels of toxins occurring in the GE food to levels found in conventional food.¹³⁴ Theoretically, this should safeguard against toxins, but studies that find potential negative long-term effects from GE consumption suggest that such regulation may not be sufficient. A recent study linking GE Corn consumption and organ failure in rats (explained in more detail in the next section) revealed an issue with elevated toxins. This prompted consumers to demand GE labeling. Such labeling would be similar the labeling of dyed, farmed salmon. The FDA requires farmed salmon that is dyed pink to be labeled. As with GE foods, this salmon is almost indistinguishable from their natural counterpart composition-wise. But the dye used to increase aesthetic appeal often contains Canthaxanthin, which has been linked to human eye defects and retinal damage.¹³⁵ Thus, dyed, farmed salmon must be labeled. If the results of the rat study are repeated with other GEs, regulators will have a strong case to label GEs due to elevated toxicity. As of now, however, these findings have not been duplicated and only relate to three strains of GE corn.¹³⁶ This is not sufficient evidence to label all GE foods, under the FDA's current standards.

Stakeholders' Opinions

Interest Groups

Public health and environmental interest groups have raised concerns that GE foods may be less healthy than non-GE food and potentially capable of adverse long-term effects. The Union of Concerned Scientists (UCS) claims that the risks that GE crops present to human health far outweigh the potential benefits. The UCS cites such risks as increased antibiotic resistance and new toxins and allergens in our food system.¹³⁷ In the process of making a GE crop, genes for antibiotic

¹³⁴ "Safety Issues Associated with Genetically Modified Foods." *African Biosafety Network of Expertise*. N.p., 2010. Web. 15 May 2011. <<http://www.nepadbiosafety.net/for-regulators/resources/subjects/food-safety/safety-issues>>.

¹³⁵ "Farmed Salmon and Human Health." *Pure Salmon Campaign*. N.p., n.d. Web. 15 May 2011. <http://www.puresalmon.org/pdfs/human_health.pdf>.

¹³⁶ De Vendômois, J. S., et al. "A Comparison of the Effects of Three GM Corn Varieties on Mammalian Health." *International Journal of Biological Sciences* 5 (2009): 706-726. *International Journal of Biological Sciences*. Web. 15 May 2011. <<http://www.biolsci.org/v05p0706.htm>>.

¹³⁷ "Risks of Genetic Engineering." *Union of Concerned Scientists*. N.p., 30 Oct. 2002. Web. 16 May 2011. <http://www.ucsusa.org/food_and_agriculture/science_and_impacts/impacts_genetic_engineering/risks-of-genetic-engineering.html>.

resistance are inserted into the crop to serve as markers for gene transfer. Even after this testing is completed, these genes are left in the plant. Antibiotic resistant genes in foods could both reduce the effectiveness of antibiotics on the people who consume the GE foods and, in the case of contamination, could lead to antibiotic-resistant pathogens.¹³⁸ New toxins are also an important concern. A 2010 study in the *International Journal of Biological Sciences* linked Monanto's GE corn with organ failure in rats.¹³⁹ The rats suffered from concentrated damage in the kidneys and liver – the two main detoxification organs- as well as some effects on the heart, adrenal, spleen and blood cells.¹⁴⁰ The researchers reported that, “[Their] data strongly suggests that these GE maize varieties induce a state of hepatorenal toxicity (kidney failure).... These substances have never before been an integral part of the human or animal diet and therefore their health consequences for those who consume them, especially over long time periods are currently unknown.”¹⁴¹ Other studies have shown that GE crops could potentially be allergens.¹⁴² As reported in the journal of Nature Biotechnology, “The potential for the transfer of an allergen was illustrated in the 1996 case of transgenic soybeans into which the gene for a 2S albumin from the Brazil nut had been transferred to enhance the methionine content of animal feed. [...] This protein is now known as the major allergen of the Brazil nut, Ber e 1.”¹⁴³ Environmental interests groups such as the Center for Food Safety (CFS) have also expressed concerns about the environmental impact of GE crops. Andrew Kimbrell, Executive Director of the CFS stated in response to the USDA’s deregulation of GE alfalfa, “Gene flow and resistant weeds have already caused substantial harm to thousands of American farmers, and must be properly addressed in a scientifically sound manner by USDA before any decisions are made.”¹⁴⁴ In its analysis of GE alfalfa, CFA also cites that the adoption of

¹³⁸ Ibid.

¹³⁹ De Vendômois, J. S., et al. "A Comparison of the Effects of Three GM Corn Varieties on Mammalian Health." *International Journal of Biological Sciences* 5 (2009): 706-726. *International Journal of Biological Sciences*. Web. 15 May 2011. <<http://www.biolsci.org/v05p0706.htm>>.

¹⁴⁰ Ibid.

¹⁴¹ Ibid.

¹⁴² Traavik, Terje, PhD, UVM, and Jack Heinemann, PhD. " Genetic Engineering (GE) and Omitted Health Research: Still No Answers to Ageing Questions." *Say No to GEs*. N.p., n.d. Web. 11 May 2011.

<<http://saynotoGEs.com/ud2006/ageing.pdf>>.

¹⁴³ Goodman, Richard E., and Stefan Vieths. "Allergenicity assessment of genetically modified crops—what makes sense?" *Nature Biotechnology* 26 (Jan. 2008): 73-81. *Nature*. Web. 16 May 2011.

<<http://www.nature.com/nbt/journal/v26/n1/full/nbt1343.html>>.

¹⁴⁴ "CFS Urges USDA To Get The Science Right, Prioritize Farmers, On Roundup Ready Alfalfa." *Center for Food Safety*. N.p., 25 Jan. 2011. Web. 16 May 2011. <<http://www.centerforfoodsafety.org/2011/01/25/cfs-urges-usda-to-get-the-science-right-prioritize-farmers-on-roundup-ready-alfalfa/>>.

this GE crop would significantly increase herbicide use – up to 23 million more pounds per year.¹⁴⁵ While none of the fears of human consumption of GE foods have yet to come to fruition, these interest groups fear that widespread, long-term consumption of GE foods will have a dangerous impact.

Federal Government

The federal government opposes GE labeling in order to protect domestic agriculture and trade with other nations. As of 2010, Ninety-three percent of American soybeans are GE.¹⁴⁶ Eighty-six percent of America's corn is GE.¹⁴⁷ These are key, commercial crops, both domestically and internationally. Moreover, by labeling all foods that contain GE crops, the U.S. would ensure that the EU and other anti-GE nations would not import these goods. Alan Larson, the US Undersecretary of State for Economic, Business and Agricultural Affairs in 2001, stated that labeling GE foods would, “effectively block \$4 billion of U.S. exports to Europe and would undermine, not reinforce efforts to restore public confidence.”¹⁴⁸ It is in the U.S. government’s interest in terms of both the economy and national security to sustain agriculture. Additionally, large agricultural corporations financially support the government, and thus have considerable influence. There also has been a recent increase in global food prices.¹⁴⁹ In light of rising food prices and the U.S.’s current poor economic conditions, further increasing prices through implementing GE labeling has the potential to be an unpopular move.

Producers

¹⁴⁵ Ibid.

¹⁴⁶ "Adoption of Genetically Engineered Crops in the U.S.: Soybeans Varieties." *Economic Research Service*. United States Department of Agriculture, 1 July 2010. Web. 15 May 2011.

<<http://www.ers.usda.gov/Data/BioTechCrops/ExtentofAdoptionTable3.htm>>.

¹⁴⁷ "Adoption of Genetically Engineered Crops in the U.S.: Corn Varieties." *Economic Research Service*. United States Department of Agriculture, 1 July 2010. Web. 15 May 2011.

<<http://www.ers.usda.gov/Data/BioTechCrops/ExtentofAdoptionTable1.htm>>.

¹⁴⁸ "U.S. vs. EU: An Examination of the Trade Issues Surrounding Genetically Modified Food." *The Pew Charitable Trusts*. N.p., n.d. Web. 15 May 2011.

<http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Food_and_Biotechnology/vf_bioTech_trade_0602.pdf>.

¹⁴⁹ Wise, Warren. "Food prices taking bite out of budgets: Costs likely to climb up to 4% this year, economist says." *The Post and Courier*. N.p., 5 Apr. 2011. Web. 15 May 2011.

<<http://www.postandcourier.com/news/2011/apr/05/food-prices-taking-bite-out-of-budgets/>>.

Producers fear that labeling will perpetrate negative reactions to GEs and decrease sales. They do not believe that there is any risk associated with the consumption of GE foods. To date, no health risks from eating GE crops have been proven.¹⁵⁰ Moreover, the alleged benefits of GE crops are significant. GE crops are more resistant to disease, drought, and pests, allowing regions with poorer growing conditions to cultivate crops. GE crops usually require fewer inputs, making them less expensive to grow and potentially reducing the amount of insecticides and herbicides in the soil and water.¹⁵¹ This ability to maximize food in a greater range of areas could greatly aid the forthcoming issues of rising food prices and an increasing global population.

Producers believe that most consumer resistance is due to a lack of knowledge. Extra labeling only confuses the consumer," said David Edwards, director of animal biotechnology at the Biotechnology Industry Organization. "It differentiates products that are not different."¹⁵² The producers have strong evidence of this consumer confusion. A recent Thomson Reuters Pulse Healthcare Survey revealed that only 25 percent of Americans profess to understand genetic engineering.¹⁵³ Indeed, the FDA requires companies to use the term "bioengineering" rather than GE, as too few people know what GE stands for, let alone what it means.¹⁵⁴ A study conducted by Hallman et al. (2004) showed that 70 percent of Americans do not know that GE foods are tested for human safety, and 76 percent do not know that GE foods are tested for environmental safety.¹⁵⁵

¹⁵⁰ Lack, Gideon. "Clinical risk assessment of GE foods." *Toxicology Letters* 127.1-3 (2002): 337-40. *ScienceDirect*. Web. 11 May 2011.

¹⁵¹ National Academy of Sciences. "Genetically engineered crops benefit many farmers, but the technology needs proper management to remain effective, report suggests." *ScienceDaily*, 22 Apr. 2010. Web. 16 May 2011. <http://www.sciencedaily.com/releases/2010/04/100413112058.htm>.

¹⁵² "Bioengineered Salmon: California Bill Seeks Clear Label." *Health Freedom Alliance*. N.p., 1 Feb. 2011. Web. 11 May 2011. <<http://healthfreedoms.org/2011/02/01/bioengineered-salmon-california-bill-seeks-clear-label/>>.

¹⁵³ Lawrence, Robyn Griggs. "USDA Caves In to Monsanto on Roundup Ready Alfalfa Read more: <http://www.motherearthnews.com/natural-home-living/usda-caves-in-to-monsanto-on-roundup-ready-alfalfa.aspx#ixzz1MPUxn8og>." *Mother Earth News*. N.p., 31 Jan. 2011. Web. 15 May 2011.

<<http://www.motherearthnews.com/natural-home-living/usda-caves-in-to-monsanto-on-roundup-ready-alfalfa.aspx>>.

¹⁵⁴ "Guidance for Industry: Voluntary Labeling Indicating Whether Foods Have or Have Not Been Developed Using Bioengineering; Draft Guidance." *U.S. Food and Drug Administration*. U.S. Department of Health & Human Services, 22 May 2009. Web. 15 May 2011. <<http://www.fda.gov/Food/GuidanceComplianceRegulatoryInformation/GuidanceDocuments/FoodLabelingNutrition/ucm059098.htm>>.

¹⁵⁵ Onyango, Benjamin, Rodolfo M. Nayga, Jr., and Ramu Govindasamy. "U.S. Consumers' Willingness to Pay for Food Labeled 'Genetically Modified'." *Agricultural and Resource Economics Review* 35.2 (2006): 299-310. *AgEcon Search*. Web. 15 May 2011. <<http://ageconsearch.umn.edu/bitstream/10210/1/35020299.pdf>>.

The labeling of GE foods would likely decrease sales. For many consumers, the term GE has a negative association. A 2006 study found that consumers paid 6.5% less for cornflakes that were labeled “contains genetically modified corn” than the generic, unlabeled box.¹⁵⁶ And regardless of consumer awareness, producers argue that labeling all GE foods would be expensive and logistically difficult. Studies have estimated that the cost of labeling will increase GE food prices by at least 10 percent.¹⁵⁷ Producers do not merely pay for the stickers; they must pay to implement the complete labeling process. And as GE crops differ greatly from one another, these variations and exemptions will all have to be taken into account and labeled accordingly. Under current manufacturer practices, the manufacturer usually buy crops from many various farms and thoroughly mixes them. For example, when Syngenta, the creator of GE Enogen corn, discussed the possible impact if their GE corn mistakenly mixed with corn designated for corn starch, they reported that one amylase corn kernel mixed with 10,000 conventional kernels weaken the corn starch mixture.¹⁵⁸ This figure demonstrates both how well mixed the food processing system is and how many sources would have to be traced for each food product. GE labeling would require manufacturers to keep track of where every crop was grown and whether it was GE free. The issue of cross-pollination further complicates this. Must the manufacturer also know and label foods made from crops that were grown near GE crops? Producers are willing to label food items as Kosher, Halal, or organic, as consumers value these classifications more highly and are willing to pay the increased price. The consumers who want GE labeling, however, are largely seeking to avoid GE products. Thus, the producer would be raising the price of the product, for the benefit of non-customers.

Recommendation

¹⁵⁶ Onyango, Benjamin, Rodolfo M. Nayga, Jr., and Ramu Govindasamy. "U.S. Consumers' Willingness to Pay for Food Labeled 'Genetically Modified'." *Agricultural and Resource Economics Review* 35.2 (2006): 299-310. *AgEcon Search*. Web. 15 May 2011. <<http://ageconsearch.umn.edu/bitstream/10210/1/35020299.pdf>>.Ibid.

¹⁵⁷ McHughen, Alan. "Labeling Genetically Modified (GM) Food." *Agricultural Biotechnology*. The Regents of the University of California, 22 June 2008. Web. 15 May 2011. <<http://agribiotech.info/details/McHugen-Labeling%20sent%20to%20web%2002.pdf>>.

¹⁵⁸ Pollack, "U.S. Approves Corn Modified for Ethanol," *NYTimes* (February 11, 2011). http://www.nytimes.com/2011/02/12/business/12corn.html?_r=1

Despite the strong public demand, there is not yet sufficient evidence to require GE labeling under current FDA laws. The FDA claims that it does not have the jurisdiction to require these labels, as it would differentiate products that are not significantly different from equivalent non-GE foods.

While several studies have sought to find evidence of nutritional changes, allergens, or toxins, most have found no significant differences or require additional research to duplicate and confirm. If any of these studies can be supported, the FDA is obligated to require labeling.

In particular, the recent release of AquAdvantage GE salmon has raised questions and concerns about unlabeled GE foods.¹⁵⁹ The genetic engineering of animals is a new phenomenon and adds a new dimension of uncertainty. Do GE animals need different regulations than GE crops? Do GE animals present a greater risk? The pending release of GE salmon has pushed the issue of GE labeling to the forefront of the news.

The FDA should pay greater attention to both the public's lack of knowledge concerning GE foods and their demands for labeling. A public in which only 25% understand GE crops is not capable of making informed decisions about labeling. The FDA should first eradicate confusion over what a GE crop is and what the current scientific understanding of impacts is through a program of education. Such a program could potentially even sway public opinion towards greater acceptance of GEs and less interest in labeling. If interest in labeling continues after widespread knowledge has been achieved, however, the FDA should take the consumer's right to know and act into greater consideration. The right to know has been a key factor cited in European and Asian decisions to label GEs. The United States' failure to consider such a popular opinion – one held 92% of the American public and the majority of the international community- demonstrates a failure in communication.¹⁶⁰

¹⁵⁹ Layton, Lyndsey. "FDA Rules Won't Require Salmon Labels." *The Washington Post*. N.p., 19 Sept. 2010. Web. 16 May 2011. <<http://www.washingtonpost.com/wp-dyn/content/article/2010/09/18/AR2010091803808.html>>.

¹⁶⁰ "Biotechnology." *World Public Opinion*. N.p., 2008. Web. 11 May 2011. <http://www.americansworld.org/digest/global_issues/biotechnology/biotech3.cfm>.