

Pricing Nonrenewable Natural Resource Use: The Implications of a Severance Tax

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Table of Contents

Acknowledgements	iii
Introduction	1
<i>Roadmap</i>	4
Chapter 1	6
<i>Environmental Economics</i>	7
<i>Environmental Economics and Market Failures</i>	11
<i>Externalities in Environmental Economics</i>	12
<i>Property Rights</i>	15
<i>Market-Based Solutions</i>	17
<i>Rights of Future Generations as a Concept</i>	19
<i>Rights of Future Generations in Environmental Economics</i>	22
<i>Political Science Discussion</i>	33
<i>Conclusions</i>	42
Chapter 2	45
<i>Externalities-Oil and Natural Gas</i>	46
<i>Property Rights-Oil and Natural Gas</i>	51
<i>Market-Based Solutions-Oil and Natural Gas</i>	53
<i>Rights of Future Generations-Oil and Natural Gas</i>	58
<i>Conclusions</i>	61
Chapter 3	63
<i>Severance Taxes</i>	64
<i>Conclusions</i>	70
Chapter 4	73

<i>State Severance Tax Overview</i>	74
<i>Case Selection</i>	76
<i>Alaska</i>	81
<i>Alaska Policy Discussion</i>	88
<i>North Dakota</i>	96
<i>North Dakota Policy Discussion</i>	102
<i>Analysis</i>	107
<i>Conclusions</i>	113
Conclusion	116
<i>Policy Recommendation</i>	116
<i>Implications</i>	120
<i>Final Discussions</i>	122
Appendix A	124
Appendix B	125
References	129

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Introduction

I live approximately 90 minutes from campus by car. Before heading toward M-14/US-23, I fill up my gas tank. While driving, I watch my once full tank read less and less, until it is one-half full and I am finally home. I know that my gas is used up, disappeared into the atmosphere. But for the most part, I neglect the fact that my consumption means that a portion of a collective finite resource is now gone forever.

When thinking about the environment, we often consider long-term concerns: what does this water pollution mean for our world, what is the effect of air pollution, how will climate change affect the planet? But when thinking about energy and the nonrenewable natural resources that allow for it, the considerations—for the general public especially—become much more obscure.

The first time I carefully considered resource use and management was in Professor Disch’s class, Democratic Theory, where we explored the Great Lakes Water Compact, an international compact used to manage the resource of the Great Lakes by establishing rules on how much water may be withdrawn and for what purpose. The second time I examined resource use was in Professor Rabe’s class, Environmental Politics and Policy. In his class, I learned for the first time about the hydraulic fracturing—or fracking—movement. It was also the first time I actively thought about the energy industry and what it means to extract a finite resource for energy use.

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The basic story of energy use is common to most. People understand the essentials: that we extract oil, gas, coal—what have you—from the earth. This can be done using conventional drilling techniques, or through the use of the increasingly popular technique of horizontal hydraulic fracturing, a technology known (or criticized) for its use of millions of gallons of water, a mystery mix of chemicals, and the blasting of shale horizontally underground. Once the resource

Pricing Non-Renewable Natural Resource Use

is extracted, the common understanding is that somehow the resource is transported, exported and converted into an energy form that people can use to power their cars, trains, planes, houses, businesses, toys, appliances—you name it. Beyond these uses, we may only think about our energy use and consumption when we get our monthly gas and electric bill; that is, when we recognize the cost of this energy as determined by our utility company. That, or when the power goes out and in a state of darkness we recognize what we are missing (they do say you only know a good thing when it's gone). Despite our completely dependent relationship with energy and the resources that allow for it, a discontinuity exists between our recognition of the services that the resources of oil and gas provide, our recognition of the impacts of the use of those resources, and our recognition of the resources themselves.

As mentioned above, the common person is generally aware of the services that oil and gas provide, that is, anything energy related. But the average citizen does not often recognize the impacts of the use of those resources. That citizen may not completely understand or think about the impacts of his and his neighbor's energy use on a typical day. She may not know how the use of the resource effects the land, water and air quality as well as the lives of people who live in areas surrounding production sites of energy sources.

Although our citizen may not recognize or acknowledge these issues on a daily basis, policy does. This is why we see programs or regulations that mitigate problems associated with the production and consumption of energy sources. These include programs that attempt to address the problems of pollution, destruction, or climate change, as is the case with discussions of carbon taxes. In this sense, the citizen relies on policy to question and seek answers to problems not always transparent to the public eye.

In a similar manner, the representative citizen does not often recognize the resources of oil and natural gas for the value of the resource itself. The value of

The Implications of a Severance Tax

the resource itself can be best appreciated by considering what it means for it to be gone. Imagine a state, occupied by a future generation of individuals just like us who have used up the last of the finite energy resources that the state relies on today. Instead of preparing for this moment and saving the wealth of the resource by looking for alternative options or conducting research, the generations before this generation focused only on the extraction of the resource and the capitalization of that wealth. This state that has lost its previous form of wealth, is left impoverished, without its primary source of revenue and energy. If collectively this were the fate of many states, the world may be left completely impoverished and with an energy crisis. This situation, though extreme, paints a picture for the value of a resource in and of itself.

In this case, unlike questions of resource impact, policy does *not* often recognize the importance of the resources themselves and the importance of having a plan to replace them. In questions of nonrenewable natural resource management, policy does not provides answers through programs or regulations that mitigate the problems associated with resource use. In this sense, policy is failing us by failing to recognize what is finite.

Energy sources are nonrenewable. We know oil and natural gas will run out some day, although whether that will be in five, 50, 500 or 5,000 years is up for question. This finite quantity of energy sources brings up policy questions of whether we are able to recognize the value of the resource itself, whether we care to protect this value for future generations and whether we should act to address and manage our use of the nonrenewable resource. This finite quality of energy sources leaves questions of whether solutions exist to mitigate use and preserve the use of resources for future generations. If these solutions exist, what are they?

That is what this thesis seeks to address. In this thesis I will explain that we, and policy more specifically, should care about how the resource is used and managed with considerations for future generations. I will explain that there is a

solution to managing the use of the nonrenewable natural resource so that its value is protected for future generations to come. I conclude with a policy recommendation of how to address and answer these questions.

Roadmap

The structure of this thesis is as follows:

In the first chapter, I explain the field of environmental economics, and clarify why it is an appropriate framework to address questions of natural resource use. I then consider externalities, property rights, natural resource management and the rights of future generations as concepts. I will also provide some examples of “market-based solutions” to provide context for the use of that term in later chapters. This chapter will conclude having explored sustainability and how we care about future generations when considering resource use. It will also conclude having commented on the importance of political feasibility.

In the second chapter, this thesis will explore oil and natural gas as representative nonrenewable resources. It will then expand on concepts defined in the first chapter by reviewing externalities associated with oil and natural gas production, as well as property rights associated with oil and natural gas. In this chapter I will review current market-based solutions to oil and natural gas problems, such as the carbon tax. I will conclude by reviewing literature regarding resource management of oil and natural gas and rights of future generations.

In the third chapter I will provide my solution to questions of managing resources for future generations: severance taxation. In this chapter I will clarify the term ‘severance tax’ more specifically. Building upon concepts defined in the first chapter and re-worked in the second chapter, this third chapter will attempt to prescribe how severance taxes may be used to address problems of oil and natural gas production and use. That is, how severance taxes can address resource management and the rights of future generations to oil and natural gas.

The Implications of a Severance Tax

In the fourth chapter I will examine the case studies of Alaska and North Dakota to provide descriptive evidence for current severance tax structure in the United States. I will explore these severance taxes as a test to examine whether the prescriptions made in the third chapter are a current reality or something severance taxes do not currently address, but should. This commentary will be designed to explore whether we can adapt severance taxes as a potential sustainability project, resisting the temptation of exploitation and short term profit.

The conclusion will provide a policy recommendation for states in using a severance tax to fully and comprehensively address resource management for the future. This solution will be contingent on the implementation of severance taxes as well as appropriate allocation of severance tax revenue. It will also rely ultimately on the political feasibility of this solution. I will conclude with commentary on the implications of this thesis for promoting further research on severance taxation and resource management.

Chapter 1

Sitting in my introductory sustainability course in the beautifully renovated Dana Building, which houses the School of Natural Resources and Environment, I remember reviewing concepts associated with various environmental ethics. This was interesting because I already understood there were debates surrounding energy and the environment, but I guess it had never dawned on me that there were also debates regarding what form the solutions may take. I learned that value systems play a role in how people understand the environment and attempt to mitigate and solve the problems they recognize. I learned there was no right answer, but merely a set of arguments for or against any framework.

Imagine, for example, the section in which our class used Marxism to criticize capitalism from an environmental perspective. The business school students in this class resisted this argument, while the Program in the Environment students fully backed some of the arguments. And I, as a political science major, watched the interactions and debates between these two camps of students with great interest.

Fast forward a year or so and I recognize the relevance of these ethical arguments when choosing my own thesis topic. Deciding to look into natural resource management and severance taxes puts me into the already existing camp of environmental economics. With this decision I began to think, what are the benefits to this approach? What are the drawbacks? This is what part of this chapter will explore. In doing so, I begin my argument for this thesis, but I also bring larger meaning to my own college experience through the reflection and implementation of arguments explored in past classes.

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In order to understand the management of natural resources such as oil and natural gas from a theoretical perspective, I must first provide context on the

current literature surrounding environmental policy. This chapter seeks to provide that context by discussing the theory of environmental economics. It will also address the concepts of the externality, property rights, market-based solutions, natural resource management and rights to future generations in order to provide a foundation for discussing the potential goals of nonrenewable natural resource management.

This chapter will conclude by arguing specifically that the rights of future generations to nonrenewable natural resources can be understood as a market problem that environmental and ecological economics recognizes as vital to solve. This chapter will also shed light on how a solution can be achieved, namely through a tax and revenue allocation scheme.

Environmental Economics

In the long term, the economy and the environment are the same thing.
If it's unenvironmental it is uneconomical. That is the rule of nature.

—Mollie Beattie, Former Director of the United States
Fish and Wildlife Service¹

In a broader context, environmental economics is one approach to addressing environmental issues and resource management. Still, environmental policy is broad, defined by many movements and ethics, such as

¹ Parenteau, Patrick. 1997. "She Runs With Wolves: In Memory of Mollie Beattie." *The Trumpeter* 14 No.2. <http://trumpeter.athabascau.ca/index.php/trumpet/article/view/176/218>.

The Implications of a Severance Tax

transcendentalism;² conservation versus preservation;³ Aldo Leopold's "land ethic";⁴ and deep ecology,⁵ to name a few. These ethics require recognition, so that the solutions they produce can be better understood. As Judith Layzer lays out in the introduction to her book, *The Environmental Case: Translating Values Into Policy*, "(1) environmental policy conflicts almost always concern fundamental differences in values, and (2) the way problems are defined and solutions depicted plays a central role in shaping how those values get translated into policies."⁶ The values of environmental economics are distinct from other approaches to the environment. For example, environmental economics places a material value on the environment in a way that contradicts the way many other environmental ethics understand the value of the environment. This valuation by environmental economics can be better understood from an ethical framework.

Many environmental movements reflect one of two ethical standpoints: anthropocentrism or ecocentrism. Anthropocentrism places human considerations

² Transcendentalism was advocated by Henry David Thoreau and held that "human potential lay in intuition and a close relationship to the natural world" See Robbins, Paul, John Hintz, and Sarah A. Moore. 2010. *Environment and Society*. United Kingdom: Jon Wiley & Sons Ltd. 69.

³ The debates of conservation and preservation defined the historical argument over Hetch Hetchy Valley and whether it should be protected for the landscape it was, or if it should be converted into a reservoir for the benefit of people. On one side of this argument was Gifford Pinchot who advocated for conservation. That is, he advocated for "the efficient and sustainable use of natural resources." This conservation argument promoted a utilitarian approach to the environment. On the other side of the argument was John Muir who promoted a preservation ethic—an ethic that advocated for the protection of the environment for its own sake (Robbins, Hintz, and Moore 2010, 68-69).

⁴ Aldo Leopold's Land Ethic focuses on the idea that humans are a member of their biotic community, which includes the "land," or the combination of the soil, waters, plants and animals. Because humans are a member of the biotic community, they cannot dominate the land, but rather, they must respect the biotic community's fellow members as equals. Leopold once wrote of the Land Ethic, "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise" (Robbins, Hintz, and Moore 2010, 70).

⁵ Deep ecology is a term that was created by philosopher Arne Naess as a response to what he called "shallow ecology" or mainstream environmentalism. Deep ecology is characterized by attention to the "deeper questions" and an ecologically-focused worldview. It emphasizes the interconnectedness of all things and the intrinsic value of nature (Robbins, Hintz, and Moore 2010, 74).

⁶ Layzer, Judith. 2012. "A Policymaking Framework (Chapter 1)." In *The Environmental Case: Translating Values Into Policy*, 3rd ed., 1. Washington, DC: CQ Press.

above those of nature, while ecocentrism is an ethical position that believes that ecological concerns should be above human priorities and central to the decision making process.⁷ The problem with environmental economics, according to critics, is that it cannot maintain ecocentric values.⁸ The very principle of the environment as an asset demonstrates that environmental economists view the environment relative to its human use. This is especially problematic when the values of nature cannot be measured monetarily. Take, for example, the inherent, aesthetic, or evolutionary value of a species. This “worth” does not indicate a tangible good or service that we can value in monetary terms. It therefore makes economic valuation in these situations especially difficult.⁹

Environmental economics also falls under the scrutiny of many environmentalists, as they believe that capitalism is largely, if not primarily, responsible for environmental degradation. To them, it seems misguided to think that the market can reverse the damage that a market society has caused. Robbins et al. mirror this very thought when they state, “As global trade continues to devour, mobilize, and dump resources, objects, and fuels at an accelerating pace, it becomes difficult to imagine how such energies could ever be harnessed and simultaneously controlled.”¹⁰

The centerpiece of an environmental economics approach is the notion of the environment as an asset. This means that the environment is seen to provide a number of services, from raw materials for energy and production to services for consumers like air and water. This conceptual framework allows environmental economics to focus on preventing the “undue depreciation of” the environment’s

⁷ (Robbins, Hintz, and Moore 2010, 67)

⁸ (Robbins, Hintz, and Moore 2010, 43-44)

⁹ (Robbins, Hintz, and Moore 2010, 42)

¹⁰ (Robbins, Hintz, and Moore 2010, 44)

value.¹¹ By valuing the environment in this manner, environmental economists employ a “cost-benefit” analysis to decide whether prevention strategies are warranted and how much sense it makes to invest in them in order to address environmental concerns.

It may seem heretical (and certainly anthropocentric) to reduce the environment to the set of “services” it provides and to attempt to set a monetary value on those services, but that is precisely what it means to conceive of the environment as an asset. Still, an environmental economics approach has certain merits that make it a useful framework for understanding and addressing environmental issues. For example, the environmental economics approach falls into the framework of our society; it does not require a major transformation of our current social values and individual mindsets to work. It is “the most dominant, widespread, and uncritically accepted ways of thinking about the environment in the early twenty-first century.”¹² In this sense, using an environmental economics approach does not require waiting until the goals and understanding of society change. Instead, it requires using the structure in place to try and solve problems. The benefit then, is that we can act *now*.

Environmental economics is relevant to the discussion of how to manage natural resources because it provides a framework to find solutions to environmental problems. Environmental economics is “the application of the tools of economics to the topic of environmental and resource issues.”¹³ Tietenberg and Lewis comment,

Both ecological economics and environmental economics provide a basis not only for identifying the circumstances that degrade the environment,

¹¹ Tietenberg, Tom, and Lynne Lewis. 2009. *Environmental and Natural Resource Economics*. Eighth Edition. Addison-Wesley Series in Economics. Boston, MA: Pearson Education, Inc.

¹² (Robbins, Hintz, and Moore 2010, 44)

¹³ Berck, Peter, and Gloria Helfand. 2011. *The Economics of the Environment*. 1st ed. Boston, MA: Pearson Education, Inc., publishing as Addison-Wesley. 2.

but also for making clear how and why that set of circumstances supports degradation.¹⁴

They state that environmental (and ecological) economics concerns itself with using market forces to incentivize sustainable environmental outcomes. In this sense, environmental economists use the market to explain and solve environmental issues.

I move forward with this framework of environmental economics as this next section will continue the discussion of the principles of environmental economics. Although the field of environmental economics encompasses vastly diverse concepts, for our purposes, I am interested in exploring only two: 1) the concept of the externality; and 2) that of rights of future generations. These concepts are connected, especially when discussing nonrenewable natural resource management. I will explore and define these concepts in the following sections so as to provide foundation for future discussions of oil and natural gas resource use and management.

Environmental Economics and Market Failures

Environmental economists provide a particularly acute analysis of what they term “market failures” for environmental goods. Market failures are instances of perverse outcomes that occur when the production or exchange of a good is not efficient.¹⁵ Berck and Helfand explain that market failures for environmental goods are often described by the following categories: lack of ownership or transferability; open access; externality; public goods; providing for the future and government caused- failure.”¹⁶ I am most interested in their commentary on the concepts of the externality and providing for the future

¹⁴ (Tietenberg and Lewis 2009)

¹⁵ (Robbins, Hintz, and Moore 2010, 34)

¹⁶ (Berck and Helfand 2011, 46-47)

because these two categories are ones that are closely related to questions of oil and natural gas use as well as use of other nonrenewable natural resources. When dealing with oil and natural gas, questions of what is the impact (what is the externality) as well as questions of resource management and conservation for future generations are common, as later sections will indicate.

Berck and Helfand define an externality as “an effect, other than a change in prices, of a market transaction on a nonparticipant in that market...the effect is called an externality because it is external to the market.”¹⁷ This means that the market participant causing the effect is not paying for that effect. Berck and Helfand also discuss the idea of “providing for the future” by clarifying, “If people put inadequate weight on the effects of present activities for the future, the future may end up without sufficient resources.”¹⁸ This means that by ignoring the impact of our activities today, we may leave future generations with a lack of resources. I will next explore these concepts in further detail. In the midst of this discussion I will also look into solutions to market failures as a focus of environmental economics.

Externalities in Environmental Economics

People 'over-produce' pollution because they are not paying for the costs of dealing with it.

—Ha-Joon Chang¹⁹

In economics, an externality refers to spillover costs or benefits. Tom Tietenberg explains, “An externality exists whenever the welfare of some agent, either a firm or household, depends not only on his or her activities, but also on

¹⁷ (Berck and Helfand 2011, 47)

¹⁸ (Berck and Helfand 2011, 47)

¹⁹ Chang, Ha-Joon. 2011. *23 Things They Don't Tell You About Capitalism*. New York: Bloomsbury Press.

activities under the control of some other agent.”²⁰ By this he means that the externality is a market failure, where one agent does not face all the consequences of his actions. In this sense, an externality is that which is external to the agent’s costs. Berck and Helfrand also clarify why externalities are seen as a “market failure.” They state:

Externalities are common. They are, however, unlikely to be addressed adequately by private markets; the participants in the market decision have no reason to think about the effects of their activities on third parties, even if the third parties suffer from their exchange.²¹

This means that those causing externalities will often not work to eliminate them. While Arthur C. Pigou is credited for the concept of the externality,²² substantial literature attempts to redefine and rework that concept.²³ However, for purposes of our discussion, we will remain and work with a simple definition: an externality is an impact, either a cost or benefit, that an agent (collective or individual) faces as a result of another agent’s actions.

According to Tietenberg, externalities can be either positive (external economy) or negative (external diseconomy). With a positive externality, the affected party benefits from the externality, while with a negative externality, the affected party is harmed or damaged by the externality.²⁴ When discussing environmental concerns, we are most interested in talking about a negative externality, that is, for example, the harm to the environment that a company’s pollution causes. This is because searching for positive externalities does not

²⁰ Tietenberg, Tom. 2004. *Environmental Economics and Policy*. 4th Edition. The Addison-Wesley Series in Economics. Colby College: Pearson Education, Inc.

²¹ (Berck and Helfand 2011, 49-50)

²² Based on discussions found in: Pigou, Arthur C. 1932. “Welfare and the Nation Dividend.” In *The Economics of Welfare*, 4th Edition. London: Macmillan and Co.

²³ For example, in 1960 Ronald H. Coase reworked solutions associated with externality problems. He argued that externalities can be most efficiently mitigated through bargaining between agents (Robbins, Hintz, and Moore 2010, 33).

²⁴ (Tietenberg 2004)

allow us to target external problems and prescribe solutions, while addressing negative externalities does permit us to do so.

In order to better understand the concept of the externality, it may be useful to review some examples. If we return to Tietenberg's commentary, he explains that a steel company's waste, when dumped into a nearby river, will provide a negative externality of pollution and a loss of business for the resort hotel located downstream.²⁵ In this example, the steel company is not bearing any cost related to its decision and will most likely continue making the decision that causes water pollution, as long as that decision comes at no cost. In a similar sense, a factory that is emitting chemicals into the air, if unregulated, will most likely continue to pollute the air. This pollution would be harmful to the air quality of the surrounding area, imposing an external cost to the health and happiness of the citizens of that area. But from an economic standpoint, because that decision to emit comes at no cost to the factory owner, this market failure may persist.

Of course, there are market externalities that occur in situations unrelated to the environment.²⁶ But when we talk about the environment and externalities, our focus often becomes that of a negative side effect of an agent's action, like pollution. This project is specifically interested in the externalities of resource use and the relation that has to the rights of future generations to that resource. This adds greater complexity to the notion of an externality because it conceives of negative side effects extending over time which means that agents in the present have responsibilities toward future agents whom they may never actually meet—An idea I will explore in later sections. With this concept of the externality

²⁵ (Tietenberg 2004)

²⁶ Such as situations between individual agents where one person's activity comes at some cost or grievance to another.

established, I will now move our discussion forward to talk about property rights in order to establish its relation as a solution to externalities.

Property Rights

The concept of property and rights has an extensive literature.²⁷ According to Tietenberg, however, in economics, “property right refers to a bundle of entitlements defining the owner’s rights, privileges, and limitations for use of the resource.”²⁸ These property rights then assign the rules that each agent may follow. Tietenberg clarifies that understanding property rights will help clarify how environmental problems arise from government and market allocations. Take the example from our previous section, in which the steel company polluted the water that both it and the resort hotel accessed. In that case, because the water belonged to neither agent, the steel company was allowed to pollute in a manner that created problems—negative externalities—for the resort hotel.

Some scholars, such as William J. Baumol and Wallace E. Oates argue that “[t]he source of an externality is typically to be found in the absence of fully defined property rights.”²⁹ Baumol and Oates clarify that in situations where property rights can be redefined, doing so oftentimes serves as an option for addressing an externality. For example, consider the case of transferring public ownership to private. In the example of the steel company and the resort, the externality could be removed if the steel company proceeds to buy off the river

²⁷ Take for example the work of political theorist John Locke. Locke said in his *Second Treatise of Government*, Chapter V: Of Property (1690), that man has property “in his own person.” That is, man owns his body and the labor of that body. According to Locke, man is able to obtain property by mixing his labor with nature; “The labour that was mine, removing them out of that common state they were in, hath fixed my property in them.” See Locke, John. 2008. “*Second Treatise of Government*.” In *Modern Political Thought*, 2nd Edition, 285–353. United States of America: Hackett Publishing Company, Inc.

²⁸ (Tietenberg 2004)

²⁹ Baumol, William J., and Wallace E. Oates. 1988. *The Theory of Environmental Policy*. 2nd Edition. Cambridge, UK: Cambridge University Press. 26.

and the land downstream. As the owner of both the river and the land, the steel company would no longer cause harm to the resort downstream and would remove the negative externality. Of course, this approach is contingent on a number of things. Most importantly, it requires that the river can in fact be purchased and transferred from public property to private. It also requires that the resort is willing to sell its land, which might be unlikely. Furthermore, privatization will still fail to address the long-term damage to the river.

As this indicates, there are situations where redefining property rights may not be the best solution; “Establishing rights in ‘clean air,’ for example, is not a simple matter. There may moreover be other reasons for desiring free access to certain socially held resources.”³⁰ With this, Baumol and Oates refer specifically to examples such as pollution and rights to resource use, where property boundaries are difficult to establish and where people want resource use to remain public. In this study, the approach of redefining property rights to manage externalities will not work. This is because the resources of oil and natural gas and their externalities will remain a problem for many despite who benefits from their use. This discussion and the externalities of oil and natural gas will be further reviewed in Chapter 2.

In short, property rights are discussed here to clarify their relationship to externalities. As we can see, situations where property rights are poorly defined exacerbate the problem of the externality; thus, redefining property rights might be a sufficient solution. In situations where property rights cannot be redefined there are alternative regulatory measures to consider, such as market-based solutions.

³⁰ (Baumol and Oates 1988, 28)

Market-Based Solutions

The goal of environmental economics is to address market failures as expressed via externalities through market instruments. The concept of market instruments refers to solutions that can be achieved through the market. Robert Stavins and Bradley Whitehead argue that market-based solutions used to address environmental issues and externalities can be divided into six major categories: pollution charge systems; tradable permits; deposit-refund systems; reducing market barriers; eliminating government subsidies; and providing public information.³¹ I will briefly explore these concepts in order to establish a greater understanding of market-based solutions and their operation.

Pollution charge systems, according to Stavins and Whitehead, “assess a fee or tax on the amount of pollution that a company or product generates.”³² This type of tax, they clarify, would be applied specifically to the amount of pollution generated, not to the amount of resource extracted. The goal with this market-based instrument, then, would be to incentivize the company to reduce their carbon emissions in a manner that makes most sense to them economically. Furthermore, a tax-based scheme (such as a pollution charge system) also has a secondary property of revenue generation. This property allows for revenue allocation considerations.

Under a tradable permits scheme, the government would set a target allowance for pollution in an industry or area.³³ The government would then distribute permits that allow companies to emit a certain amount of pollution. Depending on a company’s circumstances it may prove more cost effective for them to lower their emissions and sell their surplus permits. Similarly, companies

³¹ Stavins, Robert, and Bradley Whitehead. 1997. “Market-Based Environmental Policies.” In *Thinking Ecologically: The Next Generating of Environmental Policy*, 105–15. Yale: Yale University Press. 230-232.

³² (Stavins and Whitehead 1997, 230)

³³ (Stavins and Whitehead 1997, 230)

that emit an amount over what their permit allows for may find it more cost effective to buy permits from other companies. In this sense, the firms themselves determine how the permits will be distributed.

Yet another market-based solution can be found in deposit-refund systems. Deposit-refund systems refer to instruments such as beverage-container deposits where consumers pay a surcharge when making a purchase and get the money back when they return the product for recycling. Reducing market barriers refers to measures that make exchange easier. Eliminating government subsidies refers to the idea of removing subsidies that encourage wasteful practices when the market price would be better fit to promote more environmentally friendly practices. Providing public information relies on disclosure programs, such as the Toxic Release Inventory,³⁴ to allow consumers to make informed decisions and incentivize companies to act in a more environmentally friendly way to attract customers.³⁵

As this section has shown, there are a number of ways to address externalities associated with environmental issues. Different market-based solutions are targeted to different problems. By the end of this chapter I clarify specifically what problem I seek to address when considering nonrenewable

³⁴ The Toxic Release Inventory (TRI) and its implications are explored in Michael E. Kraft, et. al's book *Coming Clean: Information Disclosure and Environmental Performance*. In this book the authors explain that the TRI is a disclosure program that was established in 1986. The TRI was effective in reducing chemical use. Studies show that chemical releases were reduced by 61 percent between the years of 1988 to 2007 (Kraft, Stephan, and Abel 2011, 181). Despite the success of the TRI, Kraft et.al identifies areas of improvement and suggestions for addressing them (Kraft, Stephan, and Abel 2011).

Interestingly enough, I read Kraft, et. al's book as a student in Professor Rabe's Political Science 380 course. Nearly a year later, while working on this thesis, I had the pleasure of attending a lecture by Michael Kraft and sponsored by the Center for Local, State and Urban Policy, on this subject matter. I also attended a dinner with Michael Kraft at the invitation of Professor Rabe. During Kraft's lecture, he discussed the implications of the TRI for the regulation of hydraulic fracturing, namely the disclosure of chemicals used in the fracking process. For more information about Michael Kraft and his lecture, see: Center for Local, State, and Urban Policy. Dec 2013. "Using Information Disclosure to Achieve Policy Goals: How Experience with the Toxics Release Inventory Can Inform Action on Shale Gas Fracking." <http://www.fordschool.umich.edu/events/calendar/1601/>.

³⁵ (Stavins and Whitehead 1997, 232)

natural resource use and management. I will explore the necessary properties of a solution to that problem and will use Chapter 3 to name the specific policy solution with those properties. With that, I now turn towards another concept within environmental economics: the rights of future generations and sustainability.

Rights of Future Generations as a Concept

A society grows great when old men plant trees
whose shade they know they shall never sit in.

—Greek Proverb³⁶

When discussing environmental economics and the externality, we come to what may be understood as one type of externality: the externality of nonrenewable resource use that impacts the rights of future generations to that resource. This section will explore the term “rights of future generations” in general. The section that follows will continue this discussion within the environmental economics framework specifically, and justify why we can consider the rights of future generations an externality that must be accounted for via a market-based solution. It will also begin to identify taxation and revenue allocation as the solution to address the rights of future generations to nonrenewable natural resources.

When discussing the rights of future generations in regards to environmental issues, we are considering what right future generations have to natural resources and environmental quality. This concept is often described with the term “sustainability.” In order to first understand the concept, it is useful to

³⁶ Quotes.net, STANDS4 LLC. 2014. "Greek proverb Quotes." <http://www.quotes.net/quote/38505>.

explain the literature and history of the term outside the environmental economics framework.

Discussions of resource use and development in relation to people's present and future rights are not new. In 1972, Donella Meadows and colleagues published a report for the Club of Rome in which they used a world model to investigate trends of global concern, including the depletion of nonrenewable resources. In 1987 the Brundtland Commission of the United Nations—formally named the World Commission on Environment and Development—defined the term sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”³⁷ In so doing they emphasized the importance of supplementing adequate resources to today's generation but not at the expense of the future; they promoted intra-generational and inter-generational equality.³⁸ In 1992 the United Nations Conference on Environment and Development met at the Rio de Janeiro Summit where they established certain principles for respecting and recognizing global development and environmental integrity. Within their principles, they highlighted the importance of considering both the current and future generations' needs.

They also introduced the “precautionary principle” which stated:

In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.³⁹

³⁷ World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.

³⁸ That is, equality among people of one generation and people of all generations, respectively.

³⁹ United Nations Conference on Environment and Development. 1992. “Rio Declaration on Environment and Development.” Rio de Janeiro: United Nations Environment Programme. <http://www.unep.org/Documents.Multilingual/Default.asp?documentid=78&articleid=1163>. Principle 2.

At the 2002 World Summit on Sustainable Development in Johannesburg, the United Nations produced Agenda 21 as a plan for sustainable development. Within Agenda 21, they also highlighted the importance of considerations of future generations. Specifically, they advised governments to adopt national strategies for sustainable development and noted that the goals of these governments “should be to ensure socially responsible economic development while protecting the resource base and the environment for the benefit of future generations.”⁴⁰ As these reports and summits show, the idea of sustainability and rights of future generations has been considered across nations.

Beyond this history, we can delve further into the literature to gain a better understanding of the concept of rights of future generations. Harriss probes us to think about the rights of future generations when he questions, “is the present cheating the future?”⁴¹ Jeurissen and Keijzers furthermore qualify this concept with “the principle of generational equality.” They define the principle of generational equality as the idea that “moral considerations should be impartial over generations.”⁴² In this definition they argue that we have a moral *obligation* to take the future into account when making our own decisions about depletion and pollution. They argue that although we are uncertain about the preferences of future generations, we can make the assumption that they will want resources and access to a clean earth.⁴³

For rhetorical purposes, I will mainly use the term “rights of future generations” when discussing these ideas further. For a sense of clarity, when I

⁴⁰ United Nations Conference on Environment and Development. 1992. “Agenda 21.” Rio de Janeiro: United Nations Sustainable Development. <http://sustainabledevelopment.un.org/content/documents/Agenda21.pdf>.

⁴¹ Harriss, C. Lowell. 2006. “Nonrenewable Exhaustible Resources and Property Taxation: Selected Observations.” *American Journal of Economics and Sociology* Vol. 65 (No. 3). Natural Resources, Taxation, and Regulation: Unusual Perspectives on a Classic Topic: 696.

⁴² Jeurissen, Ronald, and Gerard Keijzers. 2004. “Future Generations and Business Ethics.” *Business Ethics Quarterly* Vol. 14 (No. 1). Philosophy Documentation Center: 49.

⁴³ (Jeurissen and Keijzers 2004, 49)

say rights of future generations, I am referring to the concept that future generations should have access or rights to the resources we use, specifically nonrenewable natural resources, or some sort of substitute. This concept suggests that the present generation take into account these rights when making decisions that might threaten them.

Using this intuitive understanding and explicit definition of the rights of future generations, we now turn to understand these rights within an environmental economics framework. The concept of the rights to future generations within the framework of environmental economics expands to not only what the rights are, but how the present generation ought account for them.

Rights of Future Generations in Environmental Economics

There is something fundamentally wrong in treating the Earth as if it were a business in liquidation.

—Herman E. Daly, former World Bank economist⁴⁴

In a traditional economics framework, there is a tendency to devalue the future.⁴⁵ That is, the understanding is often that the future is worth less to decision makers than the present. This devaluing is called “discounting” and is demonstrated through the “discount rate.” Discounting and the discount rate refers to the process of calculating the present value of the distant future.⁴⁶ It is a numerical way to express the value judgment that the present is worth more than the future and that beyond a certain point, the worth of the future to current

⁴⁴ See Cayley, David. 1991. “The Age of Ecology: The Environment on CBC Radio’s Ideas” Canada: James Lorimer and Company, Publishers. 238.

⁴⁵ (Jeurissen and Keijzers 2004, 56)

⁴⁶ (Tietenberg 2004)

generations is insignificant.⁴⁷ That is, people who live now inherently prefer current over future consumption.⁴⁸ In regards to resource extraction specifically, discount rates tend to skew extraction toward the present, since “they give the future less weight in balancing the relative value of present and future resource use.”⁴⁹

Economist William Nordhaus also provides some commentary on discount rates. In a critique of the *Stern Review* he explains that discount rates are central to questions of climate change policy, as well as all investment decisions.⁵⁰ He explains that the discount concept reviews the weight of the economic welfare of generations over time, with a zero time discount rate representing the equal treatment of all future generations and a positive time discount rate representing a reduced welfare of future generations.⁵¹

Of course this discount rate is problematic because it directly challenges the argument that we should care about future generations and their rights to nonrenewable natural resources. As Jeurissen and Keijzers argue in regards to the discount rate, “This assumption would thwart the principle of generational equality, because costs and benefits of future generations would count less than those of present generations.”⁵² This means that under this structure, traditional economics assumes that investment in the future does not make economic sense because the future is “worth less.”

Although the future may be devalued from a traditional economics standpoint, several authors have worked to show why discounting is not a

⁴⁷ Costanza, Robert and Herman E. Daly. 1992. “Natural Capital and Sustainable Development.” *Conservation Biology* Vol. 6 (No. 1): 37–46.

⁴⁸ (Costanza and Daly 1992; Pigou 1932, 26)

⁴⁹ (Tietenberg 2004)

⁵⁰ Nordhaus, William. May 2007. “The *Stern Review* on the Economics of Climate Change.” http://www.econ.yale.edu/~nordhaus/homepage/stern_050307.pdf. 9.

⁵¹ (Nordhaus 2007, 11)

⁵² (Jeurissen and Keijzers 2004, 56)

completely sound economic concept and why a high discount rate is especially inapplicable within an environmental economics framework. For example, Pigou argued that discounting is not necessarily economic. He stated that although people will prefer present satisfactions to future satisfactions of equal magnitude, that preference does not imply that the present satisfaction of a given magnitude is greater than a future satisfaction of the same magnitude. In this sense, he shows that the existence of preference for the present over equally certain future satisfactions “does not imply that any economic dissatisfaction would be suffered if future pleasures were substituted at full value for present ones.”⁵³ With this, Pigou reveals that discounting is not necessarily economic in decision making for individuals. However, he does acknowledge that the concept of discounting becomes complicated when we consider satisfactions not belonging to the present. That is, he acknowledges that “our desire for future satisfaction would often be less than for present satisfaction because it is very likely that the future satisfaction will not be our own.”⁵⁴ Pigou mitigates this discrepancy by arguing that although individuals may discount the future, government need not. He states that the state should protect the interests of the future: “It is the clear duty of Government to watch over, and, if need be, by legislative enactment, to defend, the exhaustible natural resources of the country.”⁵⁵ Nordhaus mirrors this through his precaution that when considering environmental questions, individual preferences are not applicable because they would greatly discount the future. This, he says, “has no necessary connection with how social decisions weight different generations.”⁵⁶

⁵³ (Pigou 1932, 25)

⁵⁴ (Pigou 1932, 26)

⁵⁵ (Pigou 1932, 28)

⁵⁶ (Nordhaus 2007, 13)

Howarth also provides an argument about discounting. He demonstrates why discounting may not be entirely applicable within an environmental economics framework and specifically within climate change considerations. Howarth argues that although individuals may discount future private decisions, that does not mean that policy makers should discount the costs and benefits to future generations.⁵⁷ He also explores the concept of stewardship: the duty of present individuals to protect and conserve environmental quality for future generations as moral grounds for why discounting the future is unjust.⁵⁸

Costanza and Daly also provide a critique of the discount rate. They argue that while individuals do discount the future, they may discount too much, leading to disastrous situations. Jeurissen and Keijzers parallel this observation when they state, “Realistic expectations must undergird any discounting of the future. Risks, for example, will become near certainties, if sustained over long time.”⁵⁹ In this sense, individual behavior and preferences may not always lead to optimal social behavior.⁶⁰ Costanza and Daly then argue accordingly:

[T]he discount rate used by the government for public policy decisions (like valuing natural capital) should be significantly lower than the rate used by individuals for private investment decisions. The government should have great interest in the future than individuals currently in the market...⁶¹

With this, Costanza and Daly reflect a similar argument as Pigou: that the government should value the future more than individuals. Given this argument, we can understand that there is reason for policy to make socially optimal decisions for the general public when the public would tend to do otherwise.

⁵⁷ Howarth, Richard B. 2006. “Against High Discount Rates.” *Perspectives on Climate Change; Science, Economics, Politics, Ethics* 5 (January): 102.

⁵⁸ (Howarth 2006, 107-108)

⁵⁹ (Jeurissen and Keijzers 2004, 56-57)

⁶⁰ (Costanza and Daly 1992)

⁶¹ (Costanza and Daly 1992)

Beyond this review of the discount rate, there is much literature in the field of environmental economics dedicated towards the value and rights of future generations through sustainability.⁶² These authors argue mainly that, when considering environmental economics, we care about sustainability and the protection of resources for future generations. I will now explore a few of these authors' specific arguments.

Environmental economist Tom Tietenberg elaborates what he terms the "sustainability criterion." He states that the sustainability criterion means that future generations should not be left worse off than current ones:

In essence, the sustainability criterion suggest that earlier generations are at liberty to use resources that would thereby be denied to future generations as long as the well-being of future generations remains just as high as that of all previous generations. On the other hand, diverting resources from future use would violate the sustainability criterion if it reduced the well-being of future generations below the level enjoyed by preceding generations. One of the implications of this definition of sustainability is that it is possible to use resources (even depletable resources) as long as the interests of future generations could be protected. Do our institutions provide adequate protection for future generations?⁶³

Tietenberg thus claims that the sustainability criterion requires that we take care of future generations interests, but that does not inhibit us from utilizing resources today. As long as we are protecting and regulating resource use in some manner, we may achieve the sustainability criterion. He then ends with the question of whether our government institutions provide adequate protection for future generation. As Tietenberg and these other authors have shown, there is an understanding that it is the role of the government to protect resources for the future. This thesis will seek to answer Tietenberg's question by showing that

⁶² (Tietenberg 2004; Costanza and Daly 1992)

⁶³ (Tietenberg 2004, 86)

current institutions do not sufficiently protect nonrenewable natural resources for future generations, but there does exist a solution for state institutions to do so.

Daly and Constanza, as ecological economists, also provide insight on sustainable development in light of resource depletion. In doing so, they provide a framework for understanding how the rights of future generations are important in ecological economics. As ecological economists, they take a slightly different approach to economics than environmental economists; they greatly value sustainability and the “precautionary principle.”⁶⁴ They also value the preservation of natural capital as opposed to addressing the concept of externalities, (which is the core of environmental economics).⁶⁵

In their article, *Natural Capital and Sustainable Development*, Daly and Constanza describe natural capital as “the stock that yields the sustainable flow.”⁶⁶ More specifically they explain the terms renewable natural capital and nonrenewable natural capital. According to them, renewable natural capital (RNC) is a stock that yields a harvestable resource or it is a flow of ecosystem services. The examples they give include sunshine, apples and fish.⁶⁷ In contrast, nonrenewable natural capital (NNC), they explain, yield no services until extracted. The examples they give include fossil fuel and mineral deposits.⁶⁸ Because this paper seeks to address finite resource management, Daly and Costanza’s discussion of nonrenewable natural capital is relevant to our understanding for purposes of later analysis.

They use these terms (RNC and NNC) in the context of explaining sustainable development, that is, of conserving natural capital for future

⁶⁴ Van den Bergh, Jeroen C.J.M. 2001. “Ecological Economics: Themes, Approaches, and Differences with Environmental Economics.” *Regional Environmental Change* 2: 13-23.

⁶⁵ (Van den Bergh 2001, 15)

⁶⁶ (Costanza and Daly 1992)

⁶⁷ (Costanza and Daly 1992)

⁶⁸ (Costanza and Daly 1992)

generations.⁶⁹ The conceptual solution they propose to achieve sustainable development is as follows:

Strive to hold throughput (consumption of TNC) constant at present levels (or lower truly sustainable levels) by taxing TNC consumption, especially energy very heavily. Seek to raise most public revenue from such a natural capital depletion (NCD) tax...⁷⁰

Costanza and Daly indicate that we must use a tax and raise revenue to address the management of natural resources. In particular, they explain the need to hold capital constant. That is, they place value on preserving the resource. Tietenberg, as an environmental economist, takes a similar position as Costanza and Daly by suggesting taxation as a solution. But he furthers this idea by saying that we need to ensure fairness and sustainability by paying future generations through a revenue allocation scheme. He says specifically of nonrenewable natural resources that economically, current “incentives for sharing the wealth from the use of depletable resources are biased toward the present... Clearly, this could be rectified by transferring some of the created wealth into the future, but how much wealth?”⁷¹ He continues by arguing the solution of sharing through an example, stating that:

If the first generation keeps net benefits of \$40.00 (thereby making it just as well off as if equal amounts were extracted in each period) and saves the extra 0.466 (the \$40.466 net benefits earned during the first period in the dynamic efficient allocation minus the \$40 reserved for itself) at 10 percent interest for those in the next period, this savings would grow to 0.513 by the second period [$0.466(1.10)$]. Add this to the net benefits received directly from the dynamic efficient allocation (\$39.512), and the second generation would receive \$40.025. Those in the second period would be better off by accepting the dynamic efficient allocation with

⁶⁹ (Costanza and Daly 1992)

⁷⁰ (Costanza and Daly 1992)

⁷¹ (Tietenberg 2004, 435)

sharing than they would if they demanded that resources be allocated equally between the two periods.⁷²

Tietenberg thus shows that a revenue allocation scheme could appropriately solve resource management problems between two different generations. That is, he shows that the present generation could use savings to pay the future generation in a way that accounts for prior generations' use. In this sense, both generations would be at least equally well off. We can apply Tietenberg to the overall argument of this thesis by noting here that a revenue allocation scheme, where the present generation pays the future generation for resource use, is a solution to achieving the sustainability criterion. By considering Costanza and Daly's argument in collaboration with Tietenberg's, we could then use the revenue to hold capital constant. This could be achieved by allocating the wealth towards creating capital, either through technology, research or investment in renewables. In this solution, by combining the arguments of Tietenberg and Costanza and Daly we can see that there is complementarity between environmental and ecological economics. This overlap between the two disciplines, Van den Bergh argues, is fruitful.⁷³ In fact, Van den Bergh argues that there is value in finding overlap between multiple disciplines when considering scientific findings at the level of policy preparation and political decision. This discussion will be explored further in the coming section.

As these authors indicate, we can care about future generations from an environmental and ecological economics standpoint, especially when managing nonrenewable natural resources. Both environmental and ecological economics suggest solutions and thus can serve as an instrument for us to use to figure out

⁷² (Tietenberg 2004)

⁷³ (Van den Bergh 2001, 20). For more information about the differences and similarities between environmental economics and ecological economics see Van den Bergh, Jeroen C.J.M. 2001. "Ecological Economics: Themes, Approaches, and Differences with Environmental Economics." *Regional Environmental Change* 2: 13-23.

how to make an institutional commitment to the care of future generations. These authors have indicated that a tax and revenue allocation scheme would be an appropriate solution to addressing the rights of future generations to resource use.

I must note here, however, that although these authors show us that in an environmental economics framework, we do care about the rights of future generations and illustrate solutions to addressing resource management problems, no solution will be perfect. This is because we truly cannot capture the preferences of future generations. This problem is compounded because we are furthermore limited by the fact that every subsequent generation may have different preferences, and our discussion does not account for how to rank or number generations. This argument truly relies on the assumption that all future generations would want equal rights to well-being as the present generation. It relies on the assumption that they would prefer and accept monetary replacement of resources. Harriss highlights this difficulty of addressing future preferences from an economics lens when he states, “Markets today cannot reflect the choices of the future. Twenty or 50 years in the future, what evaluations would consumers place on natural gas burned now or on the alternatives that are reflected in today’s decision-making processes?”⁷⁴ Nordhaus mirrors this uncertainty when he presents this metaphor:

[N]one of these approaches touches on the structure of actual intertemporal decision-making, in which this generation cannot decide for or tie the hands of future generations. Instead, each generation is in the position of one member of a relay team, handing off the baton of capital to the next generation, and hoping that future generations behave sensibly and avoid catastrophic choices by dropping or destroying the baton.⁷⁵

In this sense, we must acknowledge that the solution to managing resource use may not be the solution future generations would ultimately prefer, nor can we

⁷⁴ (Harriss 2006)

⁷⁵ (Nordhaus 2007, 17-18)

ensure they would follow through with the decisions we make now. But regardless, the solution to managing resource use is an attempt to acknowledge the idea that future generations care and deserve equal rights to resource use as the present generation.

Beyond this argument, a few words can be said about how we may understand the rights of future generations (or the failure to account for their rights) to resources as an externality (within the environmental economics framework). Dr. Sankar explains that “negative intertemporal externalities” occur when nonrenewable natural resources are depleted.⁷⁶ The term intertemporal refers to the idea of these externalities occurring across time. He shows us that we can think of the depletion of exhaustible resources as a special type of externality. Sankar proceeds to discuss how we must correct these externalities through market-based solutions (as we discussed earlier in this chapter). He says with natural exhaustible resources, such as coal and petroleum, specifically, government intervention in the form of pricing schemes to reflect social costs, such as depletion costs, is necessary.⁷⁷ In this sense, he parallels Pigou and Tietenberg’s conversation of the role government needs to play in addressing sustainability. For example, as Sankar states, “Government intervention is needed to internalize externalities in production and consumption decisions of individuals so that social optimal levels of outputs and private optimal levels of outputs will be the same.”⁷⁸

Tietenberg also gives some insight into the relationship between extraction of natural resources and externalities. He states,

What can we learn about the allocation of depletable resources over time when environmental side effects are not borne by the agent determining

⁷⁶ Sankar, Ulaganathan. 2013. “Environmental Externalities.” Chennai: Madras School of Economics. <http://coe.mse.ac.in/dp/envt-ext-sankar.pdf>. 2.

⁷⁷ (Sankar 2013, 7)

⁷⁸ (Sankar 2013, 2)

the extraction rate? The price of the depletable resource would be too low and the resource would be extracted too rapidly. This once again shows the interdependencies of the various decisions we have to make about the future. Environmental and natural resource decisions are intimately and inextricably linked.⁷⁹

This means that when we fail to take into account the externalities of resource extraction, the resulting lower price causes us to extract too much and/or too quickly. With this, Tietenberg shows us how resource extraction has externalities and how failure to address those externalities results in the over-extraction of the resource.

This discussion in total demonstrates a number of things. It reveals that beyond caring about the future for its inherent value, the rights of future generations is an externality. We learned earlier that in environmental economics we must seek ways to remove that externality in order to correct the market. This means, then, that we must correct this externality of resource management for future generations. How can we do so using what we know about environmental economics and market-based solutions? Pigou, Tietenberg, and Sankar have presented solutions and given us a framework for accounting for future generations. They indicate collectively that government intervention is necessary. They also argue that a tax and a revenue allocation scheme are the appropriate solution. This is because the revenue the tax generates allows distribution of wealth to these future generations. Constanza and Daly, the ecological economists we explored, provided the argument that the wealth distributed to future generations must assist in preserving natural capital. I argued that this could be achieved by allocating the wealth towards creating capital, either through technology, research or investment in renewables. With this discussion, I identify the extraction of the finite resource as a specific externality of nonrenewable

⁷⁹ (Tietenberg 2004, 128)

resources that I will further explore in the following chapter. For now, I argue that this externality, under the basic rule of environmental economics, is something that we should aim to address and solve. I end this section now with this thought open.

Political Science Discussion

Just beyond this discussion of how we should care about the rights of future generations in an environmental economics framework is the question of how we care in a political science framework, or rather, is there literature to suggest we do. Underlying the previous discussion of how we care about sustainability and future generations is the idea that policy must play a strong role in the decision making process for economic considerations. Although this argument was strong among environmental economists, it is important to consider the viewpoints across disciplines.

To briefly recap, the economists we discussed in the previous section acknowledged that it is the role of government and policy to make socially optimal decisions for the general public when the public would tend to do otherwise.⁸⁰ They argued that especially with environmental issues, policy institutions must provide adequate consideration and protection for future generations. Nordhaus, an economist, also provides commentary on how to consider the connection of economics to policy in light of global warming issues. He suggests that policymakers must deliberately consider and put weight to each element of data they are presented with:

What should the prudent reader conclude from all this? There are many perspectives through which to view the future costs and benefits of policies to slow global warming. These perspectives differ in terms of normative assumptions, national interests, estimated behavioral structures, scientific data and modeling, risk aversion, and the prospects of future

⁸⁰ (Costanza and Daly 1992; Howarth 2006; Pigou 1932; Sankar 2013; Tietenberg 2004)

learning. No sensible policymaker would base the globe's future on a single model, a single set of computer runs, or a single national or ethical perspective. Sensible decision-making requires a robust set of alternative scenarios and sensitivity analyses to determine whether some rabbit has in the dead of night jumped into the hat and is responsible for unusual results.⁸¹

Nordhaus argues in his critique of the *Stern Review* that prudent policymaking requires the consideration of many different perspectives—different models, interests, and normative assumptions—in order to make sensible decisions. The consideration of alternative scenarios, he says, results in better made decisions. Expanding Nordhaus' argument, we can understand that viewing issues from different disciplines provides the benefit of a certain sensitivity to decision making; the decision maker can weigh the strengths and weaknesses of many approaches, and can consider the overlap between these approaches.

Despite this recognition of the importance of an interdisciplinary approach to scientific issues and political decisions, there appears to be a gap in actual collaboration on part of the social sciences. Van den Bergh works to highlight this gap between economic discussions and social science considerations, as well as the importance of an interdisciplinary approach to issues that qualitative fields define and attempt to prescribe solutions to. He states:

Pluralism is very important for an open discussion of the advantages and disadvantages of scientific findings at the level of policy preparation and political decision-making regarding environmental policy. EE [ecological economics] can develop further along two paths. One involves more intense co-operation between natural and social scientists to influence each other's way of thinking and construct joint theories and models, in line with Wilson's notion of "consilience". In the view of many ecological economists, this is the main motivation for EE and the area where it can be most effective. The other path is to broaden the social science spectrum so as to provide for a real alternative paradigm to the neoclassical methodology of ERE [traditional environment (and resource) economics].

⁸¹ (Nordhaus 2007, 33-34)

Some ecological economists seem to think that this is the way forward (see Spash 1999). Currently, however, EE may lack the necessary social science expertise to support such an ambitious goal. Therefore, it should link up with modern research on the relationship between individual and group behaviour (institutions and ethics) in biology, anthropology, communication science, economics, political science, psychology and sociology.⁸²

Van den Bergh argues that ecological economics can be enhanced by cooperation between natural and social scientists. This interaction, he believes, will lead to discussions of scientific findings in a policy framework. He also argues that the social science spectrum must be broadened to provide ecological economics with expertise so that it can serve as a “real alternative paradigm.” In this path, ecological economics would expand its understanding on institutions and ethics to strengthen its methodology. In both instances, Van den Bergh promotes the role of social sciences in cooperating with or assisting the natural sciences.

Although there is a recognition of the importance of the social sciences in relation to scientific findings, there is still not much social science literature to suggest a strong overlap has been achieved. More specifically, in regards our discussion of market instruments, political science has been largely quiet on this issue versus economics. Still, there are several authors who do provide some exploration into the overlap of economics and political science.

For example, many scholars have worked to discuss a sort of overlap by explaining the political feasibility of environmental market-based solutions, such as the solutions of carbon taxes and cap-and-trade. In this section I consider the arguments of these authors. I will focus on their overall comments on the political feasibility of market-based solutions. In the next chapter I will discuss cap-and-trade as well as carbon taxes more specifically in order to provide more context to the current policy field and answer more questions of feasibility.

⁸² (Van den Bergh 2001, 21)

Similar to the underlying argument of environmental economists that policy must play a strong role in the decision making process for economic considerations, political scientists reflect on the importance of political feasibility. In this sense, political science literature is slightly different than the economic literature that says that government must make socially optimal decisions because political scientists address the limits of that decision making process. That is, they evaluate whether a policy, regardless of how much it has the best interest of the public in mind, has any political traction.

Barry Rabe explores this concept through the case of the carbon tax. While we will explore in the next chapter the specific political hurdles of carbon taxation, let us consider Rabe's comments on political feasibility here. Rabe opens his argument by discussing the wide support for the market-based solution of carbon taxes from academics—economists, political scientists—, politicians, think tanks, companies, even the ExxonMobil CEO, presidential advisors, etc.⁸³ Despite this wide support, he explains, carbon taxes lack “political traction in the real world of representative democracies.”⁸⁴ This lack of political traction exists despite the economic advantages that a carbon tax presents. He explores how this political traction has resulted in many instances, the failure of carbon taxes to be implemented.

Through his discussion, Rabe highlights an understanding in political science, that even academically supported ideas, if politically unpopular, will likely not occur. Thus, with any solution—and more specifically the market-based solution that involves the taxation of natural capital—feasibility is an important factor in determining its likelihood. It is a factor that is arguably the most important when considering whether an idea may become policy. This political

⁸³ Rabe, Barry. 2010. “The “Impossible Dream” of Carbon Taxes: Is the “Best Answer” a Political Non-Starter?.” In *Greenhouse Governance Addressing Climate Change in America*, 126–57. Washington, DC: The Brookings Institution. 126-127.

⁸⁴ (Rabe 2010, 129)

science perspective thus shows the biggest underlying limitation to the solution I promote.

Beyond this discussion of the importance of political feasibility, Rabe provides some insight into ways political support may be secured. He looks specifically at the ways energy tax revenues are used. He says, of currently existing programs that tax electricity, that

[O]ne common feature of the programs is that virtually all of them channel all of their revenues into specific renewable energy or energy efficiency projects. Many states that levy the charges have set up new institutions (or expanded existing ones) to pursue intrastate energy projects...Some states have established multiple programs to receive various portions of the public benefit funds, some of which distinguish energy efficiency from renewable energy while others concentrate on specific technologies.⁸⁵

Rabe points out here that states employing electricity taxes tied the revenue to specific programs relating to technology or renewable energy projects. Kathryn Harrison also discusses the importance of how revenues are distributed. She states,

The state in turn has several options for disposition of the tax revenues: earmark them for environmental spending, return them to taxpayers in the form of cuts to other taxes, or fold them into general revenues. The choice of option has implications not only for economic or environmental benefits, but also for the distribution of costs, and thus the politics of carbon taxes...⁸⁶

Harrison reminds us here that the revenue allocation of a market-based solution will have a great impact on the political feasibility of the proposal. This argument, in combination with Rabe's example of state electricity tax revenue allocation schemes, showcases the potential feasibility of having a particular revenue allocation scheme. In my case, the fact that the political structure of allocating tax

⁸⁵ (Rabe 2010, 140)

⁸⁶ Harrison, Kathryn. 2010. "The Comparative Politics of Carbon Taxation." *The Annual Review of Law and Social Science* 6: 507–29. doi:10.1146/annurev.lawsocsci.093008.131545. 105.

revenues towards technology or renewables already exists suggests that the argument, that the government must tax capital and allocate revenue towards creating capital through technology, research or investment in renewables, is not that far-fetched.

And finally, Rabe does note that the concept of political feasibility is not absolute. He states,

As scholars who have closely examined these kinds of episodes have noted, they suggest that it is indeed possible to trump the conventional wisdom and enact policy that advances a broad public interest even in the face of intense opposition.⁸⁷

Rabe highlights that there are instances when solutions that truly benefit the public become policy, despite lack of political support. There is the indication that solutions can overcome questions of political feasibility. The implications for the solution promoted within this thesis are that it ultimately it may become policy, even if it does face strong political opposition. As these authors have shown, political feasibility is an important consideration to the success of potential solutions suggested by academics (such as economists).

There are also overlaps between our ecological and environmental economy discussions from the previous sections and the political science discipline. Leigh Raymond, for example, provides insight into the concept of resource ownership and how that concept has changed within the political sphere. He tells us that earlier principles of resource ownership were shaped by the Lockean or Humean perspectives. That is, the belief was largely that existing users were the rightful owners or resources; recognition for resource ownership favored possession and prior use. He states, “the idea that the *public* might own

⁸⁷ (Rabe 2010, 148)

the resources was absent from the conversation.”⁸⁸ In fact, when considering political designs for issues surrounding the environment, Raymond argues that the “basic tendency to favor the claims of current resource users remained as late as 2005.”⁸⁹

Raymond identifies a shift in this recognition of ownership, however, through his examination of climate change policies. He finds that recognition of ownership is now shifting towards the public. He states:

After years of treating polluters as prior resource users entitled to private rights under any policy of limited entry, political actors are now witnessing (and in many cases encouraging) a remarkable normative shift in which the public is seen as the rightful owner of natural resource sinks and polluters as beneficiaries of a free ride at the public’s expense. Existing emitters have tried to block the change, but their efforts continue to look like a losing rear-guard action. The idea that we should reward polluting behavior with free pollution rights was always a bit implausible, and it is now giving way to the principle of public ownership.⁹⁰

Raymond suggests here that there has been a shift in the way people, and policy especially, recognize resource rights. The owner, Raymond argues, is becoming more so the public than the previously recognized owner of the private actor. Raymond’s argument is relevant in light of our discussion in earlier sections that suggested that the government should protect natural capital for its citizens, the *public*. Raymond’s work shows that despite economists’ arguments, the idea that the public has claims to resource sinks did not come about in the political sphere until very recently. This shift, he argues, in “the apparent agreement that the public does indeed ‘own’ some common resources, rather than those who happen

⁸⁸ Raymond, Leigh. 2010. “The Emerging Revolution in Emissions Trading Policy.” In *Greenhouse Governance Addressing Climate Change in America*, 101–25. Washington, DC: The Brookings Institution. 105.

⁸⁹ (Raymond 2010, 107)

⁹⁰ (Raymond 2010, 113)

to have been using them historically...may be the most important legacy of the recent series of changes and controversies in emissions trading policy.”⁹¹

Raymond sheds additional light on the different perspectives on the idea of public ownership. He explains that one idea is a more populist, egalitarian view of public ownership that is “rooted in a belief that the public itself is entitled to certain common resources.”⁹² This idea, Raymond says, is what supports programs that “distribute equal shares of revenue from natural resources to all citizens.”⁹³ The other perspective on public ownership of natural resources, is the government form of public ownership. This perspective, he argues, favors government decision makers over individual citizens as the rightful resource owners,⁹⁴ where decision makers or political elites allocate natural resources on behalf of the public at large. He states, “under this conception, revenues from natural resource ownership are still put to public use but not necessarily in a way that provides equal shares or direct revenue to all citizens as common owners.”⁹⁵

Once again, Raymond’s comments here are relevant to the previous discussions. In our prior conversation I reflected on the importance of government recognizing the rights of future generations by preserving natural capital. In this argument, I implicitly promoted Raymond’s second perspective on public ownership, that is, that government allocates and regulates the resource on behalf of the public at large. More specifically, I argued that the government should regulate resources to allocate wealth towards creating capital, either through technology, research or investment in renewables.

⁹¹ (Raymond 2010, 119)

⁹² (Raymond 2010, 114)

⁹³ (Raymond 2010, 114)

⁹⁴ (Raymond 2010, 114)

⁹⁵ (Raymond 2010, 114)

I end this discussion with Raymond's argument on the implications of the two perspectives of the concept of public ownership. He tells us that the shift to public ownership requires now that we determine whether we adopt a populist, egalitarian view of public ownership or the view that favors government decision makers. "That decision," he states, "will have critical implications for...future political viability."⁹⁶ That is, the political direction of the public ownership concept is not yet clear. I can apply this discussion to my argument in the previous section that the government must tax capital and allocate revenue towards creating capital through technology, research or investment in renewables. Because this argument promotes public ownership, under Raymond's argument, it may become more and more politically feasible in the modern policy sphere. Still, as Raymond indicated, it is not clear yet whether policy will ultimately adopt the populist view of public ownership or the government as decision makers view. My argument, promoting the government as decision makers in public ownership, may be the view that is more generally accepted in the policy sphere, or it may not. Further research into the policy sphere would give an answer to Raymond's question and further indication as to the political feasibility of my argument.

As shown, the discussion of economic solutions is limited in a policy sphere based on its political feasibility. As these political scientists have indicated, even the best theoretical solutions will face challenges if not supported by political interest. These authors did suggest however, that with market-based solutions, political like-ability may be better achieved through revenue allocation schemes that agree with political perceptions. As Raymond also suggested, promotion of resource rights for the public over private interest is a concept that is gaining political traction. With this thought in mind, I close this section with the reminder of the importance of political feasibility. I will return to this concept in

⁹⁶ (Raymond 2010, 115)

the next chapter when I explore the market-based solutions of cap-and-trade and carbon taxation. I will also reflect on the political feasibility of this solution promoted within this thesis in the concluding chapter.

Conclusions

Thus far, I have laid the groundwork to understanding the field of environmental economics. I have shown that in environmental economics, we care about externalities and have learned that when an externality exists we must address it by redefining property rights, or when that is not possible, by using a market-based solution. I have also established that in environmental economics, the rights of future generations can be understood as an externality. More specifically, I established that in environmental economics, the externalities of nonrenewable natural resource use imply an effect on future generations. Using this argument I then conclude that: If an externality assumes or implies an impact on future generations, then the solution (whether property rights based or market-based) must account for the future generation, or else it fails to account for the entirety of the externality and will thus not be considered a complete solution. As the literature in the end of this chapter indicated, solutions to managing the rights of future generations may best come in a tax form because of its revenue raising ability and potential to pay future generations for resource use. I also concluded that the solution could be achieved by allocating the wealth towards creating capital, either through technology, research or investment in renewables. Underlying this decision of a tax is the understanding that government must actively protect and address issues for the common good. In discussions about the role of policy, I emphasized the importance of an interdisciplinary approach to understanding and addressing problems. With this discussion I also touched on the importance of political feasibility when considering the strength of any proposal.

In Chapter 2, I will use these definitions of the externality and rights to future generations in order to clarify environmental economics problems with oil and natural gas production specifically. The argument that follows in the 3rd and 4th Chapter will then argue a more specific solution of taxation and revenue allocation for these issues. In doing so, we will be interested in the rationale for this solution, current examples of this solution and what changes could be made to address the problems that will be brought up in Chapter 2. In this sense, using the framework of environmental economics, I am taking a normative approach to the solution I shall name.

In order to better understand this approach, I turn to Tietenberg and Lewis' description of environmental economics. They prescribe two different types of economics to further understand economic analysis of the environment. They explain that there is positive and normative economics. Positive, they say, "attempts to describe what is, what was, or what will be." Normative, on the other hand, "deals with what ought to be."⁹⁷

In this sense, normative economics deal with specific value judgments. This concept of normative economics will be most relevant for purposes of considering the solution of severance taxes and what they do in comparison to what they could or should do.

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Thinking back to my introductory sustainability course, I can recall vividly the various ethics and literature we used to explore environmental problems. But that was not the only way we explored issues in our local community. A few times during the semester we left our classroom to walk around and explore sustainability efforts on campus. We viewed the solar panels, the water-bottle refill stations and the local food supplier, Student Food Co. right in

⁹⁷ (Tietenberg and Lewis 2009)

The Implications of a Severance Tax

Mason Hall. We even went to Ann Arbor's City Hall and heard Jamie Kidwell, the City of Ann Arbor's Sustainability Associate,⁹⁸ talk about recent housing efforts in Ann Arbor to expand energy efficient housing options.

The goal with these interactive learning experiences was to not only work to understand what was going on in our community, but also to observe first-hand how ethics translate to policy and action. With these experiences, I observed how theory does not always translate to reality. I also learned that solutions may be altered so that they are accepted as more feasible. I think one of the most interesting example of this was when Jamie Kidwell discussed the creation of her job. She said that a lot of time was put in coming up with a name that would appear appropriate to the public, especially because during that time, "sustainability" was just emerging as a word common to public rhetoric. Given this discussion, we can catch a glimpse into the importance of the consideration of these issues and solutions, not only from a theoretical stance, but also from a political one.

⁹⁸ For more information about Jamie Kidwell and Ann Arbor's Sustainability Framework, see: City of Ann Arbor. 2014. "Sustainability Framework." <http://www.a2gov.org/sustainability/Pages/SustainabilityFramework.aspx>.

Chapter 2

In the Ford school, during a talk sponsored by the Center for Local, State and Urban Policy, I heard Susan Christopherson, a professor in the Department of City and Regional Planning at Cornell University, discuss why local governments are emerging as the prominent respondents to shale gas development.⁹⁹ During her talk, Professor Christopherson specifically mentioned the many impacts associated with this process, with resident owners of small parcels or renters; regional businesses such as tourism, specialized agriculture and retirement homes; and regional residents who absorb indirect and public costs related to safety, roads, traffic and air pollution, all serving as the losers of this process, while non-resident owners of large acreage with minerals rights were the biggest winners. Professor Christopherson explained the distribution of benefits: “The benefits don’t occur where the drilling occurs, they occur where the expenditure occurs,” she said.

During the question and answer portion of her talk, a member of the audience pointed out that a moratorium was a common response of local governments. She then asked if there are any other themes in community responses. Professor Christopherson replied that some of the best reactions she has seen were, surprisingly, in Texas. She explained that they knew how to extract the resource effectively—and that is because they tax it. She stated that the Texans think the other states are ridiculous; that they recognize that if you are extracting the resource, there are going to be impacts. So, they say you need to tax the process to address these impacts. Listening to that, I was struck by her response. Who would have thought the Texans would be tackling resource use issues within an environmental economics framework?

⁹⁹ For more information about Susan Christopherson and her lecture, see: UM Events. 2014. “Fracking Lecture. A Vote of ‘No Confidence’? Why Local Governments Take Action in Response to Shale Gas Development.” <http://events.umich.edu/event/15968-1196666>.

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As our previous discussion has indicated, the negative externality is an impact that an agent faces as a result of another agent's actions. It is a consequence, whether intended or unintended, of a market action. This chapter will explore the externalities associated with oil and natural gas production and use. It will also explore the idea of rights of future generations as it relates to oil and natural gas.

I do this to demonstrate why oil and natural gas resource extraction and use are representationally problematic relative to the whole category of nonrenewable natural resources so that we can understand that there is a need for a solution under our collaborative environmental and ecological economics framework. Due to the nature of nonrenewable natural resources, as demonstrated by the example of oil and natural gas, I will show that the solution must come from a market-based solution, not a property rights allocation scheme. This solution will involve taxation and a revenue allocation scheme.

Externalities-Oil and Natural Gas

Oh Beautiful for smoggy skies, insecticided grain,
For strip-mined mountain's majesty above the asphalt plain.
America, America, man sheds his waste on thee,
And hides the pines with billboard signs, from sea to oily sea.

—George Carlin, comedian¹⁰⁰

The externalities of oil and natural gas, namely in the form of pollution, are not unknown to the American public. It is well accepted that the production and consumption of oil and natural gas generate a number of negative externalities. I will now consider examples of these externalities.

¹⁰⁰ Green Living. 2014. "Earth Day Quotes." <http://www.greenlivingonline.com/article/earth-day-quotes>.

Numerous externalities of oil and natural gas exist on the production side. These include impacts from activities such as site preparation, drilling, fracturing, well production and operation, and storage and disposal of fracturing fluids and flow-back.¹⁰¹ To explore the externalities of these activities more specifically: site preparation activities include the clearing of land, construction of roads, construction of infrastructure and on-road vehicle activity. These activities create externalities such as habitat fragmentation or loss, road congestion and impact on stormwater flows. Drilling activities include drilling equipment operation at the surface of the ground, drilling of vertical and lateral wellbore, casing and cementing, etc. These activities cause externalities such as methane release, noise pollution and impacts from drilling fluids and cuttings. Fracturing activities include activities such as the use of groundwater, the flowback of reservoir fluids, the venting of methane, and the storage of fracturing fluids at the drill site. These activities result in impacts such as freshwater withdrawals and flowback, methane release and impacts of surface water from fracturing fluids. Well production and operation activities include well production, use of condensate tank and dehydration unit operation as well as compressor operation. These activities result in externalities such as flowback and produced water constituents, volatile organic compounds and conventional air pollutants. Fluid storage and disposal activities include on-site pit or pond storage, off-site transportation, treatment and release by industrial wastewater treatment plants, and deep underground injection. These activities result in impacts such as flowback and produced water constituents, volatile organic compounds, seismic vibrations and road congestion.¹⁰²

¹⁰¹ Unless otherwise specified, all information in this paragraph comes from Krupnick, Alan, Hal Gordon, and Sheila Olmstead. 2013. "Pathways to Dialogue. What the Experts Say about the Environmental Risks of Shale Gas Development." RFF Report. Washington, DC: Resources for the Future. 20.

¹⁰² (Krupnick, Gordon, and Olmstead 2013, 20)

To further understand the externalities of oil and natural gas production, we can look at the example of hydraulic fracturing. Ridlington and Rumpler highlight fracturing impacts in their report. In the report they explain that fracking production activities have impacts including toxic wastewater, general water use, chemical use, air pollution and “damage to our natural heritage.”¹⁰³ They clarify that fracking requires the use of chemicals, which results in toxic wastewater that once brought to the surface can become a hazard for drinking water and public safety. Beyond that, fracking requires large amounts of water use in general. Fracking activities also result in air pollution which could threaten the health of others. Furthermore, the authors clarify that the building of roads, pipelines and other infrastructure changes the landscape of our states. These impacts from fracking are negative externalities because the fracking companies place them on the public. While the companies reap the benefits from the extraction of natural gas and oil, they are not necessarily required to pay for the costs that they bring unto others.

On the consumption side, oil and natural gas are also responsible for a number of negative externalities. These include impacts from activities such as fossil fuel combustion for electricity generation and the transportation, industrial, residential, and commercial “end use” sectors.¹⁰⁴ The combustion of fossil fuels beyond causing pollution, specifically contributes to CO₂ emissions. In fact, emissions from fossil fuel combustion are the largest source of CO₂ emissions, and the sectors mentioned above (electricity generation, transportation, industry,

¹⁰³ Unless otherwise specified, all information in this paragraph comes from Ridlington, Elizabeth, and John Rumpler. 2013. “Fracking by the Numbers Key Impacts of Dirty Drilling at the State and National Level.” Environment America Research and Policy Center. www.environmentamericacenter.org.

¹⁰⁴ Unless otherwise specified, all information in this paragraph comes from United Nations Framework Convention on Climate Change. 2014. “United States Climate Action Report 2014.” Climate Action Report First Biennial Report of the United States of America. United States of America: U.S. Department of State. <http://www.state.gov/documents/organization/219038.pdf>.

residential and commercial sectors) are the five major fuel-consuming sectors that contribute to CO₂ emissions.

We can think of CO₂ emissions as an externality because greenhouse gas (GHG) emissions (such as CO₂) are leading causes of climate change.¹⁰⁵ Impacts of climate change include rising average temperatures, warming oceans, rising average sea levels, more extreme heat and weather as well as species extinctions and loss of biodiversity.¹⁰⁶ In this sense, the use and burning of fossil fuels cause global impacts.

Beyond the immediate impact of these externalities, there is also consideration for the long-term impact of these externalities. That is, there are lasting generational concerns built into these externalities. For example, when we consider the externalities of oil and natural gas production, impacts such as water or air pollution carry not only an immediate effect, but also an intertemporal effect. That is, we recognize that the water pollution is not going to suddenly go away, but instead will be a problem that lasts many years to come. When discussing externalities on the consumption side of oil and natural gas use, we mark that their combustion and release of CO₂ emissions contributes to climate change. Climate change is understood as a problem that will damage and alter our earth. Although we are concerned about the impacts this will have on the current generation, there is also an understanding that the impacts are not easily reversed and are sometimes completely irreversible. We then begin to understand and worry about the impacts climate change will have on the earth that our children, our children's children and all future generations will inhabit.

This impact that oil and natural gas has on the future is problematic, especially from an environmental economics standpoint. Tietenberg explains that

¹⁰⁵ Intergovernmental Panel on Climate Change. 2013. "Climate Change 2013 The Physical Science Basis." Working Group 1 Contribution Fifth Assessment Report. http://www.climatechange2013.org/images/uploads/WGI_AR5_SPM_brochure.pdf. 11.

¹⁰⁶ (United Nations Framework Convention on Climate Change 2014, 6)

we can understand emissions of greenhouse gases as externalities; “Emissions of greenhouse gases impose a cost on future generations that is external to current generations.”¹⁰⁷ He explains that these intertemporal externalities are difficult to address, and undermine the ability of the market to produce sustainable outcomes because actions to reduce greenhouse gases will cost the current generation money but benefits will not be felt until significantly later.¹⁰⁸ Still, despite economic theory difficulties in addressing tomorrow’s problems, there is evidence today that society does care and is making an effort to make change to slow climate change, as shown in the United States Climate Action Report.¹⁰⁹

Besides these externalities, there is also an externality associated with oil and natural use that may not be immediately considered. This is the externality of nonrenewable natural resource use, namely that using oil and natural gas will eventually result in the loss of that resource altogether. This means that future generations will, at some point, lose access to these resources. I will explore this concept later in this chapter.

Finally, the question of why we care about the externalities of oil and natural gas must be addressed. The negative externalities of oil and natural gas are important to us because they result in a destruction of our land, our roads, our air and our water, and our health. These impacts make it clear that oil and natural gas use ruins the planet for us. This destruction concerns us because we currently inhabit the earth and want access to a clean and safe environment. When we recognize that these externalities ruin the earth for us, we also recognize a generational concern, that is, it ruins the earth for everybody—present and future. So the question now, from an environmental economics framework, is how do we address these inter— and intra—generational externalities? If we remember

¹⁰⁷ (Tietenberg 2004, 435)

¹⁰⁸ (Tietenberg 2004, 435)

¹⁰⁹ (United Nations Framework Convention on Climate Change 2014, 6)

Chapter 1 when I talked about how to mitigate resource use externalities, I explained that the government intervention in the form of pricing schemes (taxation) to reflect social costs, is necessary. I will expand on this discussion of market-based solutions to oil and natural gas in coming sections.

Property Rights-Oil and Natural Gas

In the last chapter I explained that externalities may be removed through the redefinition of property rights. As the discussion in the previous chapter also concluded, there are situations where redefinition may not be the best solution or may not even be possible. Such is the case with oil and natural gas use.

On the production side of the oil and natural gas industry, there are multiple facilities and systems in the production stream. These facilities and systems are defined according to their use in the oil and gas industry production process and include Exploration, Upstream, Midstream, Refining and Petrochemical.¹¹⁰ Exploration refers to prospecting, seismic and drilling activities that take place before a company decides where to develop. Upstream refers to all facilities for the production and stabilization of oil and gas. Midstream refers to gas treatment facilities as well as oil and gas pipeline systems. Refining refers to the part of the industry process where oil and condensates are processed into marketable products. Petrochemical refers to the production of chemical products where the main feedstock is hydrocarbons.

Depending on where in the process the oil and gas occurs, the resource will be at a different facility. This shows that it would be difficult to redefine the property rights of oil and natural gas production because the process occurs in

¹¹⁰ Unless otherwise specified, all information in this paragraph comes from Devold, Håvard. 2013. "Oil and Gas Production Handbook An Introduction to Oil and Gas Production, Transport, Refining and Petrochemical Industry". 3.0. ABB Oil and Gas. [http://www05.abb.com/global/scot/scot267.nsf/veritydisplay/34d5b70e18f7d6c8c1257be500438ac3/\\$file/Oil%20and%20gas%20production%20handbook%20ed3x0_web.pdf](http://www05.abb.com/global/scot/scot267.nsf/veritydisplay/34d5b70e18f7d6c8c1257be500438ac3/$file/Oil%20and%20gas%20production%20handbook%20ed3x0_web.pdf). 4.

many different stages at many different locations. Lipecap and Smith found that the development of property rights (unitization) in oil and gas production was challenging. They found that the development of property rights in oil and gas encountered the following problems: “natural” difficulties because of geological conditions, difficulties in trading because of volatile relative prices and asymmetric information, and regulatory-imposed difficulties.”¹¹¹ This means that evidence demonstrates that redefining property rights for oil and natural gas is too challenging to achieve.

Furthermore, there is also the consideration that if we were to find a way to redefine property rights for oil and natural gas, it still would not be a complete solution to the externalities defined. This is because the externalities of the production process effect many and cannot be easily eliminated. As we explored in the previous section, externalities from this process included road congestion, water flowback and air pollution. Common sense tells us that no matter how oil and gas property rights are changed, we can never allocate property associated with public goods such as roads, water and air. I can once again turn to Tietenberg to further understand how this process will not address externalities:

Suppose, for example, that the extraction of the depletable resource caused some damage to the environment not adequately reflected in the costs faced by the extracting firms. This would be an external cost. The cost of getting the resource out of the ground, as well as processing and shipping it, is borne by the resource owner and considered in the calculation of how much of the resource to extract. The environmental damage, however, is not borne by the owner and, in the absence of any outside attempt to internalize that cost, it will not be part of the extraction decision¹¹²

¹¹¹ Libecap, Gary D., and James L. Smith. 2002. “The Economic Evolution of Petroleum Property Rights in the United States.” *The Journal of Legal Studies* Vol. 31 (No. S2). The Evolution of Property: S589–S608.

¹¹² (Tietenberg 2004)

In this sense, redefining property rights to oil and natural gas will fail to remove all externalities.

Furthermore, when discussing the consumption side of natural gas and oil, it is once again difficult to redefine property rights. This is because it is difficult to define property rights when one reviews the externalities associated with the consumption of oil and natural gas. The negative externality associated with oil and natural gas use, namely carbon pollution, is a cost that when entered into the air, everyone bears.

As shown, when it comes to oil and natural gas production and consumption, the site of the resource is not always the same as the site of production, which is hardly ever the same as the site of consumption. The processes of oil and natural gas are carried out in many different places depending on the stage of the production or consumption cycle. This means that the externalities created during this process are found in many geographic locations. In this sense, when addressing oil and natural gas externalities, redefining property rights is not a practical solution. I will now turn toward market-based solutions to the externalities of oil and natural gas.

Market-Based Solutions-Oil and Natural Gas

As discussed in Chapter 1, there are a number of current frameworks for using market-based solutions to address externalities: pollution charge systems; tradable permits; deposit-refund systems; reducing market barriers; eliminating government subsidies; and providing public information.¹¹³ The dialogue for how we can address externalities associated with natural gas and oil specifically currently includes the market-based solutions of a cap-and-trade system and a carbon tax, which are examples of tradable permits and pollution charge systems,

¹¹³ (Stavins and Whitehead 1997)

respectively. I will briefly consider these two policy solutions here as sample solutions and frameworks that currently exist for addressing oil and natural gas externalities. When examining these solutions I will comment on the political feasibility of these frameworks, drawing on discussions from the end of last chapter. This discussion is meant to provide a brief understanding of current ideas for market-based solutions to environmental problems and what challenges they face in the policy sphere. I must note that in this exploration, I am not promoting these examples as our policy solution. These solutions are fundamentally different than the one this thesis has promoted; while this thesis has argued for the taxation of natural capital in order to replace that natural capital for future generations, these solutions work to reduce pollution. That is to say, cap-and-trade and carbon taxation as solutions are not analogous to the problems I seek to address.

Cap-and-trade refers to a permits scheme when a state determines limits on emissions. The state then gives permits that allow individuals or firms to possess transferable shares of that limit. These agents can meet the limit themselves and reduce their emissions, or they can pay other firms for their permits. In this sense, an efficient outcome will be theoretically achieved.¹¹⁴ That is to say, emissions will be reduced at a lower overall cost because firms who can afford to reduce easier than others can, and other firms, who can more cheaply purchase other permits, can also choose to do so.

Weaknesses of a cap-and-trade approach include geography regulation issues as well as issues of practical applicability (considering monitoring and oversight demand).¹¹⁵ That is to say, it has a much more complicated structure than a taxation market-based solution, for example. Beyond that, cap-and-trade often receives much criticism and is not very politically feasible due to its lack of public support.

¹¹⁴ (Robbins, Hintz, and Moore 2010, 38-39)

¹¹⁵ (Robbins, Hintz, and Moore 2010, 40)

Still, cap-and-trade does have a number of strengths in the political sphere. One perceived political advantage is that its complex structure makes it easier to obscure the ways in which it imposes costs.¹¹⁶ In this sense, it is less clear how the public may be impacted by this regulation imposed on industry. Raymond argues that cap-and-trade may benefit in light of the fact that there is strong political aversion to new taxes.¹¹⁷ That is to say, it may benefit politically as a more popular option over carbon taxation.

A carbon tax is an example of a “green tax,” which involves taxing certain goods or services for consumers or producers in the hopes that the raised price will result in decreased use of the resource.¹¹⁸ A carbon tax, then, is a tax against oil, natural gas, coal and other fuel industries in an attempt to control greenhouse gas emissions that cause climate change.¹¹⁹ This type of tax exists in a number of countries including the Netherlands and Norway.

Hsu explores several strengths of carbon taxation in his book, *The Case for a Carbon Tax*. He argues that a carbon tax would effectively address the damages associated with carbon emissions.¹²⁰ He also argues that an additional economic strength of carbon taxes is that it is capital-neutral.¹²¹ That is, it is a tax and not an investment or a subsidy, so it will therefore not encourage the creation of new capital. Beyond that Hsu argues that the carbon tax has the ability to be combined with other “regulatory instructions,”¹²² which means that the carbon tax

¹¹⁶ (Rabe 2010, 133)

¹¹⁷ (Raymond 2010, 108)

¹¹⁸ (Robbins, Hintz, and Moore 2010, 36)

¹¹⁹ Unless otherwise specified, all information in this paragraph comes from (Robbins, Hintz, and Moore 2010, 38).

¹²⁰ Hsu, Shi-Ling. 2011. *The Case for Carbon Taxes*. Washington, DC: Island Press. 27.

¹²¹ (Hsu 2011, 45)

¹²² (Hsu 2011, 460)

does not eliminate other future policy options, but rather possesses the ability to be used in combination with a number of policies.

Harrison argues that carbon taxation has a number of advantages over cap-and-trade. She says that a carbon tax is easier to implement; it can be applied to both large and small polluters; that it offers price certainty which can spur business investment to develop and adopt low-carbon technologies; and that carbon taxation offers greater transparency in its costs and distribution. She also argues that carbon taxation revenue can be used to reduce payroll or income taxes to yield economic benefits.¹²³ Rabe also parallels Harrison's argument by explaining that the simplicity and price certainty of carbon taxes are beneficial.¹²⁴

The main weakness of the carbon tax is its lack of political strength, and thus, its feasibility. As Hsu points out, many people feel that the carbon tax has too much "political baggage" and a low probability of passing.¹²⁵ Carbon taxes have been considered in the United States but they face significant political opposition, largely from industry.¹²⁶ There is also fear of carbon taxation from the general citizenry, where the impact of the taxes would be highly visible at the gas pump or in the electricity bill.¹²⁷ Carbon taxes are also objected to for their "perceived regressiveness."¹²⁸ This means that because a carbon tax is a consumption tax, similar to the sales tax, people feel that it could disproportionately harm poorer individuals. And finally, the carbon tax faces low public approval. Hsu goes as far to say that people consider a carbon tax vile.¹²⁹

¹²³ (Harrison 2010, 508)

¹²⁴ (Rabe 2010, 131-132)

¹²⁵ (Hsu 2011, 118)

¹²⁶ (Robbins, Hintz, and Moore 2010, 38)

¹²⁷ (Rabe 2010, 133)

¹²⁸ (Hsu 2011, 124)

¹²⁹ (Hsu 2011, 148)

In this sense, despite its strengths, carbon taxes face many challenges as a viable political solution.

These examples are mentioned here to merely show current frameworks related to addressing oil and natural gas. It is important to emphasize again that these solutions tackle slightly different issues than we have addressed in this thesis. Namely, these solutions are carbon pollution based, *not* resource use and depletion based. By this I mean that the market based solutions of a carbon tax and cap-and-trade system aim to address the specific externality of carbon pollution from oil and natural gas use. In contrast, this thesis expresses the need for a solution that addresses *all* externalities of oil and natural gas use, especially the externality of the rights of future generations to a depletable resource (or the wealth of that resource).

Still, we can acknowledge that the carbon tax, as a tax, does have some revenue raising ability that could be used to replace resource use. But, as a political strategy, the carbon tax is controversial and would face difficulties in expanding its reach towards addressing resource use for future generations. From this, in combination with our discussion in Chapter 1, I can conclude that a tax would pose as the potential answer to managing all externalities of nonrenewable natural resource use because of their general revenue generating power. And as we reviewed in the previous chapter, this means that the revenue allocation scheme is also an important aspect of the solution itself.

With this discussion we have learned that about current frameworks for addressing the externalities of oil and natural gas use, namely carbon pollution. We have learned that these solutions face a number of difficulties, namely political feasibility, when it comes to their implementation. These questions of feasibility are not to be taken lightly: the carbon tax and cap-and-trade have currently failed to gain enough traction to see overall implementation within the United States. Although these market-based solutions do not address the

extraction of capital as the solution I have proposed will, this discussion is still helpful to understand the policy field that our proposed solution will exist in. In this coming section I will further explore what it exactly means to say rights of future generations when I talk about oil and natural gas use. In Chapter 3 I will come more specifically to the policy solution of how to address these questions.

Rights of Future Generations-Oil and Natural Gas

The nation behaves well if it treats its natural resources as assets
which it must turn over to the next generation increased,
and not impaired, in value.

—Theodore Roosevelt, speech to the Deep Waterway
Convention, Memphis, Tenn., Oct. 4, 1907¹³⁰

As we move forward to the concept of the rights of future generations we must reflect back on the discussion in the previous chapter about the rights of future generations within an environmental economics framework. More specifically, I touched on how harvesting a nonrenewable natural resource, where the resource will eventually run out, can be considered as an externality. I now expand upon and utilize this concept by applying it to the resource of oil and natural gas.

Oil and natural gas are nonrenewable natural resources. Once gone, they are gone forever. As Maugeri writes, “Oil resources are finite; this is irrefutable.”¹³¹ Cakravorty et al agree, “Stylized facts suggest that our planet has...limited amounts of natural gas.”¹³² Tietenberg argues, “Proven crude oil

¹³⁰ Miner, Margaret and Hugh Rawson. 2006. *The Oxford Dictionary of American Quotations*. New York: Oxford University Press, 223.

¹³¹ Maugeri, Leonardo. 2006. *The Age of Oil the Mythology, Hisotry, and Future of the World's Most Controversial Resource*. Westport, CT: Praeger Publishers.

¹³² Chakravorty, Ujjayant, Michel Moreaux, and Mabel Tidball. 2008. “Ordering the Extraction of Polluting Nonrenewable Resources.” *The American Economic Review* Vol. 98 (No. 3): 1128–44.

reserves peaked during the 1970s, natural gas peaked in the 1980s in the United States and in Europe.”¹³³ This implies that we have reached maximum extraction.

Still, although it is generally understood that the resources of oil and natural are finite, arguments surrounding what this means exactly are common. There is disagreement over “peak oil,” which often concerns whether or not we have reached peak, or when we might reach it. Those who argue against the theory of peak oil often argue that we do not have knowledge of all the reserves of oil, or that we will develop technology that allows us to find new reserves.¹³⁴ Still, there is much evidence that suggests we are likely well past the peak.¹³⁵ For my argument, I am not interested in when oil will peak or when the reserve will run out. I am rather concerned merely with the fact that at some point in time, the resource *will* run out; policy should act to acknowledge that.

Because oil and natural gas are *finite* resources, our own use leaves questions about what that means for future generations. Harriss explains:

And use now of exhaustible resources reflects more or less deliberate rejection of interests and concerns about future users. Some things are renewable, such as forests, perhaps rather quickly while others take longer. Some, such as petroleum, are used up today. Our descendants will not have them.¹³⁶

As Harris details, the current use of nonrenewable resources inherently implies that future generations will not have access to them. Tietenberg mirrors this argument and the importance of it when he states:

The endowment of depletable resources is of finite size. Current use of depletable, nonrecyclable resources precludes future use; hence the issue

¹³³ (Tietenberg 2004)

¹³⁴ (Robbins, Hintz, and Moore 2010, 37; Tietenberg 2004, 462)

¹³⁵ (Robbins, Hintz, and Moore 2010, 37)

¹³⁶ (Harriss 2006, 696)

of how they should be shared among future generations is raised in the starkest, least forgiving form.¹³⁷

In Chapter 1, I proposed using an environmental economics framework (along with ecological economics considerations) to view the rights of future generations to nonrenewable natural resources as an externality. I proposed this view because our use of nonrenewable natural resources means there is less capital left available for future generations. Now I focus on fully identifying the market-based solution to that externality.

From an economic standpoint, as the last chapter indicated, it is difficult to account for future generations' rights within a market structure. Harriss elaborates, "Present market prices must reflect the views of buyers and sellers today about the future. Yet market prices at present cannot incorporate the valuations of persons who will be affected."¹³⁸ Still, Chapter 1 indicated that a solution in the form of taxation and revenue allocation would allow us to distribute the wealth of the resource to the future. This solution does stand as the best option to address the externality of the rights of future generations. Yet, as I have argued, a market-based solution such as a carbon tax will be insufficient in this context because it makes no attempt to directly incorporate the concerns of future generations to nonrenewable natural resource use. That is, it does not aim to account for the use of natural capital by seeking to replace it. Furthermore, as we discussed, the carbon tax already faces a number of difficulties with political feasibility that may inhibit its implementation.

Harriss explores options to improve our ability to take into account the "using up of natural resources"¹³⁹ within a market-based framework. He briefly

¹³⁷ (Tietenberg 2004, 121)

¹³⁸ (Harriss 2006, 696)

¹³⁹ (Harriss 2006, 697)

touches on property taxes¹⁴⁰ and severance taxation¹⁴¹ as potential means to addressing the rights of future generations to nonrenewable natural resource use. Since we already determined in earlier sections that defining property rights to the nonrenewable natural resources of oil and natural gas is difficult and problematic, we will instead turn to Harriss' suggestion of severance taxation as a policy solution. We will expand upon this idea regarding severance taxation in the coming chapter.

Conclusions

This chapter has inventoried the externalities associated with natural gas and oil. The most important conclusion has been that oil and natural gas, as nonrenewable natural resources, imply that the current generation's use of these resources impacts the rights of future generations to the same resources. I concluded that oil and natural gas are representative nonrenewable natural resource whose externalities lead us to question the rights of future generations. I then discovered that these externalities must be addressed under the environmental economics framework. I concluded also that redefining property rights is not adequate, but rather a market-based solution of taxation and revenue allocation would be most appropriate to addressing the externalities in question. In this chapter I also considered current market-based frameworks for addressing oil and natural gas carbon pollution externalities: cap-and-trade and carbon taxation. In doing so I explained the current policy field of these types of market-based solutions and attempted to address questions of feasibility.

In the coming chapter I synthesize the information from the previous two chapters with the idea of the severance tax that Harriss proposed. That is, I explain how severance taxation, as a policy solution, can allow us to take into

¹⁴⁰ (Harriss 2006, 697)

¹⁴¹ (Harriss 2006, 698)

account the rights of future generations when harvesting nonrenewable natural resources.

Although I will explain severance taxation in greater detail in the coming chapter, I would like to disclose further why I am interested in discussing severance taxation. First, there appears to be a disproportionate amount of attention to oil and natural gas production, policy and impacts versus attention given toward this regulatory severance tax. In fact, the amount of severance tax literature is conspicuously little. Second, I am interested in reviewing severance taxes due to their uniqueness in comparison to other market-based solutions. So far these various market-based solutions that we have explored work at the point of pollution. That is, they aim to reduce pollution from production or use of the resource (such as oil or natural gas). Severance taxes differ from these other solutions; they are a unique kind of market-based solution in that they take hold earlier at the point of extraction rather than the point of pollution. In doing so, they appear to be meant to address a different set of responsibilities—to extend beyond our obligations to those whom our actions affect in the present, as pollution does, to find a way to also institutionalize our obligations to future generations. Let us now reserve this discussion for further consideration in Chapter 3.

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I think what was most surprising about Professor Christopherson’s commentary on Texas was the matter of fact manner in which she recollected the Texans’ statement that we *must* tax. Yes, it does seem pretty intuitive that we should better value the resources we use, but it also begs the question, why do we often fail to actively address these problems and solutions? Why has Texas actively addressed these problems while other states have not been as proactive?

Chapter 3

The first time I discussed severance taxation with Professor Lisa Disch, I remember, was the first time she had heard of the term. We talked a bit about the term itself—*severance*—and Professor Disch did remark that the language of the tax name was in itself, interesting.

I think she made a great point, especially in light of traditional terms, such as production and extraction, that are typically associated with natural resource use. The term “production,” implies something is being created, when in fact, in the oil and gas industry, it refers to the removal of capital, not the creation. The term “extraction,” is closer to the truth in that it acknowledges the removal of the resource. But “severance”—to sever—implies to cut, almost forcibly. It is the rhetoric of not just removal, but also of death.

We have learned that once the resource is gone, it is gone. And this might be the tax that recognizes that fact.

.....

As I move forward in this exploration of environmental economics and the issues of oil and natural gas exploration, I come to the policy solution of severance taxation. The Revenue Sources Book for the state of Alaska explains the function of the severance tax: “Often referred to as a production tax, the severance tax is imposed on a producer as the resource is severed (or extracted) from the leased land.”¹⁴²

In past chapters I identified the necessity of addressing the rights of future generations in managing a nonrenewable natural resource. I left off with questions of how we might use policy to address this issue and what form that solution may come in, which I briefly identified as being a taxation and revenue allocation

¹⁴² Rodell, Angela, Commissioner, and Bruce Tangeman, Deputy Commissioner. 2013. “Revenue Sources Book Fall 2013”. Alaska Department of Revenue-Tax Division. <http://www.tax.alaska.gov/programs/documentviewer/viewer.aspx?1022r>. 32.

scheme. This chapter further will answer these questions by exploring from a theoretical perspective, the role severance taxes may play in helping to manage nonrenewable natural resources for future generations.

This chapter will be structured as follows. It will first re-iterate the problem of rights of future generations in nonrenewable natural resource use. It will review several solutions proposed in the literature. Following this discussion I will explore how the severance tax functions as a solution and why the allocation of revenue serves as the key factor in this solution. The conclusion will review the implications of this analysis.

Severance Taxes

As the last two chapters concluded, the rights of future generations to nonrenewable natural resources are necessary to consider from an environmental economics lens, but present market situations (at least those commonly explored in literature) do not allow us to adequately address the management of natural capital. I also explained in Chapter 2 that oil and natural gas are representative nonrenewable natural resources that we can target. The question I left off with then, is how we can address the rights of future generations to oil and natural gas from an environmental economics perspective? How can we achieve a sustainable solution? How can we achieve a politically feasible solution? Before addressing oil and natural gas severance taxation specifically (Chapter 4), I will first examine managing nonrenewable resources in general.

Let me set up the problem as follows: A state economy relies on the extraction of a nonrenewable resource for its economic well-being. Although its citizens benefit from the extraction of this resource, the more they extract, the less they have available. That is because extraction means diminished natural

capital.¹⁴³ Although the amount of resource left may last for five, 50 or 5 million years, the state does acknowledge it will run out. When it runs out they face the uncertainty of how to compensate for this lost resource. Although this problem may not be one they are directly faced with during their lifetime, the people of this state may recognize that the future generations will suffer any mismanagement repercussions. Their children may face the problems associated with the loss of resource. Still, they need to continue extraction because their economy and well-being relies on it. They then decide they need to figure out how to manage the resource for this current generation and generations to come. What do they do?

In past chapters I alluded to several solutions and ideas promoted by authors. I discussed the sustainability principle, or “restoring intergenerational fairness in the use of depletable resources.”¹⁴⁴ In regards to nonrenewable resources, various writings, such as those by Tietenberg, Daly and Costanza promoted the protection of nonrenewable resources for the sake of the future. Their arguments however, did not require the present generation to avoid using the resource. Instead, these authors suggested achieving successful management through taxation on the extraction of nonrenewable natural resources. Tietenberg highlights this more closely with his description of Serafy’s work:

Salah El Serafy has developed an ingenious, practical way to answer this question. Calculate the present value of the net benefits received from the extraction of a depletable resource over its useful life. This becomes the wealth to be shared. Using standard annuity tables, calculate the constant annual payments that could be made from this fund forever. (In essence, these payments represent the dividends and interest derived from the wealth; the principle would be left intact.) This constant annual payment is what can be consumed from the wealth created from the depletable resources. Receipts in excess of this amount (in the years the resource is

¹⁴³ Salah El Serafy. 1981. “Absorptive Capacity, the Demand for Revenue and the Supply of Petroleum.” *The Journal of Energy and Development* 7 (1): 73–88.

¹⁴⁴ (Tietenberg 2004)

being extracted and sold) must be paid into the fund. All succeeding generations receive the same annual payment; the payments continue forever.¹⁴⁵

Although interesting, I am not so much concerned with Serafy's calculations as I am with the description of Serafy's proposal of payments into a fund that future generations could use theoretically forever. This is because, through Serafy's work and Tietenberg's description, we can begin to understand the role taxation may play in addressing nonrenewable natural resource management. Tietenberg continues:

The payments could be invested in research rather than in instruments producing a financial return. Such a strategy might envision, for example, setting aside through taxation a certain proportion of all proceeds from depletable resources for funding research on substitutes likely to be used by future generations.¹⁴⁶

With this, Tietenberg confirms the revenue allocation scheme this thesis promoted in earlier chapters. As Tietenberg argues, by ensuring that the nonrenewable natural resource is taxed and the revenue is properly allocated, we can find a way to "repay" future generations for our use of nonrenewable natural resources. The repayment exists to ensure that when the resource runs out, there is adequate funding to find substitutes. Thus, Serafy's proposal serves as a solution to the "sustainability principle" or our rights to future generation discussion.

But just how exactly could this plan be reached in principle? Harriss discussed issues of nonrenewable natural resource management. He sheds some light on how this solution can be practically realized through the unrealized potential of severance taxation. He commented, "Natural resources present greater

¹⁴⁵ (Tietenberg 2004, 435)

¹⁴⁶ (Tietenberg 2004)

potential for financing government than has yet been realized.”¹⁴⁷ With his comment in mind, let us now delve further into severance taxation.

Severance taxation is a currently existing policy that is employed internationally as well as within the United States. Within the United States, severance taxation occurs at the state or local level and often targets resources such as gas, oil, timber, minerals, and even fish. Severance taxes specifically on the nonrenewable natural resources of oil and natural gas occur in approximately 35 states. These severance taxes either tax the volume of oil or gas produced, the value of produced oil and gas, or some combination of those two methods. In this sense, these taxes vary widely by state, with some states even calling them production taxes instead of severance taxes.¹⁴⁸ In a report on oil and gas severance taxes prepared by the National Conference of State Legislatures, Jacquelyn Pless defines the policy purpose of severance taxes:

Severance taxes help insure that costs associated with resource extraction—such as road construction and maintenance, and environmental protection—are paid by the producers, helping to alleviate potential impacts on state and local taxpayers. States distribute revenues in various ways, but typically, most of the collected taxes are deposited into the general fund. Many states also use the extra revenue to fund conservation and environmental cleanup projects and distribute portions of the collected taxes to local governments.¹⁴⁹

As is clear in Pless’ definition, states often employ severance taxation to generate revenue and address present externalities. She does, however, suggest that there is some effort towards managing the revenue from the resource to fund

¹⁴⁷ (Harriss 2006, 698)

¹⁴⁸ Brown, Cassarah. 2013. “State Revenues and the Natural Gas Boom: An Assessment of State Oil and Gas Production Taxes.” National Conference of State Legislatures. <http://www.ncsl.org/research/energy/state-revenues-and-the-natural-gas-boom.aspx>.

¹⁴⁹ Pless, Jacquelyn. 2013. “Oil and Gas Severance Taxes: States Work to Alleviate Fiscal Pressures Amid the Natural Gas Boom.” National Conference of State Legislatures. <http://www.ncsl.org/research/energy/oil-and-gas-severance-taxes.aspx>.

conservation. In fact, some states do allocate their severance tax funds towards a trust or “Legacy” fund (as I will review in Chapter 4).

Fundamental to achieving the goal of managing nonrenewable resources for future generations by using severance taxation is the question of where the revenue goes. As briefly explored above, the severance tax, like any other tax, generates a revenue. This revenue is essential to the public interest as it addresses many externalities the public faces because of the extraction—construction, maintenance, etc.—in a way that alleviates burdens to the public. Tietenberg explains the benefit of taxation: “Fees also raise revenue. Successful development, particularly sustainable development, requires a symbiotic partnership between the public and private sectors. To function as an equal partner, the public sector must be adequately funded.”¹⁵⁰ But when exploring severance taxes as solutions to nonrenewable natural resource management, the question becomes what part of the public sector will be funded? Today’s or tomorrow’s?

As we can see, severance taxes are an existing policy measure that taxes the extraction of a resource. And in some cases, their revenue goes towards conservation measures and trust funds. I propose that the conceptual solution to managing nonrenewable natural resources can be realized structurally through severance taxation. That is because current severance taxes provide the framework to achieve, if they do not already achieve, this goal of addressing the rights of future generations.

The allocation of its revenue is what would bridge the gap between what the severance tax does and what it could do to address the rights of future generations. The allocation of its revenue is what would differentiate the severance tax from any other tax used for generating revenue. It would establish

¹⁵⁰ (Tietenberg 2004, 470)

the severance tax as a tax designed for managing nonrenewable natural resources and accounting for future generations. The revenue would highlight which competing normative framework is actually achieved: sustainability versus short-term gain. Think of it this way. The severance tax as “any other tax,” would generate revenue through its fee. This revenue would then be the state’s revenue to spend any way it chooses. This may often manifest itself in dumping the money into the general fund to be later spent on public services such as education or transportation. That is, it will be spent on the present generation. (This is how many severance taxes currently work, as I alluded above and as will be explored in the case studies next chapter).

While this is a perfectly acceptable way of handling the revenue, it is almost analogous to “double-dipping,” and it certainly does not allow the severance tax to be a solution to the rights of future generations externality. In this case, the present generation is both using up the resource and making extra money off of it through the tax. Of course, we can at least recognize that they are capitalizing on the nonrenewable natural resource’s value. Still, because I am most interested in exploring severance taxation as a nonrenewable natural resource management technique, let me now consider how the severance tax would function as a sustainability project.

The severance tax as a “sustainability project” would account for future generations in its structure. That is, it would put a very specific value on the nonrenewable natural resource when taxed. The revenue would then account for future generations. This would be achieved by allocating the revenue into a trust fund to be used by future generations. The fund, as we discussed when reviewing Costanza and Daly in earlier sections, must be used to preserve capital. As Tietenberg had explained while analyzing Sarafy, this fund would provide funding for research into substitutes that could be used by future generations:

In the case of fossil fuels, for example, one might subsidize research into solar energy or the use of hydrogen as a fuel so that, as fossil fuels are depleted, future generations would have the ability to switch to alternative sources easily, without diminishing living standards in the process.¹⁵¹

In this sense, by utilizing a severance tax, a governing body would achieve balance between generations in the extraction of a resource. The implementation of a severance tax is just the first step. The conversion into a sustainability project is contingent on the revenue allocation of that tax. That is, revenue allocation into a trust fund for future generations to access is the second step. And finally, successful implementation of those funds on the part of future generations to make up for that resource, by using funding for research into alternatives and technology is necessary because it will allow severance taxation to serve as a solution to the rights of future generations problem.

Conclusions

In this chapter I have named severance taxation as the solution to managing nonrenewable natural resources to address the rights of future generations.

Before moving forward, I would now like to recap what we have determined in our analysis up to this point. Namely, that the goal of environmental economics is to remove externalities. Nonrenewable natural resources intrinsically include future generations in their externalities. When addressing the externalities of nonrenewable natural resource use, the solution must account for all externalities, including the rights of future generations through the replacement of natural capital. The nature of nonrenewable natural resource use means solutions must come from market-based solutions instead of property rights allocation schemes. Taxes provide the best option for addressing

¹⁵¹ (Tietenberg 2004)

externalities and rights of future generations because of their revenue generating property. Severance taxation provides the proper structure to directly tax the extraction of the nonrenewable natural resource. Severance taxation as a solution is contingent on the revenue allocation of the tax; the revenue of the severance tax must be allocated in a manner that addresses the removal of the nonrenewable natural resource. That is, it must replace the resource by investing in renewables or by providing for research or technology.

As this chapter has indicated, the structure of severance taxation provides a way to address issues of nonrenewable natural resource management and the rights of future generations in an already existing policy framework. This solution is contingent on how the revenue from the taxation is allocated. While admittedly lacking in economic analysis, this paper provides a look into a policy solution. To strengthen this argument I will look at existing policy to explore how it already is or could be potentially shaped to address the normative issues explored in this paper. This means that we need to examine more closely where the revenue goes in actual policy. The next chapter will do this through two case studies. When reviewing these two cases, we will be interested to see not only where the revenue goes, but also the mindset of the legislatures in creating the severance tax. That is, were they interested in recognizing the rights of future generations, or where they merely interested in a new revenue source. In reviewing these case studies, I will look at oil and natural gas severance taxes as our representative nonrenewable natural resource discussed in Chapter 2.

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After reviewing this chapter with Ray McDaniel at Sweetland for the first time I begin to gather my papers and zip up my backpack. Before I leave I tell him about how useful I found reading the Tietenberg book. “But,” I vent my minor frustration, “someone recalled the book.” I got the dreaded email from the library and I had to turn it in.

The Implications of a Severance Tax

“That’s what you call karma,” he says, laughing, “at least you know what it feels like to want something someone else has.” And with that I nod, wondering what future generations would have to say about our resource use, as I leave to work on my next chapter.

Chapter 4

Walking into Professor Mika LaVaque-Manty’s office hours, I am greeted with a “Hello— I thought of your thesis the other day!” And I stand wondering, what could have reminded him of severance taxation?

Well, just that, taxes. He explained he had been filling his taxes using Turbo Tax. The filling process consists of answering a number of questions, such as whether you are a married, whether or not you have any dependents, etc. He also stumbled across a few questions asking him if he felt he had extracted any resources lately.

I laughed.

Of course I knew severances taxes were real, but it was interesting to hear them being applied to everyday society. It was fascinating to hear an example of their stealthy infiltration into society, or at least, infiltration into Turbo Tax.

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Of course with these theoretical discussions it is always useful to look to reality to see how our conclusions compare. I now turn to two case studies to see just how applicable this discussion of severance taxes and their potential to address the rights of future generations is.

These case studies are used to showcase a number of things. I explore these case studies to show how severance taxation exists in the current policy sphere and to see what form severance taxes may take. I also explore them to understand the difference between a “sustainability-focused” severance tax and a “not sustainability- focused” severance tax. A “sustainability-focused” severance tax will be defined as a severance tax that addresses all externalities associated with nonrenewable natural resource use including future generations. It does this by 1) placing some of the severance tax revenue into a fund for future generations and 2) ensuring that the fund accounts for replacement of capital by investing in renewables, technology or research. A “not sustainability-focused” severance tax

will be defined as a severance tax that does not address all externalities including the rights of future generations and does not fulfill the two requirements listed above. Finally, I explore these case studies to bring the theory to reality. That is, by examining the case studies, I can explore whether severance taxation could actually address the rights of future generations. Before exploring these case studies, let us first consider state severance taxation on the whole.

State Severance Tax Overview

Before considering the case studies I have selected, it is useful to have an understanding of the general state severance tax climate. This overview is helpful to provide further context as to the uniqueness of the case studies I have selected. I will now briefly consider all state severance taxes here by examining the percent make-up of their severance tax collection to overall state tax collection, with some reference to their influence in total state government collection. It is important in this consideration to note that the severance tax field is quickly changing as many states update, create or change their severance tax, especially as the natural gas movement unfolds. Despite the dynamic outlook of this policy sphere, I will focus my discussion only on recent state severance tax structure using 2012 Census Bureau data¹⁵² and data from the National Conference of State Legislatures¹⁵³ in order to provide a quick outlook of all states.

Severance taxation varies widely on a state to state basis. Still, there are some general trends. For example, out of the 50 U.S. States, 15 do not impose any type of severance tax. These states include Delaware, Georgia, Hawaii, Illinois,

¹⁵² See O’Sullivan, Sheila, Lynly Lumibao, Russell Pustejovsky, Tiffany Hill, and Jesse Willhide. 2013. “State Government Tax Collections Summary Report: 2012.” U.S. Census Bureau. <http://www2.census.gov/govs/statetax/2012stcreport.pdf>.

¹⁵³ See (Brown 2013)

Iowa, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, South Carolina and Vermont.¹⁵⁴

On the opposite side of the spectrum, the states of Alaska, North Dakota and Texas impose significantly large severance taxes. In fact, in 2012 their severance tax collections collectively accounted for roughly 67.4 percent of total state government severance collection.¹⁵⁵ Interestingly enough, Alaska and North Dakota's severance taxes accounted for 82.1 percent and 56.7 percent of their total tax collections, respectively, while Texas' severance tax only accounted for 7.5 percent of its total tax collection. Furthermore, Alaska and North Dakota's severance tax revenues helped to drive their total tax revenues to increase by 47 and 27.3 percent between 2011 and 2012.¹⁵⁶ Wyoming is also of note in this category, as its severance tax accounted for 37.97 percent of its total tax collect.

Like Texas, in comparison to total revenue, most state severance taxes produce a smaller portion of the state's total revenue. These states include Kentucky, Louisiana, Montana, Nevada, New Mexico, Oklahoma and West Virginia. Their severance taxes make up 3.3, 9.5, 12.43, 4.5, 15.1, 9.62, and 11.7 percent of their total state revenue, respectively.¹⁵⁷

There are also a group of states whose severance taxes account for less than 2 percent of their total revenue. These states include: Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Florida, Idaho, Indiana, Kansas, Michigan, Minnesota, Mississippi, Missouri, Nebraska, North Carolina, Ohio, Oregon, South Dakota, Tennessee, Utah, Virginia, Washington, and Wisconsin.¹⁵⁸

¹⁵⁴ (O'Sullivan et al. 2013, 3)

¹⁵⁵ Based off of information from (O'Sullivan et al.2013). See "Appendix B" for more information.

¹⁵⁶ (Brown 2013)

¹⁵⁷ Based off of information from (O'Sullivan et al.2013). See "Appendix B" for more information.

¹⁵⁸ Based off of information from(O'Sullivan et al.2013). See "Appendix B" for more information.

These groups reveal that the state severance tax field is diverse, but does show some trends, with cases such as Alaska, North Dakota, Wyoming and even Texas posing somewhat as outliers. These cases contrast to the other groups of states that do not employ severance taxation, or generate a small portion of their total revenue from severance taxation. With this foundation established, I will now move forward to discuss case selection.

Case Selection

Although serving purely descriptive purposes, the cases were selected to have very similar characteristics. These characteristics included their production ranking for oil and natural gas (as according to the U.S. Energy Information Administration), their state Gross Domestic Product (GDP), state GDP ranking, state severance tax revenue, share of state severance tax in total revenue and state political party in power at the time the tax was created.

Before explaining the cases selected, I would like to spend some time on why I looked at these variables in particular. Since I am reviewing cases for their descriptive purpose, namely whether or not their severance tax is “sustainability-focused,” I wanted the focus to be purely on how the severance tax and revenue allocation is structured. I am not as interested in reasons why the taxes are different (which is why these cases are purely descriptive). Still, it could be argued that variables such as state GDP played a role in the policy decision-making process for different cases. In this sense, describing “sustainability-focused” and “not sustainability-focused” cases may warrant explanations for why they are labeled either way. If one case has an economic advantage or a resource advantage over another case, it may appear as an explanation for why the tax is different. It may also appear that cases were cherry-picked to suit the needs of my theoretical argument. To avoid these questions and areas of inquiry, I focused on finding states that can be labeled similar in multiple areas.

These areas included state GDP, state GDP ranking, state oil and gas production ranking, state severance tax revenue, share of state severance tax in total revenue and state political party in power at the time the tax was created. State GDP and GDP ranking was explored for the reason given above; I wanted states with similar economic situations so that differences in the tax could not be accounted for through the economic situation of the state. I looked for states with similar production rankings (in comparison to all fifty states production rankings) so that their resource extraction was similar. Similar to my reasoning for choosing GDP, I did not want differences in tax to be attributable to differing levels in extraction. In this sense, I wanted states who were either both high, middle or low producers.

I also examined state severance tax revenue and the share of state severance tax in total revenue. This is because states that generate a large source of revenue from severance taxes may have different motives than states that do not rely on severance taxation. Besides looking for cases with similar revenues, I wanted states with high dependence on their severance taxes, because they may have more invested when it comes to how the severance tax is structured. In this sense I looked for states with a high share of state severance tax revenue in total revenue.

I also sought out cases with the same political party in power, which I defined as the state having a governor and majority of the legislature in the same political party at the time the severance tax was enacted. In choosing two cases with the same political party in power, I wanted to remove any questions of whether states acted differently based on their political affiliation.

Based on these variables, I selected the cases of Alaska and North Dakota for further observation. I will now briefly explore how the cases of Alaska and North Dakota compare given the variables discussed above.

The Implications of a Severance Tax

According to the Bureau of Economic Analysis, Alaska's GDP (listed in millions of current dollars) was 47,910 in 2010, 51,237 in 2011 and 51,859 in 2012. North Dakota's GDP (in millions of current dollars) was 35,357 in 2010, 39,992 in 2011 and 46,016 in 2012.¹⁵⁹ Although North Dakota's GDP is slightly less than that of Alaska, the two are relatively comparable. This is made evident in data provided by the Bureau of Economic Analysis that ranks states by GDP. In 2010, Alaska and North Dakota were ranked 45 and 49, respectively. In 2011, Alaska was ranked 44 and North Dakota was ranked 47. In 2012, Alaska was ranked 44 and North Dakota was ranked 46.¹⁶⁰ As this data indicates, Alaska and North Dakota's GDP are similar, especially when compared to all other states.

According to the U.S. Energy Information Administration's (EIA) data collected in 2012, Alaska, with natural gas marketed production (million cu ft) at 351,259, was ranked as the 11th top producer of natural gas. In comparison, North Dakota, with natural gas marketed production (million cu ft) at 179,004 was ranked as the 15th top producer of natural gas.¹⁶¹ Based on EIA's most recent data (October 2013), Alaska's crude oil production ranking was 4, with 16,136 thousand barrels produced. North Dakota's crude oil production ranking was 2, with 29,191 thousand barrels produced.¹⁶² As this data shows, Alaska and North Dakota are relatively similar in their production rankings for oil and natural gas.

¹⁵⁹ Bureau of Economic Analysis. 2013. "GDP and Personal Income." U.S. Department of Commerce Bureau of Economic Analysis. <http://www.bea.gov/iTable/iTable.cfm?ReqID=70&step=1#reqid=70&step=10&isuri=1&7007=2012,2011,2010&7093=levels&7090=70&7035=-1&7036=-1&7001=1200&7002=1&7003=200&7004=naics&7005=-1&7006=02000,38000>.

¹⁶⁰ Bureau of Economic Analysis. 2013. "Gross Domestic Product by State (millions of Current Dollars)." U.S. Department of Commerce Bureau of Economic Analysis. <http://www.bea.gov/iTable/iTable.cfm?ReqID=70&step=1#reqid=70&step=10&isuri=1&7007=2012,2011,2010&7093=levels&7090=70&7035=-1&7036=-1&7001=1200&7002=1&7003=200&7004=naics&7005=101&7006=xx>.

¹⁶¹ United States Energy Information Administration. 2012. "Rankings: Natural Gas Marketed Production, 2012." U.S. Department of Energy. <http://www.eia.gov/state/rankings/#/series/47>.

¹⁶² United States Energy Information Administration. 2013. "Rankings: Crude Oil Production, October 2013." U.S. Department of Energy. <http://www.eia.gov/state/rankings/#/series/46>.

The United States' Census Bureau provides information on state government tax collections. From their data I was able to determine that in 2012, Alaska collected 5,787,360 (thousand of dollars) from their severance taxes, while North Dakota collected 3,187,112 (thousand of dollars) from their severance taxes. Although Alaska collected slightly more, according to the Census Bureau data, Alaska was the highest collector of severance taxes, while North Dakota was the 3rd highest, ranked after Texas.¹⁶³

The Census Bureau report also discusses state government tax collections (as we reviewed in the previous section). In their report, they state that in 2012, Alaska's severance taxes accounted for 82.1 percent of its total tax collection while North Dakota's severance taxes account for 56.7 percent of its total tax collections.¹⁶⁴ The report puts the significance of these numbers in context by reflecting that 15 out of the 50 states do not impose any severance taxes.¹⁶⁵ Furthermore, the report points out that the three states of Alaska, North Dakota and Texas account for 67.4 percent of total state government tax collections.¹⁶⁶ In this sense, the role that severance taxation plays in Alaska and North Dakota is both vast and unique in comparison to other states.

The political party in power at the time the severance tax was enacted was also the same for both Alaska and North Dakota. The governor of Alaska, Governor Sean Parnell, is a Republican who signed Alaska's most recent severance tax bill, Senate Bill 21. The 28th Alaska State Legislature, which was responsible for voting on SB 21, has a Republican majority in both houses.¹⁶⁷ Similarly, North Dakota Governor Jack Dalrymple, a Republican, was in power

¹⁶³ (O'Sullivan et al. 2013, 7)

¹⁶⁴ (O'Sullivan et al. 2013, 3)

¹⁶⁵ (O'Sullivan et al. 2013, 3)

¹⁶⁶ (O'Sullivan et al. 2013, 3)

¹⁶⁷ For more information, see The Alaska State Legislature. 2014. <http://w3.legis.state.ak.us/>.

when House Bill No. 1198, was signed into law. House Bill No. 1198 contained amendments to North Dakota Century Code sections 57-51 and 57-51.1, which include North Dakota’s Oil and Gas Gross Production Tax and Oil Extraction Tax, respectively.¹⁶⁸ The Republicans had a majority in both houses when the Sixty-third Legislative Assembly of North Dakota voted on the bills.¹⁶⁹

The information above is also summarized in Figure 1 below.

Figure 1: Alaska and North Dakota Case Study Comparison

	Alaska	North Dakota
State GDP (2012) (in millions of current dollars)	51,859	46,016
State GDP ranking (2012)	44	46
Natural Gas Production Ranking (2012)	11	15
Crude Oil Production Ranking (October 2013)	4	2
State Severance Tax Revenue (2012) (Amount in \$ thousands)	5,787,360	3,187,112
Share of State Severance Tax in Total Revenue (2012)	82.1%	56.7%
Political Party in Power at the Time of Tax Enactment	Republican Governor, Republican Majority in Alaskan Legislature	Republican Governor, Republic Majority in North Dakota Legislative Assembly

Given these similarities between Alaska and North Dakota, I found it appropriate to use the two states for my case studies. Now that I have considered the similarities between Alaska and North Dakota, I will now go further into the

¹⁶⁸ See House Bill No. 1198. 2013. 63rd Legislative Assembly of North Dakota. <http://www.nd.gov/sos/lr/scannedbills/1198.pdf>.

¹⁶⁹ For more information, see North Dakota Legislative Branch. 2014. “63rd Legislative Assembly.” <http://www.legis.nd.gov/assembly/63-2013>.

case studies by providing a detailed description of their severance taxes and revenue allocation. This will be followed by an analysis that explains what these findings mean in relation to my argument about externalities, the rights of future generations and severance taxation.

Alaska

The Alaskan oil and natural gas severance tax, known as the Oil and Gas Production Tax, was recently amended with Senate Bill 21 (the *More Alaska Production Act*), which was signed into law May 21, 2013.¹⁷⁰ This recent change mandated that starting in 2014 the tax rate changed to 35% of production value with no additional progressive tax.¹⁷¹ This compares to the previous tax structure which taxed 25% of production value and included a progressive tax set-up that went up to nearly 50%.¹⁷² In addition to this tax structure, Alaska's Oil and Gas Production Tax includes many provisions for tax credits, such as tax credits for exploratory wells, which could take the severance tax as low as 14%.¹⁷³ Differences in the tax also depend on the region of where the oil and gas is produced, namely the North Slope, Cook Inlet or the rest of Alaska. Distinctions in the tax and applicable credits also depend on whether the gas is used-in-state or leaves the state.¹⁷⁴ Since I am most interested in exploring the revenue allocation of the funds from the Oil and Gas Production Tax I will avoid discussing the intricacies of the tax credits built within the bill and will instead now turn towards the tax revenue allocation scheme.

¹⁷⁰ Senate Bill No. 21. 2013. 28th Legislature. The Alaska State Legislature. http://www.legis.state.ak.us/basis/get_bill.asp?session=28&bill=SB0021.

¹⁷¹ (Brown 2013; Senate Bill No. 21 2013)

¹⁷² Wirtz, Ronald A. 2013. "Fine-tuning the Oil Tax Machine." *Fedgazette*. https://www.minneapolisfed.org/publications_papers/pub_display.cfm?id=5127. See also (Brown 2013).

¹⁷³ (Wirtz 2013)

¹⁷⁴ (Rodell 2013)

The Implications of a Severance Tax

The revenue allocation scheme of the Oil and Gas Production Tax was difficult to track down. Still, data from the Alaska Department of Revenue Tax Division indicates that a large portion of the Oil and Gas Production Tax revenue becomes unrestricted general fund revenue.¹⁷⁵ This means it becomes revenue that is not restricted by statute or custom. The Oil and Production Tax revenue make up a large portion of this general fund revenue. In fact, the Production Tax makes up the largest portion of total oil revenue (63.8%) and in combination with Royalty Payment, Property Taxes and Corporate Income Taxes, the Production Tax contributed 92% of the total deposits to the unrestricted general fund revenue in FY 2013.¹⁷⁶

Once in the general fund, the Oil and Gas Production Tax revenue may be used for a number of services including education, health and human services, university, and transportation.¹⁷⁷ The revenue may be appropriated by the Legislature towards general government operation and for capital improvements across the state.¹⁷⁸

Determining the allocation of the remainder of Alaska's Oil and Natural Gas Production Tax revenue became a matter of searching and piecing together information. While looking through this data, information on all "Restricted Petroleum Revenue" source was given, that is, revenue that is restricted by statute or custom. This revenue included NPR-A Rents, Royalties, Bonuses; Royalties to AK Permanent Fund; Royalties to Public School Fund; and CBRF Deposits. This restricted revenue did not include the Oil and Gas Production Tax. Furthermore, "production tax applies only to oil and gas that the producer sells, so it excludes state royalties, gas used in lease operations or flared for safety reasons, and any

¹⁷⁵ (Rodell 2013)

¹⁷⁶ (Rodell 2013)

¹⁷⁷ Alaska Department of Administration Division of Finance. 2013. "State of Alaska General Fund" Exhibits 1-5. <http://doa.alaska.gov/dof/reports/resource/fy13/Exhibits.pdf>.

¹⁷⁸ (Rodell 2013, 32)

production that is re-injected into a reservoir.”¹⁷⁹ Given this information, I ruled out the possibility of Oil and Gas Production Tax being a source of Restricted Petroleum Revenue for the general fund. This distinction is important because the Restricted Petroleum Revenue is allocated in specific, *restricted* ways within the general fund.

As shown, the Production Tax makes a significant contribution to Alaska’s revenue, especially general fund revenue. The fact that the Production Tax contributes significantly to Alaska’s general fund may explain why Alaska does not levy general sales and gross receipts taxes or impose individual income taxes.¹⁸⁰ It is difficult to determine beyond that if there are any additional amounts of Production Tax revenue allocated towards other funds besides the general fund. With this in mind, I will still briefly explore other potential areas of Production Tax revenue allocation.

Within the text of Senate Bill 21 itself, there is mention of a “Community revenue sharing fund.” The bill updated this fund as follows:

* Section 1. AS 29.60.850(b) is amended to read:

(b) Each fiscal year, the legislature may appropriate to the community revenue sharing fund [AN AMOUNT EQUAL TO 20 PERCENT OF THE] money received by the state during the previous calendar year under AS 43.20.030(c) [AS 43.55.011(g)]. The amount may not exceed

(1) \$60,000,000; or

(2) the amount that, when added to the fund balance on June 30 of the previous fiscal year, equals \$180,000,000.¹⁸¹

Although it is unclear whether revenue from the severance tax is allocated towards this fund or whether the fund was just amended within the body of the bill text, we need not worry about the distinction. Further research about the community revenue sharing fund indicated that the community revenue sharing

¹⁷⁹ (Rodell 2013)

¹⁸⁰ (O’Sullivan et al. 2013, 8)

¹⁸¹ (Senate Bill No. 21 2013)

fund is a fund established within the general fund “for the purpose of making community revenue sharing payments to municipalities, reserves, and communities for any public purpose.”¹⁸² In this sense, the purpose of the community revenue sharing fund is similar to that of the general fund in that it provides for general services and is included within the general fund allocations.

An additional focus of my research became that of Alaska’s Permanent Fund. The Alaska Permanent Fund is well known for its dividend payouts to Alaskan residents. In 2013, Alaskan citizens received \$900 from this fund,¹⁸³ an amount *Alaska Dispatch* called “relatively low.”¹⁸⁴ According to them, Alaskan received a low of \$331.29 in 1984 and a high of \$2,069 in 2008 from this fund. The Permanent Fund was created as constitutional amendment Article IX, Section 15 in 1976 to put at least 25% of mineral lease rentals, royalties, etc. into a dedicated fund for its protection. This amount was increased to 50% after February 15, 1980. Under Alaskan Articles, the Permanent Fund is described as follows:

Section 37.13.010. Alaska permanent fund.

(a) Under art. IX, sec. 15, of the state constitution, there is established as a separate fund the Alaska permanent fund. The Alaska permanent fund consists of:

- (1) 25 percent of all mineral lease rentals, royalties, royalty sale proceeds, net profit shares under AS 38.05.180 (f) and (g), and federal mineral revenue sharing payments received by the state from mineral leases issued on or before December 1, 1979, and 25 percent of all bonuses received by the state from mineral leases issued on or before February 15, 1980;
- (2) 50 percent of all mineral lease rentals, royalties, royalty sale proceeds, net profit shares under AS 38.05.180 (f) and (g), and federal mineral

¹⁸² Alaska Statutes Sec. 29.60.850. Community Revenue Sharing Fund. 2013. The Alaska State Legislature 28th Legislature. <http://www.legis.state.ak.us/basis/statutes.asp#29.60.850>.

¹⁸³ Edge, Megan. 2013. “2013’s Alaska Permanent Fund Dividend Check: \$900.” *Alaska Dispatch*. <http://www.alaskadispatch.com/article/20130918/2013s-alaska-permanent-fund-dividend-check-900>.

¹⁸⁴ (Edge 2013)

revenue sharing payments received by the state from mineral leases issued after December 1, 1979, and 50 percent of all bonuses received by the state from mineral leases issued after February 15, 1980;

(3) any other money appropriated to or otherwise allocated by law or former law to the Alaska permanent fund.

(b) Payments due the Alaska permanent fund under (a) of this section shall be made to the fund within three banking days after the day the amount due to the fund reaches at least \$3,000,000 and at least once each month.

(c) The Alaska Permanent Fund shall be managed by the Alaska Permanent Fund Corporation established in this chapter.¹⁸⁵

In addition to this structure, the findings indicate that the fund is established to recognize the value of the finite resources and their value for the people of the state and future generations:

Section 37.13.020. Findings.

The people of the state, by constitutional amendment, have required the placement of at least 25 percent of all mineral lease rentals, royalties, royalty sale proceeds, and federal mineral revenue sharing payments and bonuses received by the state into a permanent fund. The legislature finds with respect to the fund that

(1) the fund should provide a means of conserving a portion of the state's revenue from mineral resources to benefit all generations of Alaskans;

(2) the fund's goal should be to maintain safety of principal while maximizing total return;

(3) the fund should be used as a savings device managed to allow the maximum use of disposable income from the fund for purposes designated by law.¹⁸⁶

In this sense, at least in the establishment of the Permanent fund, there was recognition of the potential benefit the resource had for future generations. Given this indication, I was most interested in exploring this iconic fund to determine

¹⁸⁵ Alaska Permanent Fund Corporation. 2014. "Alaska Constitution and Law Pertaining to the Permanent Fund." <http://www.apfc.org/home/Content/aboutAPFC/constAndLaw.cfm>.

¹⁸⁶ (Alaska Permanent Fund Corporation 2014)

whether the Oil and Production Tax revenue played a role in supporting this fund. I was also interested in determining whether the fund actually achieved what it set out to do as “a means of conserving a portion of the state’s revenue from mineral resources to benefit all generations of Alaskans.” As well as determining what it actually meant to “benefit” all. That is, did “benefit” mean paying future generations through dividends, or did it mean investing in resources that will benefit the economy and replace the resource use.

Ultimately it appeared that there was no direct connection between the Production Tax and revenue that is directly allocated towards the Permanent Fund. That is, even though Alaska taxes extraction of nonrenewable natural resources *and* recognizes that revenues “from mineral resources [should] benefit *all* generations of Alaskans,” it does not actually make an institutional link between these two principles: from what I found, the Production Tax does not pay into the Permanent Fund. However, as mentioned earlier, Royalties and other forms of Restricted Petroleum Revenue are allocated to the AK Permanent Fund.¹⁸⁷ Despite not being used for the Permanent Fund, there is the potential that the Production Tax could play a role in the Permanent Fund *Dividend*. Graphs indicating the general fund expenditures show revenue going towards the Permanent Fund Dividend.¹⁸⁸ Since the Production Tax makes up for most of the general fund revenue, it could be assumed that Production Tax revenue may then contribute to these dividend payouts. This is even more strange, and more concerning from the perspective of the goals of this thesis: whereas the Production Tax does not pay into the Permanent Fund which explicitly provides the future generation clause, it *does* fund the dividend payouts. While in principle the extraction tax *could* recognize the rights of future generations, the labyrinth of

¹⁸⁷ (Rodell 2013)

¹⁸⁸ Alaska Department of Administration Division of Finance. 2013. “State of Alaska General Fund” Exhibits 1-5.

Alaska's various funds proves, in practice, to capture it solely for the entitlements of the present.

The Permanent Fund Dividend is money that is paid to Alaska residents from the investment earnings of mineral royalties.¹⁸⁹ The value of each dividend is determined by the commissioner by October 1 of each year and is available to eligible Alaskan residents who apply through the Permanent Fund Dividend Division.¹⁹⁰ Alaskan residents may receive a check from the department or have the dividend directly deposited into the individual's financial account.¹⁹¹ In this sense, the people of Alaska are paid yearly through this Fund and thus are granted a share of the wealth made from the resources. It is also important to note is that Alaska's Constitution states that the Fund's principal cannot be spent (without a vote), which means the dividend can only be paid from Fund earnings. In this sense, there is the potential for no dividend payout if earnings were zero.¹⁹²

Although the Permanent Fund does give citizens payouts through the Permanent Fund Dividend, I was curious to know what the Permanent Fund principal was used for. Namely, I was interested to see if there was any other indication of investing in future research or renewable resources as options should oil and gas resources ran out, since the payout dividends did not indicate this notion whatsoever.

I found that the Alaskan Legislature decides how the Fund income is used. To date, the Legislature has inflation-proofed Fund principal, paid dividends to qualified applicants (as discussed above), made special appropriations to the

¹⁸⁹ Alaska Department of Revenue Permanent Fund Dividend Division. 2014. "About The Permanent Fund Dividend Division." <http://pfd.alaska.gov/DivisionInfo/AboutUs>.

¹⁹⁰ Parnell, Sean, Angela Rodell and Daniel DeBartolo. 2014. "*Statutes and Regulations.*" Juneau, Alaska: State of Alaska Department of Revenue Permanent Fund Dividend Division. <http://pfd.alaska.gov/Content/StatsAndRegs/2014StatandRegWeb.pdf>.

¹⁹¹ (Parnell et al. 2014)

¹⁹² Alaska Permanent Fund Corporation. 2014. "Frequently Asked Questions." <http://www.apfc.org/home/Content/aboutFund/fundFAQ.cfm>.

principal and paid for some Fund-related state expenses.¹⁹³ The Fund is also invested in stocks, private equities, hedge funds and public infrastructure.¹⁹⁴ In this sense there is some notion of securing prosperity for future Alaskan generations through these investments; however I found no indication of investments into renewables or research. I found no indication of a guiding sustainability principle that preserves natural capital. I will explore the importance of this in the “Analysis” section of this chapter.

Although there is still more to be known about the revenue allocation of the Production Tax, it is inarguable that the tax does play a profound role in its overall revenue generating ability for the state. As shown, the Production Tax contributes heavily to the general fund. Although the connection is not clear, it is also possible that some amount of Production Tax revenue contributes to the Permanent Fund Dividend. With this understanding of the Alaskan Oil and Gas Production Tax established, I turn now towards a policy discussion regarding the creation of this tax and its revenue allocation.

Alaska Policy Discussion

In order to contribute to the discussion on Alaska’s severance tax, I will now explore the policy surrounding the most recent Senate Bill 21. This policy discussion will rely mainly on statements made and recorded in various news articles. I will follow-up this discussion with a look at statements and publications surrounding the creation of the Permanent Fund.

The general statements surrounding Senate Bill 21 (what ultimately became the More Alaska Production), as shown through newspaper articles, indicate that the government made tax changes for the preference of industry. That is, the bill was passed, despite projections that it will decrease revenue from the

¹⁹³ Alaska Permanent Fund Corporation. 2014. “Frequently Asked Questions.”

¹⁹⁴ Alaska Permanent Fund Corporation. 2014. “Frequently Asked Questions.”

Oil and Gas Production Tax. In fact, projections by the Tax Division of the Alaska Department of Revenue show that the most recent changes of Senate Bill 21 will result in a revenue reduction of approximately \$250 to \$300 million in Fiscal Year 2014.¹⁹⁵ Beyond that, the governor acknowledged that the new tax structure should incentivize industry to come to Alaska.

Statements in support of the bill and in support of industry in particular include statements made by Alaskan Governor Parnell. The Office of Governor Sean Parnell's website actively promotes Senate Bill 21 and describes four "guiding principles" for the More Alaska Production Act (MAP Act). These principles include that the MAP Act is "fair" to present and future generations of Alaskans (because it provides a stable revenue stream and cuts billion dollar risk to Alaskan's treasury); it "drives new production" by incentivizing more production with a per barrel credit and a Gross Revenue Exclusion for new oil; it is "simple" with a "balanced" fiscal impact across all oil prices by generating more revenues for the State treasury at low oil prices, while keeping Alaska competitive at high prices; and it is "competitive."¹⁹⁶ Whether the MAP Act actually achieves these principles is up for debate, but it is reflective of Governor Parnell administration's language.

I found that besides his focus on encouraging industry, Governor Parnell's emphasis on competitiveness in comparison to other states was also interesting:

Alaska can now compete with states like North Dakota and Texas for investment capital and jobs. With Senate Bill 21, tax breaks will now be tied directly to putting new oil in the pipeline. The Alaska Legislature has sent a strong message to the world: Alaska is back, ready to compete, and ready to supply energy to America. Having produced only less than half of our known reserves, Alaskans have every reason to be optimistic about the future of our state. Senate Bill 21 lays the groundwork for a great Alaska

¹⁹⁵ (Rodell 2013)

¹⁹⁶ Office of Governor Sean Parnell. 2013. "More Alaska Production Act." <http://gov.alaska.gov/parnell/priorities/resources/more-alaska-production-act.html>.

The Implications of a Severance Tax

comeback. Thanks to the Alaska Legislature and our Administration members for seeing this through. A future of new jobs, new opportunities, and a bright future for all Alaskans starts now.¹⁹⁷

In this quote, Governor Parnell names North Dakota and Texas as direct competitors to Alaska. This implies a focus of competing with these states through the tax changes so as to not lose industry to other oil and gas producing states.

Perhaps because of this “benefit/encourage industry” approach, Senate Bill 21 was heavily criticized by many citizens. In fact, in April of 2013, citizens held rallies across the state in cities such as Juneau, Anchorage and Fairbanks among others. These individuals held signs protesting “Stop the Giveaway” and “SB will be the end of dividends.”¹⁹⁸ These protests reflected the citizens’ belief that the MAP Act would give away their resource and money (dividends) associated with that resource. After the bill passed, opposition to this bill was so strong that the August 2014 primary will include a ballot referendum to repeal the tax; this referendum will be one of four referendums to have made it to the ballot in Alaska.¹⁹⁹ While gathering signatures for the referendum petition, citizens argued that Senate Bill 21 was unconstitutional because the Alaskan Constitution requires that the state’s resources be managed for the maximum benefit of its people and they saw the new tax as making it easier for the industry to take resources without paying for them.²⁰⁰

¹⁹⁷ Parnell, Governor Sean. 2013. “The Alaska Oil Comeback.” *Juneau Empire*. <http://juneauempire.com/opinion/2013-04-16/alaska-oil-comeback#.UvPOKo6Ad8s>.

¹⁹⁸ Demer, Lisa. 2013. “Opponents of Parnell’s Oil Tax Cuts Rally Across Alaska.” *Anchorage Daily News*. <http://www.adn.com/2013/04/04/2852346/opponents-of-parnell-oil-tax.html>.

¹⁹⁹ Demer, Lisa. 2013. “Critics of Oil Tax Cuts Move Ahead with Referendum to Repeal the Legislation.” *Anchorage Daily News*. <http://www.adn.com/2013/04/18/2870575/critics-of-oil-tax-cuts-move-ahead.html>.

²⁰⁰ Demer, Lisa. 2013. “Critics of Oil Tax Cuts Move Ahead with Referendum to Repeal the Legislation.”

Regardless of the outcome of the referendum, the referendum demonstrates the strength of citizens' opposition to the MAP Act. It indicates their belief that the bill gives away their resources at a cost to the revenue of Alaska and a cost to themselves (and their dividends). As this policy discussion has shown, at least in the most recent tax change, focus has fallen mainly on increasing and promoting industry in Alaska by providing benefits and tax breaks for them. In choosing industry over revenue, the government of Alaska has sacrificed a large portion of state revenue to come. It has also upset residents and resulted in the tax legislation being placed on a ballot referendum. In addition to these observations, there appears to be a lack of focus on resource management for future generations as shown both through the act of reducing state revenue to encourage industry and by the fact that there is more emphasis on production rather than conservation of the resources. As mentioned in the previous section, there is potential for a connection between Alaska's oil and gas severance tax and its Permanent Fund. Although this connection is not clear, it is useful to the creation of the Permanent Fund to determine any intentions surrounding it.

Karl Widerquist and Michael Howard provide an analysis on the Permanent Fund in their book, *Alaska's Permanent Fund Dividend Examining its Suitability as Model*. In this book, they detail the conditions surrounding the formation of the Permanent Fund. They explain that Alaska, having only achieved statehood in 1959, was an impoverished state.²⁰¹ Alaska had claimed entitlement lands that fortunately had oil fields in them. When, in 1968, the Atlantic Richfield Company discovered oil fields on the North Slope lands of Alaska, Alaska benefited greatly. The sale of state oil leases amounted to \$900 million, which the state of Alaska used to build schools, create a loan program for college students

²⁰¹ Unless otherwise specified, all information in this paragraph comes from Widerquist, Karl, and Michael Howard. 2012. *Alaska's Permanent Fund Dividend Examining Its Suitability as a Model*. New York, NY: Palgrave Macmillan. 17-18.

and to finance other public services. Despite this action, Alaskans felt a great deal of the money was wasted and did not help build Alaska's overall economy. In order to avoid resource exploitation and waste of money, the idea of a permanent, or perpetual fund emerged as a potential solution.²⁰² In 1970, Alaskan Governor Keith Miller proposed putting \$500 million of the \$900 million into a permanent fund to be a "revenue-producing fund in perpetuity for future generations of Alaskans."²⁰³ His version of the fund did not pass. Another attempt at a permanent fund was vetoed by Governor Jay Hammond in 1975. He wrote in his veto message that a constitutional amendment was required to create a "permanent fund." According to Widerquist and Howard, "Governor Hammond said he supported putting some of the oil money in a permanent fund to keep the government spending from growing so large that future Alaskans would face wrenching dislocations when the boom ended."²⁰⁴

In 1976, voters created the permanent fund that exists in Alaska today through a constitutional amendment.²⁰⁵ With this fund established, Alaskans found a way to maintain wealth for the future. Widerquist and Howard give us a clear way to understand the initial intentions of the fund:

The overwhelming support for the amendment was best explained by Elmer Rasmuson, an Alaska banker who served as the first chairman of the trustees of the Alaska Permanent Fund Corporation (APFC). "The Permanent Fund began, chiefly, with a 'negative' goal, to place part of the one-time oil wealth beyond the reach of day-to-day spending." Ultimately, the Permanent Fund was the political product of a coalition that wanted to take money off the table and save it for the future, without specifying how those savings would be used.²⁰⁶

²⁰² (Widerquist and Howard 2012, 19-20)

²⁰³ (Widerquist and Howard 2012, 20)

²⁰⁴ (Widerquist and Howard 2012, 21)

²⁰⁵ (Widerquist and Howard 2012, 21)

²⁰⁶ (Widerquist and Howard 2012, 21)

In this sense, the fund was created with the future in mind, not to preserve natural capital, but rather to preserve wealth for the future. The difference is important to note; although this fund aims to preserve wealth, it is not directed to acknowledge the use and value of the resource itself. That is, it does not allocate wealth to replace capital by investing in renewables, technology or research. Furthermore, Permanent Fund Dividend payouts provide question as to whether the benefit of the future is truly kept in mind, as they indicate entitlement for present generations since they distribute wealth to current individuals.

There were then debates, on how the fund should be invested. Some proposed that the fund be used as a development bank. Under a development bank scheme, loans, even risky ones, would qualify as income producing investments.²⁰⁷ In contrast, others proposed to manage the fund like a savings account, and they emphasized the need for prudent investment.²⁰⁸ Ultimately this fund was treated as a saving account. Legislation from 1980 restricted the Permanent Fund investments to a list of cautious, authorized investments.²⁰⁹

Governor Hammond was a leading figure in the creation of the Permanent Fund Dividend (PFD). His interpretation of the state constitution gives us an indication of the mindset in creating the dividends:

Hammond incorporated into his thinking the notion that the Alaska constitutional provision mandating that the state use and develop its natural resources ‘for the maximum benefit of its people’ meant that Alaskans were in some sense *owners* of the state’s oil wealth in the same way as they would be if they were stockholders of a resource-owning corporation.²¹⁰

²⁰⁷ (Widerquist and Howard 2012, 22)

²⁰⁸ (Widerquist and Howard 2012, 23)

²⁰⁹ (Widerquist and Howard 2012, 23)

²¹⁰ (Widerquist and Howard 2012, 25)

In this sense, Governor Hammond interpreted the constitution as suggesting the people of Alaska deserve a share of the wealth from oil. These views were important because, as Widerquist and Howard explain, under Alaska's Constitution, the Alaskan governor is "more powerful than chief executives of other states."²¹¹ In 1980 a Permanent Fund Dividend Bill was approved, with the removal of the individual income tax as the tactic that got it through. In this sense, corporations are now mostly responsible for paying the state's taxes.²¹² The bill that was passed also included a provision that benefited residents who have lived in Alaska longer because they would earn more of the dividend. This was a provision of the bill that Governor Hammond and many legislators strongly stood by.²¹³ However, this dividend payment based on cumulative residency was invalidated by the Supreme court.

In 1982 PFD debates were back into full-swing. Those who supported a PFD program argued that the program would motivate the public to protect the Alaska Permanent Fund; that dividends distribute wealth more equitably; that direct distribution of the fund's income would provide a safety-net for low-income residents; that individuals would have to right to decide how to use a portion of their oil wealth; and that economic analysis showed that dividends would provide "greater economic 'bang for the buck' than the alternatives of spending the same amount of money on the operating budget, capital projects, or loans to residents."²¹⁴ Finally, in 1982, the Permanent Fund Dividend was passed and that first year residents received \$1000 checks.

Hammond provides a historical and anecdotal account of the creation of the Permanent Fund and Permanent Fund Dividends in "Diapering the Devil." He

²¹¹ (Widerquist and Howard 2012, 26)

²¹² (Widerquist and Howard 2012, 28)

²¹³ (Widerquist and Howard 2012, 30)

²¹⁴ (Widerquist and Howard 2012, 31)

explains how he was very personally involved in the establishment of the PFD.

Hammond states,

I believed the best, perhaps the *only*, way to meet our constitutional mandate to manage our natural resources for the maximum benefit of all the people was to grant each citizen an ownership share in Alaska's resource wealth to be used as they, not the government, felt was for their maximum benefit.²¹⁵

Hammond emphasizes furthermore that he felt that distributing the wealth by dividends would put the revenue in the public eye. By doing this, he felt he could protect the wealth from "invasion by politicians."²¹⁶ In this sense, he saw the dividends as a management solution to oil wealth instead of allowing politicians to continually use it for pet projects.

Hammond provides insight into a number of policy issues surrounding the Permanent Fund and PFD. One thing that really stood out to me was his discussion on Alaska's abolishment of the income tax. Deemed by Hammond, "the most stupid thing we could do," the abolishment of the income tax came in as the Alaska Permanent Fund program was still being ironed out.²¹⁷ Fearing a veto would jeopardize the new Permanent Fund program, Hammond proceeded to let it pass. He acknowledges now that the income tax repeal led to "uneconomic development": that is development that does not generate "revenues for the state to offset the cost of providing services to the attendant population increase or for managing, enforcing, or enhancing resources being exploited."²¹⁸ I found this discussion insightful because it shows the recognition that abolishing the income tax was an unsustainable decision. The abolishment, as he argues, meant they had

²¹⁵ Hammond, Jay. 2012. "Diapering the Devil: How Alaska Helped Staunch Befouling by Mismanaged Oil Wealth: A Lesson for Other Oil Rich Nations." in *The Governor's Solution. How Alaska's Oil Dividend Could Work in Iraq and Other Oil-Rich Countries*. Washington, DC: Center for Global Development. 5-54. See page 18.

²¹⁶ (Hammond 2012, 19)

²¹⁷ (Hammond 2012, 25-26)

²¹⁸ (Hammond 2012, 24)

decided to use up “one-time-only” oil dollars to pay for the income tax.²¹⁹

Although focusing more on wealth than natural capital, Hammond’s statements show some recognition of Alaska’s “double-dipping.” That is, of using the revenue to repeal taxes on the citizens instead of using it to allocate more funds towards conservation.

As this discussion has shown, considerations surrounding the Permanent Fund and the Permanent Fund Dividend emphasize preserving wealth for the state and recognizing the citizen as owning a part of the oil wealth. But, what is left out of the picture in this case is the acknowledgement of the loss of natural capital. The Permanent Fund does not ensure for replacement of capital by investing in renewables, technology or research. Now that I have briefly considered the policy surrounding Alaska’s severance tax, I will turn towards the next case study: North Dakota. Following this consideration of North Dakota, I will analyze the two case studies by focusing on their revenue allocation and whether it successfully addresses the rights of future generations.

North Dakota

North Dakota has two oil and natural gas severance taxes: the Oil and Gas Gross Production Tax and the Oil Extraction Tax. North Dakota’s Oil and Gas Gross Production Tax taxes \$0.833 per thousand cubic feet (MCF) of gas (through June 30th, 2014). This value changes on July 1st each year. It also taxes 5% of the gross value of a natural gas or oil.²²⁰ There are a number of exemptions, but for argument purposes I will move forward in this discussion to explore the Oil Extraction Tax and revenue distributions of both taxes.

²¹⁹ (Hammond 2012, 26)

²²⁰ North Dakota Tax. 2014. “Oil and Gas Tax Frequently Asked Questions.” <http://www.nd.gov/tax/misc/faq/oilgas/>.

North Dakota's Oil Extraction Tax focuses its taxation only on oil. The tax itself is imposed "upon the activity in this state of extracting oil from the earth, and every owner, including any royalty owner, of any part of the oil extracted is deemed...to be engaged in the activity of extracting that oil."²²¹ The Oil Extraction Tax rate is 6.5% of gross oil value or 4% of gross oil value if the well qualifies for a reduced rate. Qualifying wells in the Bakken formation are taxed 2% of the gross oil value in order to better encourage oil exploration in that region.²²² There are a number of additional exemptions, however with this basic foundation of North Dakota's severance tax structures, I now consider the revenue allocation of North Dakota's two oil and natural gas severance taxes.

The revenue scheme of the Oil and Gas Gross Production Tax is very complicated, but is as follows. The revenue collected by Tax Department is deposited into the Legacy Fund, the Tribal Share and the Oil and Gas Research Fund. The remainder is distributed by formula to the Oil and Gas Impact Grant Fund, Political Subdivisions, Abandoned Well Reclamation Fund and the North Dakota Heritage Fund. The state gets a share of that revenue, which is also distributed by formula to the General Fund, Property Tax Relief Sustainability Fund, Strategic Investment and Improvements Fund, State Disaster Relief Fund and then any additional revenues are transferred to the Legacy Fund.²²³

The revenue allocation of the Oil Extraction Tax has some similarities to the allocation of the Oil and Gas Gross Production Tax. For example, its revenue is also distributed to the Legacy Fund, the Tribal Share and the Oil and Gas Research Fund. Other funds are distributed by percentage: Foundation Aid

²²¹ North Dakota Century Code. Chapter 57-51.1 Oil Extraction Tax. 2013. <http://www.legis.nd.gov/cencode/t57c51-1.pdf?20140211115153>.

²²² North Dakota Century Code. Chapter 57-51.1. See also (Brown 2013)

²²³ For a comprehensive breakdown of the revenue scheme, see "Appendix A" for the "2013-15 Oil and Gas Tax Revenue Allocation Flowchart." See also, North Dakota Legislative Council. July 2013. "2013-15 Oil and Gas Tax Revenue Allocation Flowchart." 15.9055.01000. <http://www.legis.nd.gov/files/resource/15.9055.01000.pdf?20140124111003>.

The Implications of a Severance Tax

Stabilization Fund (10%), the Common Schools Trust Fund (10%) and the Resources Trust Fund (20%). Revenue from the Resources Trust Fund is distributed to the Energy Conservation Grant Fund and the Renewable Energy Development Fund. Like the Oil and Gas Gross Production Tax, a portion of this revenue also goes to the state, which is also distributed by formula to the general fund, Property Tax Relief Sustainability Fund, Strategic Investment and Improvements Fund, State Disaster Relief Fund and then any additional revenues are transferred to the Legacy Fund.²²⁴ See “Appendix A” for the complete revenue allocation chart.

While this revenue allocation system may sound complex, we can understand it in the context of my argument by looking closer at a few of the funds. I would like to draw attention specifically to the general fund, the Legacy Fund, the Energy Conservation Grant Fund, the Renewable Energy Development Fund and the Strategic Investment and Improvements Fund.

Similar to the Alaska general fund (and any general fund for that matter), the North Dakota general fund is used to finance a number of state services. This includes health services, higher education, elementary and secondary education, and public safety.²²⁵ The general fund is also spent on agriculture, industrial development and promotion, regulatory services, natural resources and general government activities.

The Legacy Fund is somewhat similar to Alaska’s Permanent Fund. It was created in 2010 by the voters of North Dakota through constitutional amendment

²²⁴ (North Dakota Legislative Council 2013)

²²⁵ Clayburgh, Ray. 2001. “45th Biennial Report.” Office of State Tax Commissioner. <http://www.nd.gov/tax/genpubs/45thbiennialreport.pdf?20140228111629>. 34.

Article X, Section 26 to the Constitution of North Dakota.²²⁶ Article X, Section 26 states:

Section 26.

1. Thirty percent of total revenue derived from taxes on oil and gas production or extraction must be transferred by the state treasurer to a special fund in the state treasury known as the legacy fund. The legislative assembly may transfer funds from any source into the legacy fund and such transfers become part of the principal of the legacy fund.
2. The principal and earnings of the legacy fund may not be expended until after June 30, 2017, and an expenditure of principal after that date requires a vote of at least two-thirds of the members elected to each house of the legislative assembly. Not more than fifteen percent of the principal of the legacy fund may be expended during a biennium.
3. Statutory programs, in existence as a result of legislation enacted through 2009, providing for impact grants, direct revenue allocations to political subdivisions, and deposits in the oil and gas research fund must remain in effect but the legislative assembly may adjust statutory allocations for those purposes.

The state investment board shall invest the principal of the North Dakota legacy fund. The state treasurer shall transfer earnings of the North Dakota legacy fund accruing after June 30, 2017, to the state general fund at the end of each biennium.²²⁷

As this portion of Article X, Section 26 shows, the Constitution requires that 30 percent of total revenue derived from taxes on oil and gas production or extraction must be deposited into the Legacy Fund. Furthermore, Section 15-08.1-08 provides that if the balance in the Strategic Investment and Improvements Fund exceeds \$300 million at the end of any month, 25 percent of any revenue received for deposit in the Strategic Investment and Improvements Fund must go instead into the Legacy Fund.²²⁸ The North Dakota Legacy Fund Investment Policy

²²⁶ North Dakota Legislative Branch. 2011. "Appendix C North Dakota Legacy Fund Investment Policy Statement." <http://www.legis.nd.gov/assembly/62-2011/docs/pdf/lbs090611appendixc.pdf>.

²²⁷ North Dakota Constitution. 2010. *Article X Finance and Public Debt*. <http://www.legis.nd.gov/files/constitution/ArticleXFinanceandPublicDebt.pdf?20140204155920>.

²²⁸ (North Dakota Legislative Branch 2011)

Statement states, "...the goal of investment for the Legacy Fund is principal preservation while maximizing total return."²²⁹ The Legacy Fund was initially only invested in short-term, fixed income investments, but now half of the Legacy Fund is invested in stocks, and the rest is in fixed-income and real estate.²³⁰

Also of note is that the Legacy Fund earnings are not accessible until 2017 and the fund falls under the oversight of the Legacy Fund Advisory Board. Because the funds are not yet accessible, I cannot detail how the fund is used. I can, however, review debates surround this fund in order to determine the mindset surrounding its creation, namely to determine whether this fund is seen to carry a special purpose in protecting the wealth of the resource (as it being a constitutional amendment might imply). This will be reviewed in the following section.

I will now briefly consider the Energy Conservation Grant Fund, the Renewable Energy Development Fund and the Strategic Investment and Improvements Fund. The Energy Conservation Grant was created by the 63rd North Dakota Legislative Assembly to provide funding for political subdivisions in making energy efficiency improvements to public buildings.²³¹ The Renewable Energy Development Fund was established by the North Dakota Legislature in 2007 and in 2013 the Legislature authorized \$3,000,000 to be made available to the fund every two years. The fund serves to support North Dakota's Renewable Energy Program, whose responsibilities include providing financial assistance to foster the development of renewable energy through research, development,

²²⁹ (North Dakota Legislative Branch 2011)

²³⁰ Fehr, Stephen and Melissa Maynard. August 2013. "North Dakota's Oil and Tax Windfall Now \$1.3B." *The Fiscal Times*. <http://www.thefiscaltimes.com/Articles/2013/08/28/North-Dakotas-Oil-and-Tax-Windfall-Now-1-3B>.

²³¹ North Dakota Department of Commerce. 2014. "Community Services." <http://www.communityservices.nd.gov/energy/political-subdivision-energy-conservation/>.

demonstration and commercialization.²³² The Strategic Investment and Improvements Fund is meant to be used for expenditures to improve state infrastructure or initiatives to improve the efficiency of state government.²³³ As mentioned earlier, if funds in the Strategic Investment and Improvements Fund exceed \$300 million at the end of any month, 25 percent of any revenue received must go instead into the Legacy Fund.²³⁴ The implications of this are interesting because it once again draws importance to the Legacy Fund.

The information above is also summarized in Figure 2 below.

Figure 2: North Dakota Funds Summary

Fund	Purpose
General Fund	Finances state services.
Legacy Fund	30 percent of total revenue derived from taxes on oil and gas production or extraction must be deposited into the Legacy Fund. Fund originally invested in short-term, fixed income investments, but now half of the Legacy Fund is invested in stocks, and the rest is in fixed-income and real estate. Legacy Fund earnings are not accessible until 2017.
Energy Conservation Grant Fund	Provides funding for political subdivisions in making energy efficiency improvements to public buildings.
Renewable Energy Development Fund	Supports North Dakota’s Renewable Energy Program. Program responsibilities include providing financial assistance to foster the development of renewable energy through research, development, demonstration and commercialization
Strategic Investment and Improvements Fund	Used for expenditures to improve state infrastructure or initiatives to improve the efficiency of state government. If funds in the Strategic Investment and Improvements Fund exceed \$300 million at the end of any month, 25 percent of any revenue received must go instead into the Legacy Fund.

²³² North Dakota Renewable Energy Program. 2014. “Mission Statement.” <http://www.nd.gov/ndic/renew-infopage.html>.

²³³ (North Dakota Legislative Council 2013)

²³⁴ (North Dakota Legislative Council 2013)

The Implications of a Severance Tax

These last three funds were briefly examined to demonstrate North Dakota's attempts at addressing environmental issues and improvement. In this sense, their allocation structure is clear and understood. In the following section I will focus mainly on the Legacy Fund as a point of comparison to Alaska's Permanent Fund.

As this section has shown, North Dakota's oil and natural gas severance taxes contribute to a number of funds. Many of these funds acknowledge the importance of financing and developing renewable energy and research. A considerable amount of the revenue is also dedicated towards the idea of saving for the future, especially through the concept of the Legacy Fund. With this understanding of North Dakota's Oil and Gas Gross Production Tax and Oil Extraction Tax established, I turn now towards a policy discussion regarding the creation of this tax and its revenue allocation.

North Dakota Policy Discussion

Similar to my description of Alaska, the policy surrounding the tax structure makes these findings more interesting in that it provides context to the decisions made in structuring the taxes. I will now review statements made in formation of the Legacy Fund in light of the North Dakota Oil and Gas Gross Production Tax and Oil Extraction Tax.

Before discussing the Legacy Fund I must note that my search for articles surrounding HB 1198, the bill that included amendments to both the Oil and Gas Gross Production Tax and Oil Extraction Tax, was not fruitful. I was surprised to find very little news articles about this topic, which indicated to me that the severance tax updates in HB 1998 went largely under the radar. Still, despite the lack of media on the tax updates, North Dakota's severance taxes have been

greatly successful, as evident by North Dakota's severance tax revenue increase.²³⁵

Given the great success of North Dakota's severance taxes, there are questions about what move North Dakota might make next. In June 2014, voters will vote on a constitutional amendment to abolish property taxes. North Dakota might also, or instead, as *Forbes* speculates, abolish its income tax.²³⁶ This action would be very similar to the Alaskan government's actions. By linking severance taxes with the abolishment of taxes for present citizens, North Dakota would be going in the opposite direction; they would be moving towards the "double dipping" we discussed earlier rather than towards sustainability.

In addition to discussions made about the severance taxes, statements made surrounding the Legacy Fund also provide an indication of the intent behind its creation. As mentioned in the previous section, North Dakota's severance tax is allocated to the Legacy Fund. The Legacy Fund was first proposed in 2008, but was rejected, perhaps due the revenue allocation structure to the fund.²³⁷ The 2008 proposal called for \$100 million of the oil and gas revenue to go to the state's general fund, with anything remaining being deposited into the Legacy Fund. Residents objected, as the *Fiscal Times* clarifies: "Opponents, led by educators and school advocates, thought that measure gave lawmakers too much money to spend without restrictions."²³⁸ The second proposal, with support from the education community, was approved in 2010.²³⁹

²³⁵ See data on North Dakota in "Appendix B."

²³⁶ Barro, Josh. 2012. "Wow: Tax Collections In North Dakota Are Up 44 Percent." *Forbes*. <http://www.forbes.com/sites/joshbarro/2012/04/17/wow-tax-collections-in-north-dakota-are-up-44-percent/>.

²³⁷ (Fehr and Maynard 2013)

²³⁸ (Fehr and Maynard 2013)

²³⁹ North Dakota Legislative Council. July 2013. "Study of the Lasting Benefits of the Legacy Fund- Background Memorandum." 15.9035.01000. <http://www.legis.nd.gov/files/events/memorandum/15.9035.01000.pdf?20140211234909>.

There is indication that the Legacy Fund was modeled after Norway's Sovereign Wealth Fund, which was conceived to capture revenue that may be needed in the future. There is certainly evidence that the Legacy Fund was created with this same intent:

I'm a firm believer that when you harvest a one-time, finite resource, you have to put away some of that wealth for future generations," said North Dakota Sen. Dwight Cook, a Republican from Mandan.²⁴⁰

As this quote shows, there is some idea that representatives recognize the potential this fund has for sharing wealth with future generations. This recognition suggests some form of a sustainability principle. Still, this sharing of wealth does not necessarily recognize the preservation of natural capital. In this case North Dakota is concerned with parceling out the income from the natural capital (oil and gas), but is not necessarily worried about the depletion of natural capital itself. In other words, their recognition of the value and implications of depleting natural capital is indirect at best. This idea is reflected in other language surrounding the Legacy Fund. In the North Dakota Legacy Fund Investment Policy Statement, for example, the Mission of the Legacy Fund is listed:

The Legacy Fund was created, in part, due to the recognition that the state revenue from the oil and gas industry will be derived over a finite timeframe. The Legacy Fund defers the recognition of 30 percent of this revenue for the benefit of future generations. The primary mission of the Legacy Fund is to preserve the real, inflation-adjusted purchasing power of the monies deposited into the Fund.²⁴¹

In this sense, the Legacy Fund was created as a way to mitigate the use of the nonrenewable resources oil and natural gas for the "benefit" of the future. Similar to Alaska, the question of what "benefit" ultimately means in a policy sense and whether this compares to a sustainability principle is up for question. In order to

²⁴⁰ (Fehr and Maynard 2013)

²⁴¹ (North Dakota Legislative Branch 2011)

be considered sustainable they must ensure that the fund accounts for replacement of capital by investing in renewables, technology or research. In this case, since the use of the Legacy Fund will not be determined until it is available in 2017, I will be unable to comment on what it actually does, but instead can only comment on the function as spelled out in the Constitution and through policy discussions. As far as we can tell, the Constitution appears to recognize the concern of not spending a one time financial gain too quickly, but does not appear to institutionally recognize the drain of natural capital. Although mentioned in the constitutional amendment, it is important to note that the requirements outlined for the Legacy Fund are also mentioned in the severance tax bill text themselves.

There is evidence that this Legacy Fund serves more as a way to preserve wealth than it does a recognition of the value of the natural capital itself. That is, the acknowledgement is often that the Legacy Fund exists to protect North Dakota's economy in the event of a shortfall. Labeled a "rainy day fund," the Legacy Fund will ensure that the state has funds in place in case economic issues beyond the state's control occur (such as if future resource extraction is not as lucrative).²⁴² Majority Leader Rich Wardner, R-Dickinson commended the fund's creation stating, "It looks good now, like the sky's the limit...What we're doing is very responsible."²⁴³ With this statement Wardner reflects the sentiment that the Legacy Fund is a fiscally sound decision.

Although the fund will not be available until 2017, there is discussion on how it will be spent once opened. An article in USA today stated:

Though the first dollars will not be spent for four years and economic conditions could change, lawmakers are beginning to consider how to spend the money. Education is always popular with lawmakers, and House Majority Leader Al Carlson said he likes Wyoming's college scholarship

²⁴² Smith, Nick. 2013. "North Dakota Ready For a 'Rainy Day.'" *The Bismarck Tribune*. http://bismarcktribune.com/news/local/govt-and-politics/north-dakota-ready-for-a-rainy-day/article_0a815d76-0133-11e3-9534-0019bb2963f4.html.

²⁴³ (Smith 2013)

program financed from its permanent fund. It is unlikely, Carlson and others said, that North Dakota, with a much smaller fund than Alaska, would write annual dividend checks to residents. "You have to be very careful about this. It's a one-time resource," said Carlson, a Republican from Fargo."²⁴⁴

In this sense, the Legacy Fund revenue could go to education, which would benefit citizens greatly, but we will most likely not see direct payouts in the form of dividends from North Dakota. Still, Representative Carlson's comment about the importance of this "one-time resource" does suggest that legislators will be very careful and deliberate in decisions about how to use the fund revenue. However, once again, this language does not suggest a recognition of the preservation of natural capital.

The governor of North Dakota, Governor Dalrymple, also provided some input about the use of the fund:

The governor noted that Norway, which has "the granddaddy of all endowment funds," has not determined what to do with its energy bounty. "They've really been accumulating money for 20 years, and they're still trying to decide whether to run the country on the money, to give the money back to people, invest a whole lot of money in infrastructure, eliminate all taxes," Dalrymple said. "If you have a state endowment fund, how do you manage it? We're not really far along either. We're really just beginning to talk about what we're going to do with it."²⁴⁵

As Governor Dalrymple's statement suggests, there are many considerations that the state must make before determining what they will do with the fund. All of the considerations he mentions have a lot to do with benefiting the residents or financing the state. In this sense, we do not see much consideration or recognition for the value of the resource and replacement of it.

²⁴⁴ (Fehr and Maynard 2013)

²⁴⁵ (Fehr and Maynard 2013)

Now that I have briefly considered the policy surrounding North Dakota's severance taxes and Legacy Fund, I will now analyze the two case studies by focusing on their revenue allocation and whether it successfully addresses the rights of future generations.

Analysis

As the previous discussion has indicated, there are differences in Alaska and North Dakota's oil and natural gas severance tax, not just in the way the tax is structured to charge the extraction of the resource, but also in the way the generated revenue is handled. In fact, the distinction in revenue allocation is what, as I have argued, allows the severance tax to be designated as either "sustainability-focused" or "not sustainability-focused." As I mentioned earlier, a "sustainability-focused" severance tax is defined as a severance tax that addresses all externalities associated with nonrenewable natural resource use including future generations. It does this by 1) placing some of the severance tax revenue into a fund for future generations and 2) ensuring that the fund accounts for replacement of capital by investing in renewables, technology or research. In contrast, a "not sustainability-focused" severance tax is defined as a severance tax that does not address all externalities including the rights of future generations and does not fulfill the two requirements listed above.

Before I analyze the revenue allocation of these two cases, I would first like to describe the differences in researching the case studies from my own firsthand experience. I do this to shed some light on what is transparent and what is not transparent about each state's tax(es) from a research perspective. This is important to consider in reference to what we discussed in Chapter 1 about the role of policy in addressing social issues. As discussed, policy is expected to reason and act differently than individuals do. Thus, it is not unreasonable to hope that policy will try to educate citizens on its purpose and goals. My research on

The Implications of a Severance Tax

Alaska and North Dakota's severance tax policy revealed their ability (or inability) to clearly disclose their policy decisions and thus educate their citizens.

While researching, I started with Alaska's most recently updated severance tax. On the Alaska State Legislature website, I do admit it was easy to locate the Senate Bill 21 and read through it to discover how the tax was structured. What was *not* apparent in this bill was the revenue allocation structure. I went on what I deemed a "wild-goose-chase" to try and figure out just how the Oil and Natural Gas Production Tax revenue was allocated. I ended up finding information buried in the Revenue Sources Book Fall 2013,²⁴⁶ a 106 page report prepared by the Alaska Department of Revenue-Tax Division. Interestingly enough, the report did a thorough job explaining the tax structure and the structure of various funds, but seemed to lack information that connected the severance tax-to-fund revenue allocation structure. In this sense, Alaska's policy does not clearly outline how the revenue was used; it does not teach its citizens clearly.

In contrast, given North Dakota's two severance taxes, the Oil and Gas Gross Production Tax and the Oil Extraction Tax, I did find it more difficult to locate the bill text to find the tax structure description. However, their revenue allocation could not be more obvious. Prepared by the North Dakota Legislative Council Staff, the 2013-2015 Oil and Gas Tax Revenue Allocation Flowchart²⁴⁷ provides a clear look into exactly how much of the severance tax revenue is collected and where that revenue is allocated. This lists both the specific funds, the amounts and even descriptions of this fund. In this sense, North Dakota was very transparent about their revenue allocation from these taxes. In fact, out of curiosity, I "googled" this information instead of going through the North Dakota Legislative website and found this revenue allocation was the first hit. I provide

²⁴⁶ (Rodell 2013)

²⁴⁷ See North Dakota Legislative Council. July 2013. "2013-15 Oil and Gas Tax Revenue Allocation Flowchart." 15.9055.01000. <http://www.legis.nd.gov/files/resource/15.9055.01000.pdf?20140124111003>.

this personal anecdote to perhaps showcase the level of transparency surrounding each state's severance tax allocation. Although the information is available for both states, North Dakota really brings it out into the open, while Alaska seemed to have obscured the allocation process.

Moving forward, I would now like to consider revenue allocation of Alaska's and North Dakota's severance tax in the context of my general argument surrounding nonrenewable natural resource management and the rights of future generations. In these cases we saw two alternatives for revenue allocation that had both similarities and differences. In the Alaska case, revenue from severance taxation was mainly deposited in the General Fund, while other portions of revenue may be related to the Permanent Fund, with some revenue handed off to citizens through the Permanent Fund Dividends. In this case study, there was an indication that Alaska recognized the importance of preserving and sharing wealth with its citizens, but did not account for the conservation of natural capital. In the North Dakota case, the revenue is allocated to a number of funds, with 30% allocated towards the Legacy Fund, which hints at a desire to save for the future, but also still lacks consideration for natural capital.

When originally coming into these cases, I thought Alaska would clearly represent a "not sustainability-focused" severance tax solution and that North Dakota would clearly represent a "sustainability-focused" severance tax solution. These thoughts were based on preliminary research that indicated that the Alaska severance tax was allocated mostly to the general fund and that the most recent Alaskan severance tax change appears to have been done to benefit industry, while in contrast, North Dakota's severance tax revenue was clearly stored away in the Legacy Fund to be saved for the future. Upon beginning my investigation into these two cases, however, I quickly determined that these cases were much more complicated than I had originally anticipated. In this sense, I recognized that there were many aspects to each of these severance taxes, that despite making

labeling difficult, could reveal many different things. For this reason, I decided to take a multiple-step approach to analyzing the cases. That is, I analyzed multiple allocations of the tax and labeled each specific allocation “sustainability-focused” or “not sustainability-focused” based on my definitions, instead of making a blanket statement about the whole tax.

I turn now to a closer assessment of the cases of Alaska and North Dakota. With Alaska, as first indicated, a majority of Alaska’s severance tax revenue is allocated as unrestricted revenue towards the general fund. This means that the revenue is dumped into a general pot that is used for public services, which could be considered a major benefit of the tax from a political standpoint. It could be considered a major benefit because the residents of the state recognize the tax for providing a number of services to them. However, for my analysis, use of the tax revenue this way indicates the “double-dipping” discussed in Chapter 3, which results in the resource being used and additional money being made off of the resource through the tax, with no allocation towards the future. Thus, based off this alone, Alaska serves as an example of a “not sustainability-focused” severance tax—a tax that does not allocate funds for future generations.

However, as we explored, there is a connection between the severance tax and the Permanent Fund Dividends that residents of Alaska receive. Although the dividends are paid off of earnings from the Permanent Fund and could be seen as fulfilling the first requirement I mentioned earlier of accounting for future generations (if we were in fact “the future”) by placing tax revenue into a fund for future generations, I cannot hold this revenue allocation appropriate under our argument structure. This is because the dividends do not guarantee the second requirement of repayment of resources. Residents may spend this revenue in a way which would not guarantee that replacement of capital is achieved. The only way replacement of capital could be achieved is by ensuring that the fund is invested in renewables, technology or research, which it is not. Thus, despite the

benefits that residents enjoy from this dividend, if connected to the severance tax, under my argument I will once again have to label the Alaskan severance tax as “not sustainability-focused.”

Finally the question of the Permanent Fund itself is an interesting consideration. While I found no concrete evidence that the severance tax was clearly tied to this fund, I will consider it here under the assumption that the two are connected. As mentioned earlier, I found that the Permanent Fund does not appear to invest any of its principles into research, renewables or technology. This lack of investment in these areas shows that the benefit for future generations from the Permanent Fund is merely monetary and not cognizant of repaying for resource use explicitly. This means that, although structurally the Permanent Fund could achieve a sustainability goal, it does not. And thus, when combined in consideration of the severance tax, I must still consider the tax “not sustainability-focused.”

Also to note with the Alaska case is that these provisions for revenue allocation are not made in the text of the bill itself. This has a number of implications within my argument. The lack of provisions within the bill text means that no direct answer for what the severance tax is supposed to do or how the revenue is supposed to be allocated is given. In this sense, the law is not guiding, rather it is obscured. Because within my argument, the revenue allocation of the tax is a necessary part of making the severance tax a solution, this fact once again makes Alaska’s severance tax “not sustainability-focused.”

While I cannot completely rule out the fact that Alaska’s Oil and Gas Production may be used for future generations through investment in renewables, research or technology, the evidence has made clear that no direct connection between Alaska’s severance tax and considerations for future generations have been made. Thus, Alaska remains an example of a “not sustainability-focused” severance tax—a tax that does not allocate funds for future generations and does

not account for the replacement of capital. (That is until the “sustainability-focused” severance tax occurs or is proven).

I also explored North Dakota’s severance taxes. With the revenue allocation from these taxes, it is clear that revenue is set aside with some consideration of the future. This is especially clear within the revenue allocation framework that directs revenue specifically to the Renewable Energy Development Fund. As I explored in the North Dakota section, the Renewable Energy Development Fund supports North Dakota’s Renewable Energy Program, which provides financial assistance to foster the development of renewable energy through research, development, and commercialization. Based on this revenue allocation and this fund, I can label North Dakota’s severance tax a “sustainability-focused” severance tax because it provides funding to replace oil and natural gas resources, which would benefit future generations. Still, it is important to note that the revenue that will go to the Renewable Energy Development Fund is estimated to be only \$3 million compared to the \$2,287 million the Oil and Gas Gross Production Tax and the \$2,995 million the Oil Extraction Tax will bring in. To give another figure: the Legacy Fund is estimated to receive \$1,502 million.²⁴⁸ In this sense, compared to the total revenue generated, the revenue allocated towards the Renewable Energy Development is rather insignificant.

In the last two sections I also discussed North Dakota’s Legacy Fund. The Legacy Fund had a number of implications. The Legacy Fund was established in the North Dakota Constitution, but is specifically addressed in the severance tax text, along with all revenue allocations. A number of things may be said about this fact. First, I should acknowledge that North Dakota’s severance taxes are directly tied to specific revenue allocations within their text. This indicates a clear,

²⁴⁸ (North Dakota Legislative Council 2013)

structural solution; it indicates that policy is fulfilling its role as educator. The Legacy Fund specifically, existing in the Constitution, indicates its strength and permanence. Thus in combination with the Constitution, the revenue allocation of the severance taxes is clearly outlined and defined by the law. Because my argument relies on clear allocation of severance tax revenue, North Dakota's severance tax succeeds at potentially addressing future generations.

Of course, with the fund opening in 2017, we do not yet know how the revenue allocation will ultimately pan out. If North Dakota decides to do something similar to Alaska and payout dividends to its residents or remove taxes for current citizens, it will ultimately not fulfill provisions of providing resource research and replacement for future generations. By only focusing on conserving revenue and still failing to conserve natural capital for the future, the tax may ultimately become a "not sustainability-focused" severance tax in relation to its allocation of the Legacy Fund. As I discussed in the previous section, discussions indicate that this scenario is very likely. In contrast, if the Legacy Fund both puts aside revenue for future generations as well as ensures that the fund accounts for replacement of capital by investing in renewables, technology or research, then the severance tax in relation to its allocation of the Legacy Fund may be considered "sustainability-focused."

Conclusions

I conclude this section now having examined both cases and determined that Alaska's severance tax is most likely a "not sustainability-focused" severance tax that does not go far enough to address all externalities including the rights of future generations because, as we saw, there is no indication that investments are made to acknowledge resource replacement for future generations. I also concluded that I can, to a small degree, label North Dakota (based on its Renewable Energy Development Fund) as a "sustainability-focused" severance

The Implications of a Severance Tax

tax that 1) places some of the severance tax revenue into a fund for future generations and 2) ensures that the fund accounts for replacement of capital by investing in renewables, technology or research. Still, I also discovered that there are many ways in which North Dakota's severance taxes do not go far enough as a solution. For example, the revenue allocated to the Renewable Energy Development Fund is rather insignificant compared to total incoming revenue and other fund allocations. Although I was not specific about the amount of revenue needed to be allocated sustainably, it is fair to argue that \$3 million is not enough to replace the natural capital that is being used. Furthermore, North Dakota's Legacy Fund could help them achieve a "sustainability-focused" severance tax, but based on their potential allocation, it appears they will most likely fail to address the replacement of natural capital.

I would like to also note now that this analysis is not nearly as comprehensive as it could be. I am not an expert on taxes and cannot determine with absolute certainty that the severance taxes are not solutions in their current form. For example, there could be more evidence that Alaska is actually allocating their severance tax more sustainably than it appears. Furthermore, these conclusions are not absolute. Evidence might appear that the Legacy Fund plays out differently than expected. Thus "sustainability-focused" and "not sustainability-focused" labels for these severance taxes are not static terms—they are flexible dependent on what changes are made to the tax.

One objection could be that Alaska does make renewable investment or conservation efforts. That would not change this analysis. The point is here, even if the general fund of Alaska is ultimately allocated to address the needs of future generations—there is nothing currently existing structurally that connects Alaska's severance tax towards these protective properties.

I end this discussion now having identified the intricacies of my case studies' severance tax structure. The discussion revealed that politically, the case

studies recognized the preservation of wealth, but not of natural capital. These examples suggest that whereas severance taxes could be adapted to achieve sustainability goals, a lot of thinking would need to change in order for them to do so. I move forward now to a final policy recommendation that will once again require reflection on these cases.

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In the midst of writing this section I receive an email from Professor Rabe. One of his colleagues, a professor at Muhlenberg College in Pennsylvania, had emailed asking for information about severance taxes:

Would you have the breakdown of the percentage of state revenue that comes from severance taxes? I was talking with a Pittsburgh reporter today and told him about the large shares in Texas and Alaska and he was stunned and wondered if he could get the data.²⁴⁹

Professor Rabe forwarded me this email asking if I had any data (of course I had a lot), and was happy to send it his way. What interested me the most about this exchange was the part about the reporter being stunned. Most people are not aware of what a severance tax is let alone how much revenue it generates for states (remember the census bureau facts).

This is not a trend that exists on its own. Severance taxation is not a term that the general public is familiar with. Every time I explain my thesis project to someone, the word severance tax openly invites blank stares. I always follow up, “Oh, it’s a tax on the extraction of natural resources from the earth.” My hands make a pulling motion. They nod, eyes glazed, in response.

²⁴⁹ From an email I received February 5th, 2014.

Conclusion

Policy Recommendation

This argument and analysis has built up to a policy recommendation. That is, when using a nonrenewable natural resource, states should account for all externalities of that use, including the externality as defined in previous chapters: the rights of future generations. In order to account for the use of nonrenewable natural resources, governing bodies should tax the extraction of that resource with a severance tax. In doing so they would acknowledge the removal of the resource. But this acknowledgement is not sufficient. In order to be sufficient as a solution, the severance tax must 1) place some of the severance tax revenue into a fund for future generations and 2) ensure that the fund accounts for replacement of capital by investing in renewables, technology or research. The case studies of Alaska and North Dakota have shown that there is room for thinking about the rights of future generations within a severance tax framework, but that a lot of thinking on the part of policymakers would need to change in order for them to completely do so. I will now discuss what structural adjustments could be made for these case studies as representative of my general policy recommendation for all states. This discussion will focus entirely on working towards using the severance tax as a means to mitigate nonrenewable natural resource use; it will not focus on adjusting the tax to increase revenue.

In the case of Alaska, Alaska's severance tax may be or may become a "sustainability-focused" severance tax by making sure that a portion of severance tax revenue is directly allocated to the Permanent Fund. The Permanent Fund is important as a solution because, as a constitutional amendment, it carries more authority and strength as opposed to funds created by regular legislation. In this sense, the Permanent Fund is more protected. Furthermore, it ensures that policy is fulfilling its "educator" role we discussed earlier. By clearly defining the allocation of the tax, policy can better outline its purpose and goals in doing so.

The Permanent Fund must then also be improved by ensuring that a portion of the principal goes towards research or renewable resource investment. It must do this to recognize the use of capital. Currently, as I found, the Permanent Fund investments do not address or promote sustainability, but by changing this, Alaska can ensure sustainability and that externalities of future generations are addressed.

In the case of North Dakota, as I explored, the state government already allocates their severance tax sustainably through their Renewable Energy Development Fund. In order to make this allocation an even more sustainable solution, the amount allocated must be increased. Furthermore, similar to Alaska's Permanent Fund, North Dakota's Legacy Fund poses a chance to allocate revenue sustainability in a manner that is protected by the state constitution. In order to achieve the goal of allocating funds in a way that addresses the rights of future generations, North Dakota must decide explicitly how to allocate the Legacy Fund. When the revenue becomes available in 2017, North Dakota must allocate it towards renewables, technology and research investments that replace and repay the resource use of oil and natural gas for generations to come. If they decide to do otherwise, by using the Fund similarly to Alaska's Permanent Fund and Permanent Fund dividends, then they will not address all externalities as previously defined and they will certainly not recognize the use of natural capital. The other option that North Dakota may have is to invest the principal of the Legacy Fund into renewables or technology that if developed, would replace the oil and natural gas resource that is used up.

Expanding this policy recommendation towards all states, it is clear that in order to address all externalities associated with nonrenewable natural resource use, the state should employ a severance tax. This tax will directly acknowledge the removal of the resource in question by taxing the value or volume produced. Beyond that the state must allocate the revenue from this tax in a manner that actually replaces the resource and recognizes the use of natural capital. This

means the revenue must provide for the replacement by addressing technology or research or recognizing the energy value of oil and natural gas and investing in alternative forms of energy such as renewables. If the state's policy fails to do this, it will not serve as a solution to managing nonrenewable natural resource use.

Of course, if a severance tax was implemented in a way that generated a lot of revenue, not all revenue must go towards renewable investments and research, but a significant portion must, that is, enough to repay the resource use. Thus, other earnings could be used to satisfy the citizens of today through dividends or general fund allocation. This is an important consideration when we consider the political feasibility of this recommendation.

As this thesis has illustrated, policy should be different than the individual; it should make decisions for the benefit of the public. Policy should also have a teaching function; it should play a role in educating its citizens in questions of socially beneficial actions. Given this understanding, I recommend that the revenue allocation be specifically written out within the severance tax legislation so as to clearly layout exactly how the revenue is allocated. Furthermore, the fund involved in renewables and research investment would benefit from being a constitutional amendment, much like the Alaska and North Dakota case. This is because a constitutional amendment would secure the stability of the fund and revenue allocation scheme much better than a general statute. Taking these actions would ensure that policy was playing an active role in educating its citizens.

When making this policy recommendation, the strengths and weaknesses of the recommendation must also be considered. As this thesis explored earlier, questions of feasibility are an important consideration to any proposed solution. The literature I reviewed indicated that even the best theoretical solutions will face challenges if not supported by political interest. I went as far as to argue that

the political feasibility of an idea is one of the biggest determinants in whether the idea will ultimately become policy.

There are a number of weaknesses to this recommendation. These include especially the political feasibility of this proposal. The severance tax may face challenges in this feasibility criteria. For example, a severance tax may face opposition from industry, and, depending on the amount of opposition, this may inhibit passage of a severance tax. Reflecting back on our discussion of carbon taxes and cap-and-trade, we can recall that those solutions faced this type of feasibility problem. The political challenges they faced prevented the carbon tax and cap-and-trade from seeing overall implementation within the United States. Still, as we explored earlier, a large number of states already employ severance taxes. The benefit then, is that severance taxes already exist structurally within those states and adjusting them may be politically easier than creating them.

Still, the second political hurdle may be convincing residents of a state that allocating money towards future research, investment in renewables and replacement of the resource may be worthwhile. As we explored earlier, the revenue distribution of a market-based solution plays a large role in its political feasibility. In the case studies we saw that the public is interested in receiving personal benefits from the revenue. For example, although the residents of Alaska were outraged by the severance tax benefits given to industry, their main motivation seemed to be because that directly cut into their personal dividends. In that example, the residents were most concerned with how the tax would benefit them and protect *their* resource, as opposed to considering it a resource they share with future generations. I underscore this because it suggests that whereas *structurally* severances taxes *could* be adapted to sustainability goals, a lot of thinking on the part of both policymaker and citizen would need to change in order for them to do so. Although this is a potential political hurdle, there is descriptive evidence that people do care about the future to some extent. As we

saw with the Alaska and North Dakota case, the Permanent Fund and the Legacy Fund were voted by the people into the constitution for the *benefit* of future generations. At least in the language, we do see consideration of the future, which indicates this proposal could find some support in residents of today's states.

We also saw political support within the work of political scientist Leigh Raymond. As Raymond argued, there has been a shift towards agreement in the idea that the public does own common resources. Because the argument to employ severance taxes and allocate revenue to replace natural capital promotes the idea public ownership, under Raymond's argument, it may become more and more politically feasible in the modern political sphere. Of course I noted in earlier sections that the limitations of this feasibility rely on the answer to whether policy will ultimately adopt the populist view of public ownership or the government as decision makers view.

The strength of this proposal beyond that, as described, is that it fits within a framework that currently exists. In this sense, we can find answers to questions of resource use and management by merely manipulating the structures existing today. We can continue or begin to price, to tax, nonrenewable natural resource use and then adjust the way we use that revenue. In doing so, we can see that the severance tax has implications beyond general revenue accumulation. Instead, we can understand that the severance tax has broader implications for how to responsibly and sustainably use and manage resources for tomorrow, today.

Implications

The implications of this recommendation, if fully achieved, indicate that there is a way to responsibly use and manage nonrenewable natural resources for today's generation and for generations to come. It would answer the question of whether solutions could exist to mitigate resource use and preserve the use of resources for future generations. Beyond this recommendation there are more

implications for the potential of severance taxation. We will now consider these here.

I think a lot can be said about severance taxation and its general revenue raising ability. As indicated in our discussion of Alaska and North Dakota, severance taxation accounts for a large portion of state revenue. “Appendix B” shows the severance tax collections for all states from 2002-2012. As this table indicates, severance taxation is important for raising revenue in a number of states, while other states lack a severance tax and are missing out on potential revenue from this form of taxation. That being said, if more states were to recognize the revenue generating ability of severance taxation and were to implement severance taxes, they too may benefit from this revenue creation.

Besides using this revenue to address nonrenewable natural resource management for the sake of future generations, states could also benefit from using a portion of this revenue to address current externalities. Although not part of my argument, we can see that the general revenue raising ability of severance taxation could address a number of issues with resource use. For example, when it comes to the resource use of oil and natural gas, typical regulatory schemes target the production of carbon and other externalities of oil and natural gas use. For example, market-based schemes such as cap-and-trade or a carbon tax attempt to lower carbon emissions and remove that externality of oil and natural gas consumption. Severance taxation could partially be used to address these types of issues. That is, the revenue could address externalities of production and possibly serve as a way to somewhat target carbon emissions on the consumption side, as Professor Rabe once put it, as a potential “back door carbon tax.” Although this has not been explored in this thesis, it is another possibility to consider.

Final Discussions

I must also consider the weaknesses of this analysis and policy recommendation as a whole. For example, I am not an environmental economist and cannot confirm the use of severance taxation for nonrenewable natural resource management through models and a complete environmental economics framework. In this sense these questions and answers must be considered more thoroughly. Still, my work can be considered a first attempt to ask these questions, consider solutions and promote ideas through a theoretical lens—a political theorist lens.

As noted in this thesis, there is value to reviewing and exploring ideas in interdisciplinary ways. This thesis worked to explore the value we should place on finite resources from a theoretical lens by reviewing the arguments of environmental and ecological economists. It also attempted to connect the exploration of the value of the finite resource by delving into the policy sphere. In doing so, this thesis provided a way to understand the relationship between multiple fields when viewing issues that the greater society faces.

This thesis also serves to start the discussion on how we think about the use of a finite resource. That is, whether we care to notice our use, whether we care to find solutions, and whether policy could find a solution. By starting these conversations, I hope to open the door to these questions of how we choose to understand and perhaps adapt our understanding of nonrenewable natural resource use.

And finally, there are implications about the research of severance taxation in general. In fact, I found this research and discussion, while writing, even more so interesting given its lack of literature. Upon researching I found little consideration of severance taxes. That said, it is clear that we need more literature to fully understand the current structure of severance taxes and their potential as both a current policy strategy and a future resource management technique.

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This thesis is not only about severance taxation and its potential for addressing nonrenewable natural resource management. It is also a self story. This thesis is an accumulation of my college experiences. My advisors have encouraged me and led me to environmental theory (Professor Disch) and environmental policy (Professor Rabe). They have provided the foundation for these thoughts and subsequent research. Because of their initial push, I was inspired to bring the story to light. Even if I am ultimately wrong—or if someone disagrees with the premises of my normative argument—I hope to encourage further research and exploration into this fascinating topic.

Appendix A

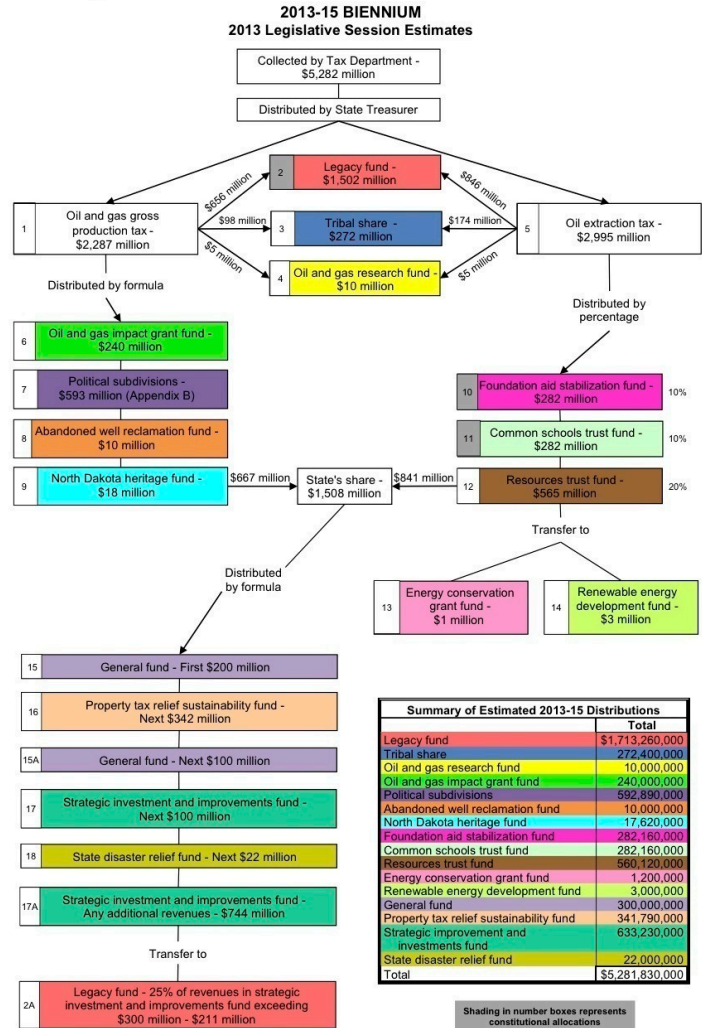
Appendix A: 2013-15 Oil and Gas Tax Revenue Allocation Flowchart

15.9055.01000

Prepared by the Legislative Council staff

2013-15 OIL AND GAS TAX REVENUE ALLOCATION FLOWCHART

This memorandum provides information on the estimated allocation of oil and gas tax collections for the 2013-15 biennium as approved by the 2013 Legislative Assembly. A summary of the funds is included in Appendix A, and a more detailed schedule of the distribution of oil and gas gross production tax collections is included in Appendix B.



ATTACH:2

North Dakota Legislative Council

July 2013

Source: North Dakota Legislative Council. July 2013. "2013-15 Oil and Gas Tax Revenue Allocation Flowchart." 15.9055.01000. <http://www.legis.nd.gov/files/resource/15.9055.01000.pdf?20140124111003>.

Appendix B

Appendix B: State Severance Tax Revenue Summary

Figure 3
State Severance Collections By Year (2002-2012)
 (Amounts in \$ thousands)

State	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Alabama	65,667	104,386	113,646	144,813	182,778	144,306	197,581	115,374	90,538	115,975	116,467
Alaska	551,293	640,856	697,394	925,699	1,274,642	2,436,660	6,939,040	3,829,564	3,355,049	4,238,789	5,787,360
Arizona	6,417	14,662	15,544	26,338	40,494	43,560	43,757	19,481	33,372	40,237	40,578
Arkansas	13,217	15,213	15,840	18,565	22,225	21,579	27,820	33,547	65,147	79,656	82,770
California	28,569	12,485	14,471	14,251	16,048	31,526	31,599	27,105	24,409	31,879	37,112
Colorado	57,130	37,245	115,884	145,114	212,753	136,888	151,474	285,015	71,436	146,690	175,090
Connecticut	-----	-----	-----	-----	-----	-----	12	-----	61	60	64
Delaware	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Florida	40,114	46,700	48,651	59,121	55,790	45,870	56,000	81,300	71,000	59,020	49,860
Georgia	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Hawaii	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Idaho	3,650	2,450	2,568	2,488	2,897	6,649	6,758	4,952	6,730	7,787	8,309
Illinois	259	295	349	448	564	354	0	-----	0	-----	0
Indiana	652	652	563	695	947	1,003	1,680	162	1,426	1,825	2,212
Iowa	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Kansas	66,810	85,271	98,148	117,424	149,676	132,281	168,696	142,658	102,878	122,152	132,907
Kentucky	187,416	172,202	187,109	228,848	281,581	275,313	293,334	355,985	317,146	342,320	346,050
Louisiana	493,662	482,340	476,609	711,766	716,396	904,164	1,035,695	911,433	758,469	729,260	885,982
Maine	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Maryland	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Massachusetts	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Michigan	31,688	49,118	58,220	68,055	90,956	81,874	113,506	59,343	57,424	80,423	64,285
Minnesota	13,477	23,083	14,814	32,348	28,022	34,591	31,821	45,820	23,290	27,618	46,370
Mississippi	31,897	47,241	53,809	66,275	89,910	81,814	135,248	113,762	90,832	112,326	116,378
Missouri	-----	33	53	75	49	58	21	18	2	5	2
Montana	88,882	111,095	83,503	181,201	247,385	264,740	347,221	349,714	253,649	278,372	305,617

Nebraska	1,221	1,782	1,806	2,560	2,820	2,499	4,968	4,718	3,473	4,440	5,355
Nevada	21,493	25,162	37,155	39,691	44,526	62,178	74,130	145,450	182,752	272,240	303,038
New Hampshire	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
New Jersey	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
New Mexico	453,397	483,739	587,625	712,539	923,304	942,354	625,938	931,832	654,752	804,586	768,106
New York	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
North Carolina	1,889	1,858	1,894	1,932	1,967	1,898	1,889	1,740	1,464	1,610	1,562
North Dakota	138,244	161,253	175,625	262,339	346,672	391,337	791,692	827,417	1,136,553	1,883,816	3,187,112
Ohio	8,655	8,065	8,112	7,920	7,675	7,015	9,420	11,052	10,550	11,197	10,182
Oklahoma	364,459	547,951	655,051	762,506	1,059,919	942,148	1,184,765	1,067,182	743,686	830,662	848,947
Oregon	29,612	25,797	16,603	12,148	12,032	12,513	11,815	13,038	12,742	13,199	14,119
Pennsylvania	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rhode Island	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
South Carolina	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
South Dakota	2,191	2,755	2,012	2,870	4,355	4,700	6,838	7,668	8,410	10,596	13,759
Tennessee	1,120	1,095	1,061	1,438	1,796	1,604	2,357	2,413	2,251	2,355	2,450
Texas	974,727	1,501,289	1,896,803	2,347,512	3,216,387	2,762,940	4,124,428	2,338,481	1,737,136	2,677,604	3,655,582
Utah	28,972	37,788	50,009	73,434	99,517	101,539	106,060	102,121	89,162	101,665	107,075
Vermont	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Virginia	1,644	1,608	1,680	1,772	1,852	2,006	2,060	1,997	1,882	1,923	1,986
Washington	43,418	38,360	37,624	43,034	48,446	48,727	44,038	29,681	20,905	26,706	36,302
West Virginia	177,093	193,680	204,126	307,265	336,387	328,320	347,592	376,677	417,230	585,992	626,203
Wisconsin	3,460	3,295	4,610	3,476	3,739	4,960	5,290	4,211	5,004	5,631	5,013
Wyoming	301,594	440,757	683,208	805,613	1,043,160	803,632	883,786	1,197,540	721,002	1,044,150	968,525

----- indicates that a state does not collect this tax.

Source: United States Census Bureau, Governments Division. <http://www.census.gov/govs/statetax>.

Figure 4
Share of State Severance Tax in Total Tax Revenue By Year (2001-2012)

State	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Alabama	1.75%	1.01%	1.63%	1.62%	1.86%	2.14%	1.63%	2.18%	1.39%	1.08%	1.34%	1.30%
Alaska	54.06%	50.60%	57.21%	51.92%	49.81%	51.31%	66.06%	79.46%	77.27%	74.18%	76.54%	82.10%
Arizona	0.05%	0.08%	0.17%	0.16%	0.24%	0.30%	0.30%	0.33%	0.17%	0.33%	0.33%	0.31%

Arkansas	0.32%	0.26%	0.30%	0.28%	0.28%	0.32%	0.29%	0.37%	0.45%	0.86%	1.00%	1.00%
California	0.03%	0.04%	0.02%	0.02%	0.01%	0.01%	0.03%	0.03%	0.03%	0.02%	0.03%	0.03%
Colorado	0.82%	0.83%	0.56%	1.64%	1.90%	2.49%	1.49%	1.57%	3.28%	0.83%	1.55%	1.71%
Connecticut	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Delaware	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Florida	0.20%	0.16%	0.17%	0.16%	0.17%	0.14%	0.12%	0.16%	0.25%	0.23%	0.18%	0.15%
Georgia	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hawaii	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Idaho	0.10%	0.16%	0.10%	0.10%	0.08%	0.09%	0.19%	0.19%	0.16%	0.23%	0.24%	0.25%
Illinois	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Indiana	0.01%	0.01%	0.01%	0.00%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%
Iowa	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Kansas	2.29%	1.39%	1.70%	1.86%	2.08%	2.39%	1.92%	2.36%	2.13%	1.58%	1.79%	1.79%
Kentucky	2.23%	2.35%	2.07%	2.21%	2.52%	2.90%	2.78%	2.92%	3.65%	3.32%	3.36%	3.30%
Louisiana	6.45%	6.71%	6.47%	6.16%	8.24%	7.35%	8.24%	9.41%	8.93%	8.66%	8.23%	9.85%
Maine	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Maryland	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Massachusetts	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Michigan	0.28%	0.14%	0.22%	0.24%	0.29%	0.38%	0.34%	0.46%	0.23%	0.25%	0.34%	0.27%
Minnesota	0.01%	0.10%	0.17%	0.10%	0.20%	0.16%	0.19%	0.17%	0.27%	0.14%	0.15%	0.23%
Mississippi	0.74%	0.67%	0.94%	1.05%	1.22%	1.50%	1.26%	2.00%	1.75%	1.45%	1.67%	1.67%
Missouri	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Montana	8.82%	6.16%	7.47%	5.14%	9.66%	11.63%	11.41%	14.13%	14.53%	11.84%	12.08%	12.43%
Nebraska	0.07%	0.04%	0.05%	0.05%	0.07%	0.07%	0.06%	0.12%	0.12%	0.09%	0.11%	0.12%
Nevada	0.77%	0.54%	0.61%	0.79%	0.70%	0.72%	0.99%	1.21%	2.59%	3.13%	4.30%	4.50%
New Hampshire	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
New Jersey	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
New Mexico	16.87%	12.50%	13.41%	14.68%	15.91%	18.07%	17.05%	12.01%	19.34%	15.13%	16.16%	15.10%
New York	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
North Carolina	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%
North Dakota	14.14%	12.37%	13.69%	14.29%	18.69%	21.37%	21.95%	34.24%	34.27%	42.96%	49.28%	56.70%
Ohio	0.04%	0.04%	0.04%	0.04%	0.03%	0.03%	0.03%	0.04%	0.05%	0.04%	0.04%	0.04%
Oklahoma	11.21%	6.02%	9.28%	10.19%	11.12%	13.56%	11.57%	14.22%	13.03%	10.51%	10.70%	9.62%

Oregon	0.59%	0.57%	0.45%	0.27%	0.19%	0.16%	0.16%	0.16%	0.18%	17.00%	0.16%	0.16%
Pennsylvania	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Rhode Island	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
South Carolina	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
South Dakota	0.22%	0.22%	0.27%	0.19%	0.26%	0.37%	0.37%	0.52%	0.57%	0.64%	0.77%	0.90%
Tennessee	0.01%	0.01%	0.01%	0.01%	0.01%	0.02%	0.01%	0.02%	0.02%	0.02%	0.02%	0.02%
Texas	6.95%	3.40%	5.16%	6.17%	7.16%	8.79%	6.85%	9.06%	5.49%	4.41%	6.20%	7.50%
Utah	1.27%	0.74%	0.96%	1.19%	1.56%	1.82%	1.67%	1.74%	1.88%	1.75%	1.86%	1.84%
Vermont	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Virginia	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%
Washington	0.44%	0.34%	0.30%	0.27%	0.29%	0.30%	0.28%	0.25%	0.18%	0.13%	0.15%	0.21%
West Virginia	4.90%	4.99%	5.39%	5.44%	7.14%	7.40%	7.07%	7.12%	7.87%	11.45%	11.39%	11.70%
Wisconsin	0.01%	0.03%	0.03%	0.04%	0.03%	0.03%	0.03%	0.04%	0.04%	0.03%	0.04%	0.03%
Wyoming	37.47%	27.56%	36.21%	45.40%	46.31%	29.15%	36.98%	36.75%	43.33%	33.41%	42.41%	37.97%

Source: United States. Census Bureau, Governments Division. <http://www.census.gov/govs/statetax>.

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