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INTOXICATION OF POWER:  
IMPACTS OF COAL POWERED DEVELOPMENT ON  
AMERICAN VIEWS TOWARDS LIMITS, PROGRESS, AND  
THE ENVIRONMENT IN THE MID 19<sup>TH</sup> CENTURY

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## ABSTRACT

The mid-19<sup>th</sup> century was a pivotal period in American environmental history. During this time span, revolutionary changes were occurring in how Americans lived that had subsequent impacts upon their relationships with environmental systems. As such, many environmental historians, such as Roderick Nash, William Cronon, and Theodore Steinberg have researched this period extensively. While offering valuable insights about some of the changes that occurred, existing literature cannot adequately answer how coal and its subsequent impact on the development of the United States influenced American attitudes. The aforementioned authors do not try to make the connection between the development, which accompanied coal, and the new attitudes that surfaced during that development. The time span between 1830 and 1860 saw revolutionary changes in the speed, size, and distance of the production and distribution of goods. Through an analysis of primary and secondary documents, this thesis shows how coal powered development had a strong influence in changing attitudes towards limits, progress, and human-environmental relationships.

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## Chapter 1

### Introduction: Revolutions in Power

“Things are in the saddle,  
And ride mankind.

There are two laws discrete,  
Not reconciled, --  
Law for man, and law for thing;  
The last builds town and fleet,  
But it runs wild,  
And doth the man unking.”

This quote by Ralph Waldo Emerson alludes to a profound shift that occurred during the middle of the 19<sup>th</sup> century in the United States. The period between 1830 and 1860 saw revolutionary changes in energy, which in turn influenced the ways Americans lived. Prior to this transitional period, all forms of energy came from the burning of wood, the natural motion of water and air, or the muscle of animals and humans. However, in the beginning of the 19<sup>th</sup> century coal was being used for heat and power, power which would be harnessed through the steam engine and rapidly shift energy use in the United States. This shift from wood and muscle to fossil fuel brought about a new age of power that helped to shape many aspects of life that define the modern age in America. Some of these changes include the railroad, the large-scale factory, and centralized supply chains.

While some of the legacies left from coal- powered development are more obvious, others remain elusive, largely because they were not solely physical in nature. These legacies consist of the changing societal views that coal development caused, including changing attitudes towards limits, a new view of progress, and the birth of a power ethic which characterized a new relationship with the environment. In order to gain more understanding of these intangible

legacies, I pose a two-part question: how did coal influence the development of the United States in the mid 19<sup>th</sup> century, and did that development have an impact on American attitudes towards the environment? Thus, the goal of this thesis is to answer these questions in order to see how physical changes were influencing the United States in the 19<sup>th</sup> century.

I believe that understanding this legacy is important for three reasons. First, it fills a gap in the existing American environmental history literature. While multiple authors have discussed the influence of coal in the development of the United States during the 19<sup>th</sup> century, few cover any changes occurring in the same period regarding American opinions. Moreover, none of the literature makes an effective attempt at connecting the rapid industrial development that occurred with the subsequent changes in the American-environmental relationship. For example, the author Roderick Nash explains the perceptual shift occurring among Americans regarding wilderness. In *Wilderness and the American Mind*, Nash provides evidence that Americans deemed wilderness as an evil wasteland during the march of the frontier. However, as this march waned in the mid to late 19<sup>th</sup> century, Americans began to cherish wild places, mostly because of two factors, new transcendentalist writing, and the scarcity of wild places. This was an important shift to be sure, yet he does not incorporate the influence of coal development that was occurring in the middle of the century, and in effect misses a pivotal source of shifting societal views that occurred during this revolutionary age in American history.

Second, answering this central question sheds light on the attitude shifts that occurred as the United States transitioned into the modern industrial power it is today. The development occurring during the 19<sup>th</sup> century served as the starting point for the rapid industrial growth experienced in the 20<sup>th</sup> century. Along with this development came changing attitudes and viewpoints, as a remarkable new age of power dawned on American society. Many of these changes have left legacies still discernable in present-day society, such as an economy based upon limitless growth. Increasingly, these societal tendencies are undergoing inspection, as the

United States attempts to solve problems that have arisen from this type of growth model, including the overexploitation of natural resources, energy insecurity, and environmental degradation.

Third, I believe the research conducted for this thesis offers a different angle on what occurred in the United States during the mid-19<sup>th</sup> century. Often, historical works only discuss the growth of railroads and industry during the period. Rarely does existing literature engage with the influence these events had on the way people thought or with how profound these changes actually were. The type of question posed in this thesis forces one to engage with these connections in order to find a satisfactory answer. In this pursuit, I have analyzed both primary and secondary sources that illustrate how American society reacted to revolutionary increases in power which occurred during the 19<sup>th</sup> century. Thus, I believe this process offers a different perspective on a well-worn piece of American history.

In order to examine the impacts of coal upon environmental viewpoints, my research consisted of several steps. First, I reviewed literature both relevant to the period and to the central question of the thesis. In doing so, I concentrated upon works of American environmental history that both discussed development occurring during the 19<sup>th</sup> century and any opinions surfacing in reaction to this development. In my search, I reviewed many key authors in American environmental history, including Roderick Nash, William Cronon, Jared Diamond, and Leo Marx. This literature review served as the formative step of the thesis, guiding further research. It informed me of a gap in the existing literature and several key ideas to explore that would be fruitful in answering my central question. This was a gap in connecting coal development with changing attitudes, which could provide an adequate answer for this thesis. The key ideas that would serve as a guide were coal's influence on railroads, its destructive influence on ecosystems, disconnection from seasonal changes, perceptions of wilderness, and contradictions between agrarian ideals and mechanical aims.



Using the literature review as a guide I then researched the impact coal development had on the country. This included following sources cited in existing literature and conducting general research about the changes occurring between 1830 and 1860 regarding coal development. This research yielded results, which allowed me to make connections between impacts of coal development and changing attitudes in American society regarding the environment. The most important finding from this research was the discovery of several themes, often surfacing in the research. They included the rapid increase of the speed of transportation, the size of loads that transportation could handle, and the distance transportation could bridge. These three crucial ideas of *size*, *speed*, and *distance* would serve as tools for connecting developmental changes with the way Americans thought about limits, progress, and their relationship with the environment.

After researching the rapid increase of coal use during this period and its subsequent impacts on the development of speed, size, and power, I then focused my research on primary documents that could convey popular opinions from the mid-19<sup>th</sup> century. This is where the literature review, again, served as important guide to my research. A major part of the review focused on *The Machine in the Garden* by Leo Marx. This work, more than any other, focused on the reaction Americans had to coal- powered development. Importantly, it used many primary documents from the period to show this reaction. As such, I used the book as a guide to the periodicals of the time, reviewing the articles of the major periodicals mentioned in the book. Using this review, I eventually concentrated on articles from six prominent periodicals from the period, which portrayed opinions and reactions to coal powered development. Through these articles, I was then able to determine popular reactions to coal powered development and infer whether they influenced any attitudinal changes. The results of this analysis were interesting, as many of the articles depicted strong responses to the development occurring at the time. Some examples regarded coal power as an example of divine intervention, a new limitless resource, and

as power that gave humans control over their environment. As such, they alluded to changing perspectives that accompanied rapid increases in speed, size, and distance that characterized the age. Once these responses were discovered and analyzed, connections were then made between impacts of coal power and changes in American views.

The layout of the thesis closely mirrors my methods. As such, immediately following this introduction is the literature review. This literature review details the contributions of each author, gaps in the literature, and how these contributions and gaps were combined to guide my research. Building off this literature, the next chapter, *Impacts of Coal Power on American Development*, contains research on the impact of coal power on the development of the United States between 1830 and 1860. It then discusses influences of coal power on the rapidly increasing speeds, sizes, and distances involved with both the railroad and industry. The following chapter, *The Influence of Coal on American Views* then discusses reactions of Americans towards these increases in speed, size, and distance. Featuring excerpts of articles from the mid-19<sup>th</sup> century, the chapter illustrates these reactions and posits connections between changes associated with development and changing attitudes towards limits, progress, and the environment. Finally, a concluding chapter ties the thesis together in an effort to determine the impact of coal powered development and how it might have influenced the ways American society viewed its surrounding environment.

Overall, the thesis attempts to synthesize existing literature, the development occurring during the mid-19<sup>th</sup> century, and the responses to that development. The main goal again is to answer the fundamental questions: how did coal influenced the development of the United States in the mid 19<sup>th</sup> century, and did that development have an impact on American views towards the environment? These questions remain central to understanding this revolutionary period of history, especially since it may have left legacies still visible in modern American society.

## Chapter 2

### Literature Review

Literature reviewed for this work consisted of *Down to Earth* by Ted Steinberg, *Collapse* by Jared Diamond, *Nature's Metropolis* by William Cronon, *Wilderness and the American Mind* by Roderick Nash, *The Machine in the Garden* by Leo Marx, and *The Development of American Agriculture* by Willard Cochrane. This assortment of authors served as a crucial springboard for this thesis, laying the groundwork of ideas which I planned to build upon through my work. In the course of the review a clear dichotomy began to appear between these sources. The authoritative works fell into two broad categories: those that focus on the physical impacts of historical events and those that focus on views which accompanied historical events.

While these sources provide interesting insights on the impact of coal on both the American landscape and American attitudes, none of them tries to effectively discuss the relationship between the two. This oversight means that no source could provide an acceptable answer to the two questions posed by this thesis. As such, it is crucial to fill this important gap to discover how the physical changes brought about by coal power may have influenced how Americans thought about their environment. My hope for such a discovery is greater understanding of the source of social processes at work in contemporary society. In order to reach this discovery however, it remains important to review the literature that has already tried to further this understanding.

To begin, Steinberg, in *Down to Earth: Nature's Role in American History*, offers a sweepingly broad analysis of how the flora and fauna of the New World shaped the development of the United States. In his analysis however, he only quickly mentions the role that coal had in the process of development in America, describing how coal power led to the advent of the railroad systems, massive mining operations, and some ecological changes. In addition, the

analysis is largely limited to Appalachia, describing the unsupportable population increase, environmental damage, and economic dependency brought about by coal development in the area. The coal extraction in Appalachia, he writes, was very similar to the wood extraction in the southern United States. This extraction involved outside capital from northern cities, incoming railroads, and large-scale mines, all aiming to exploit the reserves of bituminous coal found in the region (Steinberg, 113). This activity had an obvious impact on the people who lived in the region. The large mines threatened the integrity of the ecological systems they relied upon and the outside influence from the north dispossessed a large portion of the population in Appalachia (Steinberg, 113). In addition to the extraction situation in Appalachia, Steinberg also briefly mentions the issue of coal ash in those northern cities, which quickly became a waste issue, as the majority of the population in these cities began to use coal as a major source of heat (Steinberg, 166).

Unfortunately, in his brief sections about coal, Steinberg does not mention how the changes brought about by coal-powered technology may have had more than an economic impact, leading the book to miss possible connections between major historical events. One such event is the rapid explosion of consumption after WWII. While this phenomenon is explained partially through the need for wartime factories to continue producing, the book misses a connection between the influence of coal on American views and their newfound willingness to accept a lifestyle based on the unlimited consumption of goods. This willingness was likely influenced by new ideas concerning progress brought about by coal-powered development, but the book does not attempt to investigate this connection. Overall, Steinberg provides a valuable account of the influence environmental factors had on American history. Unfortunately, his work does not share any insights on American attitudes toward development during the 19<sup>th</sup> century.

Jared Diamond similarly neglects this important development in the late 19<sup>th</sup> century. In *Collapse: How Societies Choose to Fail or Succeed*, Diamond merely explains the direct ecological impacts of coal. These include damage from mining, such as acid mine drainage and the destruction of ecological systems. Diamond goes on to describe how the coal industry has had it easier than other hard-rock mining industry at skirting environmental regulations. This, he argues, is due to the fact that society perceives coal as a necessary part of modern life (Diamond, 76). The question still remains, however, how has society gained this stance? In neglecting to flesh out this question, Diamond misses an important source of this social viewpoint that has allowed coal mining to continually disrupt the natural systems upon which people rely.

In *Nature's Metropolis: Chicago and the Great West*, William Cronon illustrates the environmental history of Chicago as it grew into a large city. In the book, he discusses the impact of the railroad as it began to connect Chicago to the rest of the country. First, the railroad began to separate people from the former seasonal limits on travel. The new power of coal-powered locomotives and the technology of rail networks allowed transportation to occur year round, regardless of adverse weather. The awesome power of this new technology to disrupt this age-old relationship between people and the environment, led to an attitude, where locomotives were seen as, "engines of endless growth" (Cronon, 71). This shift towards an unlimited growth model is an important piece of information that helps to answer the question of whether coal development caused any change in American views. It seems that the development of coal was having at least some sort of impact on Americans during the mid 19<sup>th</sup> century. In addition to conquering the seasons, coal-powered railroads were also achieving revolutionary speeds, which dramatically reduced the great distances that once made civilization a chain of islands among the wilderness. Prior to the advent of locomotive power, travel from New York to Chicago took two weeks, after railways connected the two cities travel took merely two days (Cronon, 76).

Thus, Cronon provides important information for this thesis. In *Nature's Metropolis*, he contributes to an illustration of the changes occurring at the time, especially those concerning railroads. In doing so, he shows that coal development did have at least one impact on American thought. Missing however, is whether other aspects of coal development influenced these perceptions. For example, did the revolutionary changes in speed influence how people thought about their physical environment? On this question, the book is silent. Additionally, he fails to address the consequences of those changes. By simply discussing the railroads, Cronon misses what really influenced the American mind. I argue it was not the railroads themselves, rather the new abilities they afforded to society, which worked to change the way Americans thought about the environment, themselves, and where they were going. This view of locomotives as “endless engines of growth” is an important one. It indicates that Americans were beginning to frame future progress through an unlimited growth model, and those coal-powered railroads were an impetus for this new attitude. The book however, does not go into any discussion of this or any other possible attitudinal shift related to coal development.

Despite that previously discussed literature has largely overlooked the relationship between coal powered development and changing American views, some of the authors do try to get at the deeper historical roots of the American relationship with the environment. In the classic *Wilderness and the American Mind*, Roderick Nash attempts to explain the perceptual shift in America concerning wilderness. The book focuses on the idea that a disconnection from the environment which was initially a part of our habitat, came partially from the creation of the idea of wilderness and partially from Biblical sources that considered wilderness the playground of the devil (Nash, xi). This caused a powerful distinction between human-controlled and uncontrolled spaces. As a result, Nash argues that human society began to see a clear distinction between itself and the rest of the world, where previously nature was an integral part of human

life. The creation of this distinction was a result of herding, settlements, and early agriculture, marking the beginning of technological development (Nash, xii). These technological developments, insists Nash, served as the thrust for a new environmental perception, which severed humanity from the larger web of life. Consequently, nature lost its significance in everyday life, and was viewed in an adversarial light, resulting in the over-exploitation of natural resources. This bias against the environment then began to shift as the census of 1890 declared the death of the frontier. The subsequent scarcity of 'wild' places caused a change in the American perception of wilderness, from adversarial to valuable (Nash, xiii).

While Nash makes a compelling argument about a historical shift in American thought, I believe there are several gaps in his explanation. First, while the distinction between the human environment and wilderness created through herding, early agriculture, and settlements disconnected us from our 'habitat' I would argue this disconnection was minimal in comparison with the detachment brought by coal power. Americans were still limited by the low-energy nature of systems that relied on muscle, wood, and waterpower. This reality also largely limited the environmental destruction Nash describes, as humans remained intimately linked to small regional feedback systems limited by the small scale on which activity could take place. People could only walk, ride, or navigate a waterway so far in a given day. Additionally, civilization was much more susceptible to natural events, such as powerful storms. What I seek to do here is provide insight on how the power of coal played an integral role in the disconnection of American society from the intimate feedback loops that maintained the health of ecological systems which underpin life. The subsequent ability to increase the scale of speed, size, and distance so fundamentally altered the American relationship with the environment, that it may have influenced how Americans considered nature.

Second, Nash rightly attributes the shift in American attitude toward wilderness to the idea of scarcity brought about by the 1890 census. This census was monumentally important because it announced the death of the frontier, which had defined life in the United States since its beginnings as a colonial nation. It remains interesting however, that this framing of the period as a time of limits, lies in contrast with the growing view that possibilities were unlimited, as Cronon illustrates. It seems odd that Nash neglected to address the influences of coal development, especially when that development had a large influence on the creation of National Parks. While it is true that the scarcity of wild places led to a movement that championed the creation of these great parks, in reality the parks were actually built because of the railroad interests in the area. These railroads, like those connecting Chicago with the rest of the country, dramatically changed the access Americans had to parks, radically reducing the amount of time and effort it took to travel to a park. Nash admits this, as he discusses the influence of railroad activity in the creation of the National Parks (Nash, 114). What is absent in the analysis of these events is how coal powered modes of transportation, which made wilderness accessible, were also altering the way Americans thought about nature.

Part of this new attitude was the obsession with human-powered control of natural systems. This craze is illustrated in *Wilderness and the American Mind*, when Nash discusses the management of the new parks. These parks were created and managed to fulfill the American perception of wilderness: prolific amounts of game, grandiose landscapes, and magnificent natural curiosities (Nash, 186). To achieve this state of wilderness required the extermination of predators, the suppression of fire, and the development of areas to provide lodging and other services. As such, wilderness was not the “environment” so to speak, but rather a human-created version of natural spaces, because Americans now had the ability to subjugate the land. In focusing on the idea of scarcity, Nash offers an important contribution to understanding of



changing views that occurred during the mid-19<sup>th</sup> century. However, I believe his analysis is incomplete, because it misses any discussion of the possible influence coal development had on the changes that occurred in this revolutionary period of American history. This influence is important because it has served a role in shaping modern views towards the environment.

Another work that addresses how coal development had an impact on American environmental views is the *Machine in the Garden* by Leo Marx. The book's focus is illustrating how the pastoral ideal became a powerful metaphor of contradiction as Americans began to romanticize agrarian ideals during the Industrial Revolution (Marx, 4). The book contains a wonderful variety of literary works from the 19<sup>th</sup> century exemplifying the impact of coal power through the proliferation of the machine, not only throughout the countryside, but also throughout society. The first interesting aspect of the book is Marx's documentation of initial negative reactions expressed by authors such as Ortega Y Gasset, Nathaniel Hawthorne, and Thomas Carlyle during the 19<sup>th</sup> century as the industrial attitude swept the nation. As the steam engine was developed to harness the massive increase of energy generated from burning coal, intellectuals began to assess the consequences of such power. Gasset makes the astute observation that people did not share the same enthusiasm for the consumption of goods with the realities that make those goods possible (Marx, 9). This comment highlights a possible connection between the new distances possible through railroad development and its influences on how Americans looked at the environment. Distances between production and consumption became so great that Americans could consume goods without having to intimately face the harsh realities of producing those goods. Hawthorne on the other hand describes his feelings, when he is confronted while sitting in a quiet hollow with the sounds of a nearby locomotive, "the long shriek, harsh, above all other harshness, for the space of a mile cannot mollify it into harmony" (Marx, 13). Carlyle, in contrast, expresses more than discontent with the new industrial power

sweeping the nation, “a mighty change in our whole manner of existence...Men are grown mechanical in head and in heart, as well as hand” (Marx, 173). Cited the most frequently among dissenters in *The Machine in the Garden*, Carlyle also had concerns about the impact of mechanical power on the social and economic system:

What changes, too, this addition of power is introducing into the Social System; how wealth has more and more increase, and at the same time gathered itself more and more into masses, strangely altering the old relations, and increasing the distance between the rich and the poor (Marx, 171).

Additionally, the English writer was disturbed by the proliferation of mechanism from the physical world to every other aspect of life, including music, art, literature, science, religion, philosophy, and politics (Marx, 171).

These concerns cited by Marx indicate that the industrial changes occurring in the United States during the mid 19<sup>th</sup> century were indeed influencing opinions. For example, the power wielded by humanity led to an excessive emphasis on means rather than ends, indicating a change in ideas concerning the human-environment relationship and ideas of progress. Increasingly, people were engaging solely with the how, and did not concern themselves with the why (Marx, 171).

While concerns about the influence of industrial power were voiced initially, they often came from outside of mainstream thought and were soon largely cast aside and ignored by society. One proponent of this mainstream thought was Timothy Walker. In *The Defence of Mechanical Philosophy*, he proclaims that the machinery dominating the landscape was evidence that life was getting better all the time.

Where she [Nature] denied us river, Mechanism has supplied them. Where she left our planet uncomfortably rough, Mechanism has applied the roller. Where her mountains have been found in the way, Mechanism has boldly leveled or cut through them. Even the ocean, by which she thought to have parted her quarrelsome children, Mechanism has encouraged them to step across. As if her

earth were not good enough for wheels, Mechanism travels it upon iron pathways (Marx, 181).

Walker exemplifies an important aspect of the times, that power had visible and tangible impacts upon the landscape, which often made life easier. These salient examples of human domination and “improvement” worked to extinguish cries from viewpoints opposing this new brash development, as the observation of mechanization proliferating throughout life faltered in comparison to the leveling of a mountain, or traveling on an “iron pathway”.

It is important to note that achievements in science as well as the political movement to establish America became entwined with the development of coal-powered technology, making it all seem like a logical march of progress (Marx, 161). As a result, Americans quickly shifted their views on industry, from hesitation to acceptance (Marx, 167). Soon technological power was seen as a force that would free the working masses from repetitive labor. By 1830, coal power, through its ability to dominate nature, took hold of the American imagination, causing a deep and widespread belief that the systematic domination of nature was the ultimate path of progress and made everyone’s lives better (Marx, 181).

As time moved on, power came to increasingly define American culture. It was believed that the surge in human ability to dominate the landscape was evidence of an *evolution* in culture, creating vast amounts of technical knowledge (Marx, 184). It is important to mention here that there is a distinct difference between knowledge and wisdom, the former of which does not necessarily mean the latter. This idea of evolution led to the belief that American culture would eventually reach an “Automated Utopia” (Marx, 185). This was reinforced by the fact this new power was granting access for a vast number of the population to an unprecedented share of the pleasures of life. The changes in power, speed, and distance that had occurred over the last several decades completely captured the imagination of the public. Evidence of this is provided

by the account of Swedish novelist Frederika Bremer's visit to America, where she observed boys in a schoolroom drawing, "smoking steam-engines, or steamboats, all in movement" (Marx, 208). Later she remarked, "interest in locomotive machinery has a profound connection with life in this country." One of the most important parts of this book is the insight it provides into the major assumptions of the age. It was believed that peace, equity, freedom, and happiness were the inevitable byproducts of coal development and the power it bestowed to Americans. Eventually, after humans improved the landscape to their satisfaction, the things sacrificed along the way would eventually work themselves back into the world.

Thus, *The Machine in the Garden* is a valuable addition to the literature on 19<sup>th</sup> century environmental views because it possesses evidence of the American reaction to the development of coal power between 1830 and 1860. Importantly, it also provides a rich collection of sources I can delve into in order to develop this thesis. What the book does not convey, is any connection between the impacts of coal and these attitudinal changes. Marx instead focuses on the contradiction of pastoral ideas attached to mechanical development without discussing its implications for American attitudes. I believe this conclusion is markedly different from the focus of my thesis because it does not illustrate how coal-powered development altered American attitudes towards the environment. That being said, Marx does provide an invaluable resource by supplying a collection of primary documents from the period that are specific to the development of coal.

Crucial to understanding the revolutionary nature of coal power is knowledge of what life was like prior to the implementation of the new fuel. To that end, Nash, Cochrane, Cronon, and Steinberg are particularly useful. *Wilderness and the American Mind*, illustrates how wilderness, especially for those living on the frontier, was a threat to survival so severe that it was like removing centuries of societal advancement that had occurred in Europe (Nash, 24). Wilderness

was referred to as the enemy, which had to be destroyed at any cost especially for those living on the frontier (Nash, 27). Nash shows how part of the reason Americans originally viewed wilderness with such contempt was because it constantly pushed back against the civilization they had come to know. Thus, prior to the 19<sup>th</sup> century, America was characterized by the frontier life, which constantly battled against environmental constraints.

Cochrane on the other hand, discusses the quality of agriculture prior to coal powered development. His work, *The Development of American Agriculture*, outlines how difficult movement was prior to the introduction of coal power. Between 1775 and 1800 pioneers had to deal with rough mountainous terrain and dense forests which made travel arduous and slow (Cochrane, 47). One can see the contrast in transportation between the 18<sup>th</sup> and 19<sup>th</sup> centuries in figure 2-1, as the frontier expanded westward (Cochrane, 49).

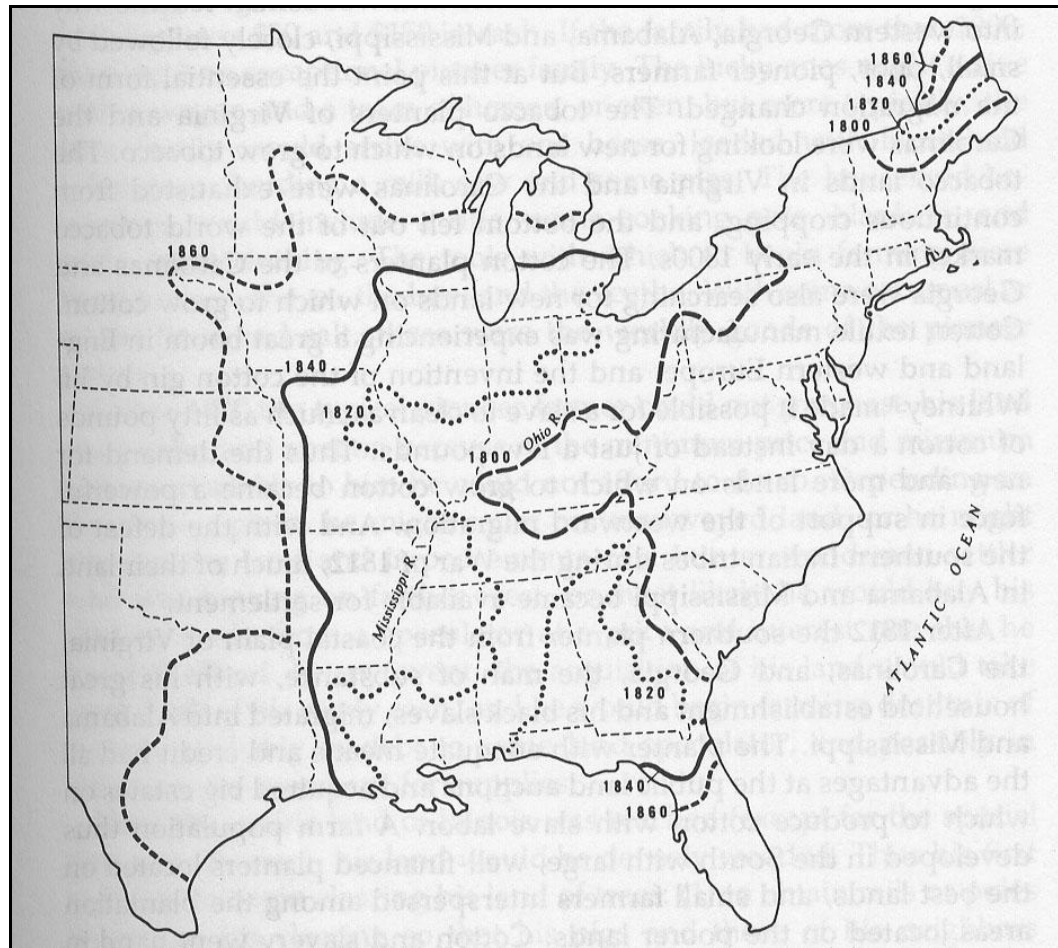


Figure 2-1 Map detailing the movement of the American frontier between 1800 and 1860.

In addition to the tepid rate of transportation, there was also very little option for routes heading west. Prior to the 19<sup>th</sup> century, people could only travel west by two routes. One followed a valley in the southwest corner of Virginia, while the other was by an old military road to Pittsburgh, which connected to the Ohio River, where one could float down the river by canoe or flatboat (Cochrane, 48). The method of transportation itself was often difficult, as people primarily moved either by water, horse, or on foot (Cochrane, 50).

In regards to agriculture, prior to the development of railroads, farming was largely limited to simply sustaining the families who worked the land (Cochrane, 184). An important characteristic of agriculture during this time was an abundance of land, but a critical shortage of labor. People were in short supply and young men would often rather secure their own land than work it for someone else (Cochrane, 189). As a result, agricultural production was limited because of this labor shortage, something that would radically change, when coal began to fulfill this need later in the century. With the advent of the coal powered factory, agricultural machines could be manufactured on a large scale. For example, John Deere produced around 1,000 plows per year in the mid 1840's, while this number jumped to over 10,000 plows per year merely a decade later (Cochrane, 190). This helped Americans overcome limits of scarce labor and bolster agricultural production, as railroads extended markets across the country. This extension was important, because it shows another limiting factor to American agriculture: distance. Due to the aforementioned issues with transportation, farms could not easily bring goods to market, suppressing the need to produce a surplus. This limitation changed dramatically however, as railroads connected agricultural areas to cities through rail (Cochrane, 195). Overall, Cochrane illustrates the main limitations for agriculture prior to coal use, including arduous travel, long distance, and scarcity of labor

Cronon on the other hand, shows what limitations existed for growing cities before the 1800's. In *Nature's Metropolis*, he describes how, "nature threw up obstacles which those who dreamed of human progress had to overcome at every turn" (Cronon, 56). Chicago, before advances in coal power reached the shores of Lake Michigan, was largely subject to the whims of nature. The seasonality of weather, including wide variations in temperature and precipitation throughout the year, often crippled transportation in the area, turning streets into quagmires and stranding boats in harbors (Cronon, 57). These fluctuations made travel extremely difficult and

time consuming, creating a large barrier to the connection of Chicago with other cities in the United States, hindering its growth. The gravity of the control nature had on the city is apparent when Cronon illustrates the coming of the Galena and Chicago Union railroad. In fact by 1861, Chicago had become integrally connected to the rest of the Union by railroads, as evidenced by figure 2-2 (Cronon, 69).

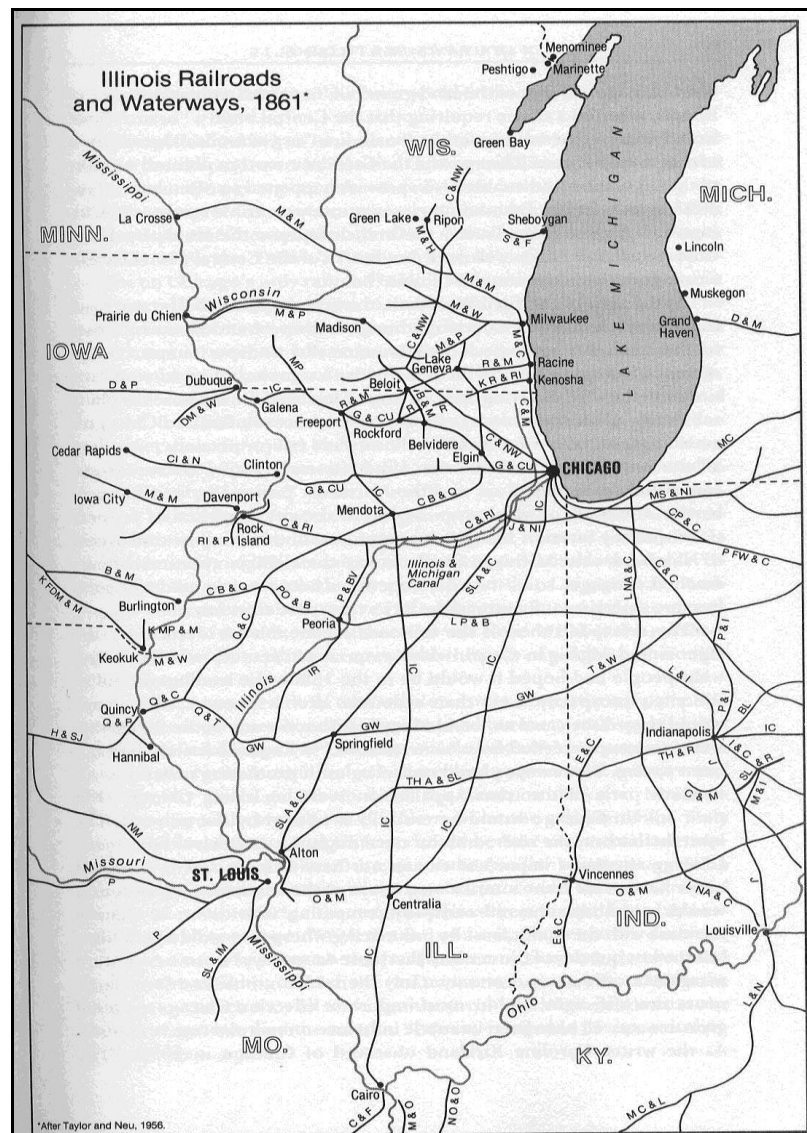


Figure 2-2 Map of railroads and waterways used for transportation in Illinois by 1861.



The impact was so great that the editors of *Chicago: Her Commerce and Railroads* exclaimed, “With railroads as the engines of growth our city is capable of almost unlimited extension...” (Cronon, 71). Overall, the growth of large cities like Chicago, were largely limited by natural forces which controlled much of the trade capable in and around urban areas.

In sum, these authors paint a picture of life in America before coal power. It was a difficult, dirty, and often dangerous life, especially on the frontier. Relying on wood, muscle, and water power meant that people had to succumb to the power of natural forces, especially the temperature and precipitation fluctuations brought by the seasons. Additionally, shortages of muscle power (labor scarcity) and long distances over tough terrain pitted Americans against nature in a constant battle for survival.

Analyzing the body of literature as a whole, no single piece attempts to look at the entire influence the advent of coal had on the United States. Furthermore, none of the pieces adequately describe the influence this development had on the landscape *and* the influence that development had on the American relationship with the environment. Each offers some valuable evidence to further this thesis, however none adequately captures it as a whole. Marx does realize the importance of the changes occurring in the late 19<sup>th</sup> century, but focuses more on the contradictions of the age, and not the change in American views on limits. That said, these authors and their respective work provide a loose guide for this thesis. They offer important primary documents, developments of size, speed, and distance, and ideas of progress to explore. Additionally they have influenced me to investigate both the actual development of coal-powered technology; especially the development of the railroad *and* to make an effort to connect that development with the changes in attitudes shown above. Thus, I will use chapter three to outline the development of coal-powered technology with a subsequent chapter discussing the impacts of that development on the American mind.

### Chapter 3

## Impacts of Coal Power on American Development

The goal of this chapter is to illustrate the developments brought about by coal in mid-19<sup>th</sup> century America. The energy within this hard black rock, lying in the geological bosom of the United States, had a profound impact on the development of the country between 1830 and 1860. In 1832, a report on American business, entitled the McLane Report, showed that nearly all industry relied on water for mechanical power (Chandler, 144). Over the next two decades however, industry in the United States began to adopt coal as its main source of power, a development that would fundamentally alter the American landscape and the views of its people.

By 1815, merchants and shippers in the United States had created a national market and shipping network, creating a healthy demand for goods throughout the Eastern Seaboard (Chandler, 149). This demand however, remained largely unmet for several decades, as production could not keep pace. The situation changed in dramatic fashion with the birth of large-scale factory production in the 1850's. This birth was fathered by the distribution of coal through new canal systems and eventually railroads created to transport the substance from rural mining operations to the industrial cities of the Northeast. Prior to the completion of the Pennsylvania railroad in 1853, Pittsburgh was the only industrial center in the United States that had coal reserves close enough to meet both domestic and industrial energy needs (Chandler, 145).

As Pittsburgh relied on its nearby bituminous coal reserves, anthracite coalfields in the other corner of Pennsylvania were beginning to attract attention. Development of large mines soon began in the area, coupled with infrastructure to support them. This meant the creation of canals, like the Pennsylvania Canal, which extended throughout the state by 1831, connecting

Pittsburgh and Philadelphia (Chandler, 152). Figure 3-1 shows the extent of canals (in blue) and railroads (in red) in Pennsylvania by 1832 (Atkinson, 1835).

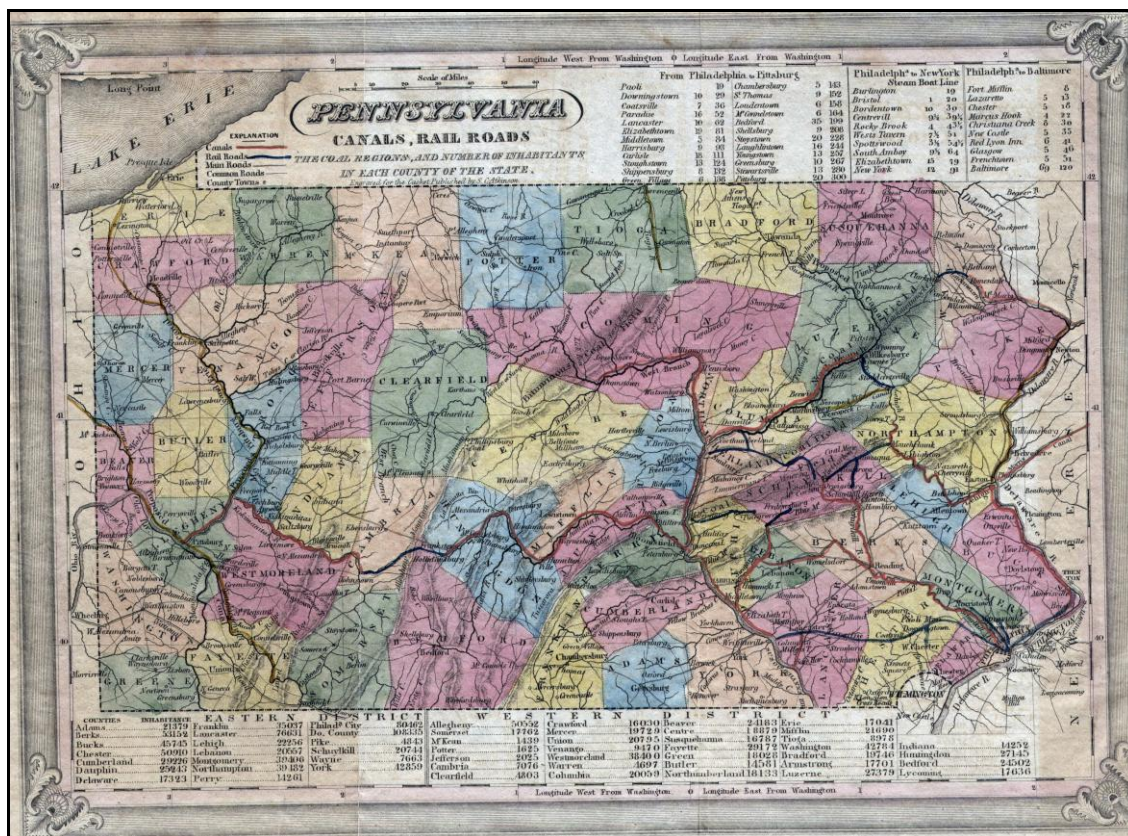


Figure 3-1 Map of Pennsylvania canals, coal regions, and county population in 1832.

One of the first canals, the Lehigh Valley canal, connected Mach Chunk to Easton, while initial sections of the Schuylkill connected Reading to Philadelphia. These improvements were necessary for the waterways to bear the large shipments of coal resulting from a skyrocketing demand for the new fuel. An example of this growth is the increase of anthracite coal shipments between 1820 and 1849, shown in table 3-1. Over this period, shipments swelled from 18,000 tons to nearly 3.2 million tons, meaning that over the span of twenty-four years, the coal production in the United States increased over one hundred and seventy fold (Chandler, 155). In

addition, table 1 also provides consumption rates, which verify the importance of anthracite coalfields. The share of anthracite in coal consumption jumped from 30% in 1826 to 87% in 1842 (Chandler, 154). In order for consumption to increase, canals and railways had to be built to carry coal all over the country. Figure 3-2, from page 215 of *The Development of American Agriculture*, shows the extent of the canal system in use by 1860.

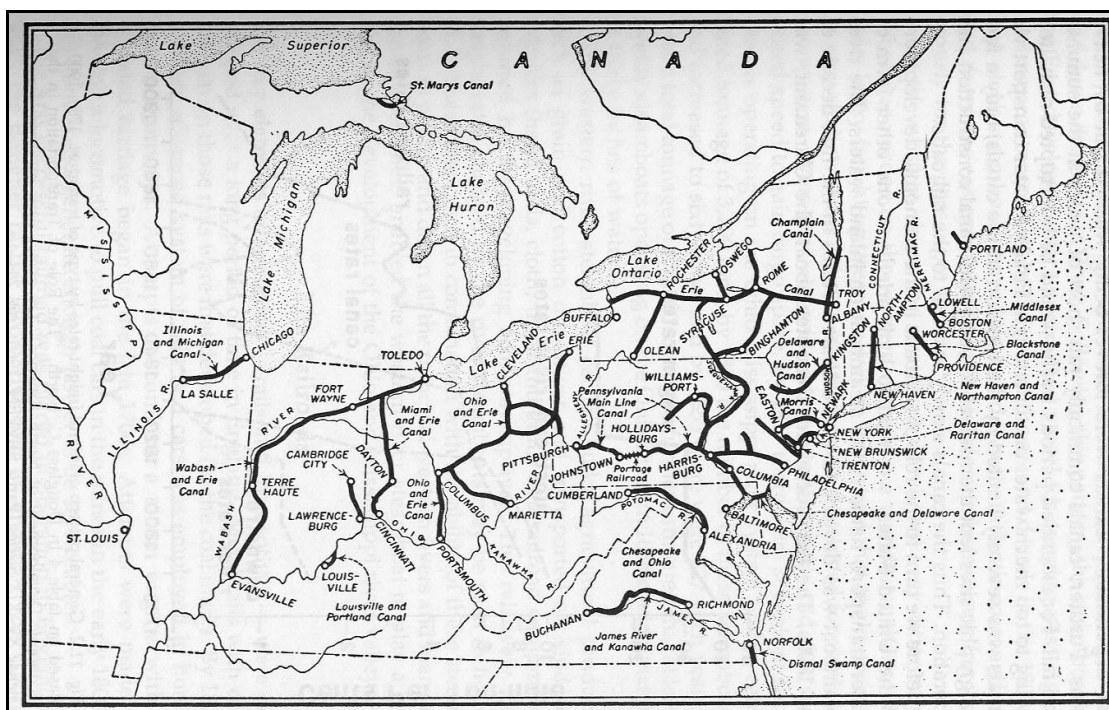


Figure 3-2 Map of the canal system in use by 1860 in the United States.

As a result, Americans were moving and consuming massive amounts of coal by the mid-19<sup>th</sup> century. Over less than a quarter decade, coal had become the major source of energy for transportation, heating, agriculture, and industry.

## Industry

Growing shipments of this newly harnessed power were crucial as they provided energy for the large factories of the East Coast and fuel for the industrial revolution. The industrial revolution did not grow exponentially in the United States at first, as it did in Europe. This was due to American industry's widespread reliance on water and wood power along with the use of leather belting in mechanized operations (Chandler, 144). It is important to remember that wood and water do not occur in limitless quantities. Wood, while abundant at first, was becoming increasingly scarce, especially around the urban industrial centers that required the most fuel. Steinberg points out that between 1839 and 1869 American demand for wood had skyrocketed from 1.6 billion to 12.8 billion board feet. By 1860, urban areas in the Northeast, nearly depleted of wood, imported it almost exclusively from the vast forests in Michigan, Wisconsin, and Minnesota (Steinberg, 64). Additionally, waterways could only provide so much energy, which would often fluctuate from variables such as the seasonality of weather and temperature or extensive use upstream. For example, blast furnace operations could only work in the spring because of heat extremes in the winter and summer, and low water levels in the fall (Steinberg, 58). Textile factories, like the one built by the Boston Associates in 1821, required an elaborate set of canals, locks, and dams to provide energy for manufacturing cotton cloth (Steinberg, 59). As more and more operations set up along a river, water power became an increasingly scarce commodity. Additionally, the power a river could supply was ultimately limited itself. Often companies would have to build huge dams, some over 30 feet high, in order to create the energy required to run large textile mills (Steinberg, 60). This reliance on increasingly limited resources changed rapidly however, as coal provided the cheap energy with which to run factories and refine iron ore for use to create metal gearing for greater efficiency. Increases in coal

consumption are evidenced by table 3-1, which depicts the increases in coal production and consumption between 1820 and 1849 (Chandler, 155).

Table 3-1 Coal production between 1820 and 1849.

Pennsylvania Anthracite Coal Production Between 1820 and 1849 (In Thousands of Tons of 2240 lbs.)					
Total				Increase or Decrease	
Year	Shipments to tide	Consumption and sales at mines	Total production	Amounts (in tons)	Per cent
Before					
1820	-	18.0	18.0	-	-
1821	0.4	1.6	2.0	-	-
1822	1.0	2.2	3.3	1.3	66.7
1823	2.2	2.7	4.9	1.7	50.9
1824	5.8	3.2	9.0	4.1	82.6
1825	9.5	4.1	13.6	4.6	51.2
1826	33.7	4.8	38.5	24.9	182.2
1827	48.1	6.7	54.8	16.3	42.4
1828	77.4	14.5	91.9	20.7	29.2
1829	110.4	22.8	133.2	41.3	44.9
1830	178.7	35.9	209.6	76.4	57.4
1831	176.8	53.5	230.3	20.7	9.9
1832	368.8	79.4	448.2	217.9	94.6
1833	485.4	106.8	592.2	144.0	32.1
1834	376.6	80.2	456.9	-135.4	-22.9
1835	560.8	117.8	678.5	221.7	48.5
1836	684.1	141.6	825.7	147.2	21.7
1837	862.4	176.8	1,039.2	213.5	25.9
1838	725.7	147.3	873.0	-166.2	-16.0
1839	797.9	159.6	957.4	84.4	9.7
1840	841.6	166.6	1,008.2	50.8	5.3
1841	942.3	184.5	1,127.0	7 118.8	11.8
1842	1,076.6	209.9	1,286.6	159.6	14.2
1843	1,240.7	238.2	1,478.9	192.3	14.9
1844	1,596.4	303.3	1,899.7	420.8	28.5
1845	1,975.1	369.3	2,344.4	444.7	23.4
1846	2,284.7	422.7	2,707.3	362.9	15.5

1847	2,814.9	512.3	3,327.2	619.8	22.9
1848	3,027.7	545.0	3,572.7	245.5	7.9
1849	3,164.7	560.1	3,724.8	152.1	4.3

Moreover, coal essentially changed the size, speed, and location of production. Prior to the power attained through burning coal, manufacturing operations were often located in the country because they needed to be close to sources of raw material (Chandler, 150). This changed quickly as operations could now ship materials over large land distances, relatively quickly, through new coal powered railroads. This allowed the movement of energy intensive industries, like glass, paper, or iron from the country into nearby cities, providing evidence of rapidly increasing distances between extraction and production. This movement assisted in creating the industrial cities of the Northeast United States, as urban centers became connected to the surrounding natural resources. Consequently, operations began to specialize, from coal and natural resource extraction to the transformation of those materials into goods. This was extremely important as it undermined intricate small-scale feedback systems associated with most industry before the introduction of coal power. For example, before the Northeast was connected by trains, the iron industry consisted of smaller units located fairly far from cities. This was necessary as iron furnaces were operated in close proximity to the natural resources they required; namely woodland for charcoal and pig iron in the ground (Chandler, 150). Thus, those that created the iron also had an intimate knowledge of the resource base they relied on and as such could perceive disturbances in that resource base. Furthermore, they also had an intimate knowledge of the limitations of the land. There was only so many trees growing near any given operation, and the acquisition of those trees for charcoal was highly dependent on the roughness

of terrain and distance from the operation. Operations did not simply relocate from the country into the city however, they also transformed in the speed and size of their output. A good example of this growth comes from the textile industry. As steam power permeated into textile manufacturing, it allowed factories to break away from the rivers on which they had previously relied. The water-powered factories simply could not compete with newer coal-powered factories that substantially increased production (Chandler, 142). Thus, Americans began to overcome environmental constraints with the power of coal, as industries broke away from the water and wood energy they once relied upon. This was extremely important because former sources of energy had clearly defined limits. Coal on the other hand was a new resource, which seemed to be in limitless supply, as beds of it were soon found throughout the United States.

The influence of coal on the industrial system in the United States had wide-ranging impacts on the development of the United States between 1830 and 1860. Over this time period it dramatically increased the rates, sizes, and distances involved in the production of many goods, from iron to textiles. This was largely due to the new steam engines, designed to harness the energy of coal, used either to run machinery or pull freight on railroads. This transition to coal power meant that industries no longer had to rely on wood or water for the energy to produce goods. Thus, the United States overcame what had been a looming environmental limit to the industrial growth of the young nation. While coal played a role in changing industry, it was also revolutionizing transportation.

### **Transportation**

Prior to the advent of coal use no form of motorized transportation existed in the United States (Rodrigue, 12). Thus, the major drivers of transportation were either animals, or



waterways that could be navigated using either winds or currents. Neither of these two methods of transit was speedy: horses averaged only 5-10 miles per hour and boats were not much faster (Rodrigue, 12). As a result, the size of loads (especially on land), the speed, and the overall distance they could travel was extremely limited. These factors made the transportation of goods very costly. In the United States during late 18<sup>th</sup> century it was as expensive to move a ton of product over 30 miles on land as it was to transport it across the Atlantic Ocean (Rodrigue, 13). Obviously, this created a significant barrier to trade, limiting trade largely to localities, with exportation over greater distances kept at a minimum.

Transportation changed rapidly, however, when coal began to provide the power necessary to transform what was possible. This transformation was important as it radically increased the size of freight, the speed at which it could be carried, and the distance it could travel on both land and water. The first infrastructural development that occurred in the United States was the creation of canals to ship freight inland and between places without existing waterways to connect them, such as the Erie Canal, built in 1825 (Rodrigue, 13). As previously mentioned, the growth of the industrial revolution grew spurred the development of canals, in order to meet the new demand for coal in industrial centers. Examples include the Lehigh Valley canal, which connected Mauch Chunk to Easton and sections of the Schuylkill River that connected Reading to Philadelphia (Chandler, 152). While the canals were the first major influence of coal on the development of American transportation, they were dwarfed in importance by the railways that were soon to follow.

Initially created in 1814 to distribute coal from mines, steam powered railways soon became the dominant form of transportation needed to haul raw materials, goods, and people (Rodrigue, 14). The difference in speed between old methods of travel like stagecoaches and the new railways was exponential. For example, a trip from New York City to Chicago, which took

3 weeks by stagecoach, was reduced to a mere 72 hours when traveled by train (Rodrigue, 14).

These dramatic increases in the speed of travel are exemplified in figure 3-2, which shows the amount of time it took to travel from New York City to the rest of the country in 1830 versus the time it took in 1857 (Cronon, 77).

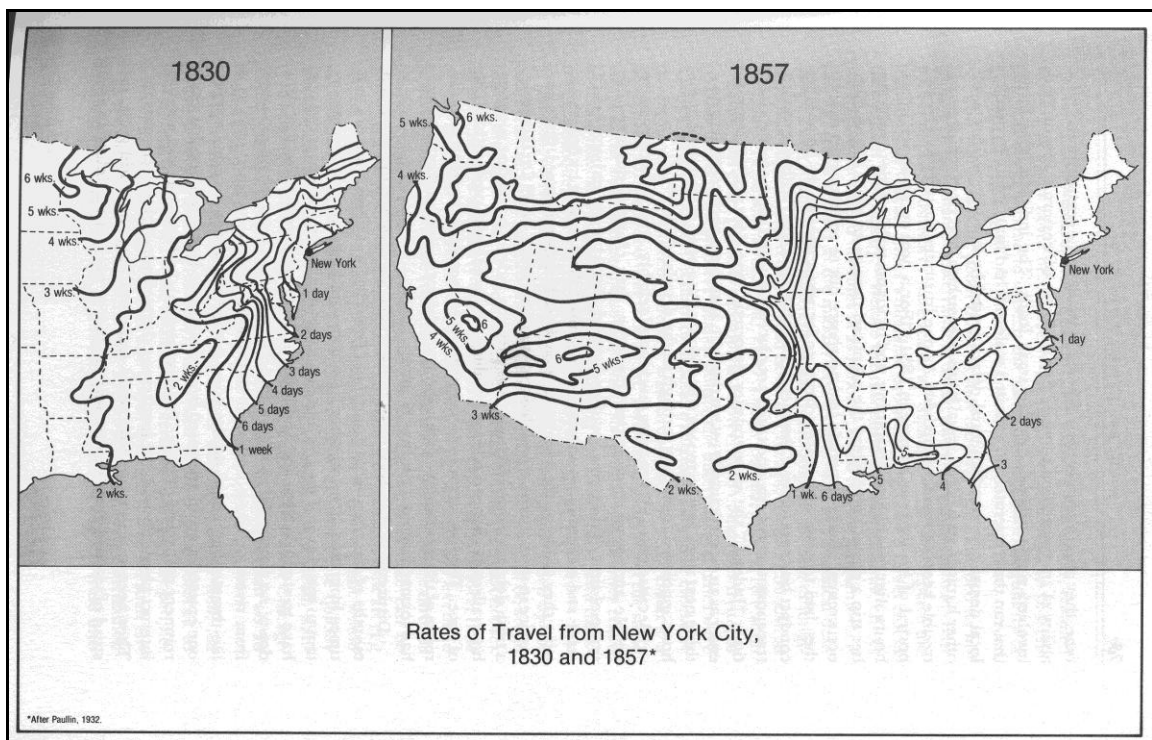


Figure 3-3 Rates of travel from New York City, 1830 to 1857.

These developments in speed, size, and distance had a pivotal role in shaping the development of America. They allowed for the increasing consolidation of industry in large cities, the economically viable shipment of goods across long distances, and expeditious travel for many citizens. Thus, the age-old limits of wood, water, and muscle power were surpassed in grandly rapid fashion. Evidence of this growth comes from comparing the miles of track laid in the middle of the century against the mileage towards the end of the century. In 1842 there were

only 4,026 miles of track, however this expanded to 93,262 miles in 1880 (Rickard, 16). These systems of rail allowed the fluid movement of materials and goods, assisting industry specialization and growth in production. This growth subsequently resulted in higher demand for raw materials, creating a positive feedback loop where railroads led to the extraction of materials for industry to occur further and further away from those who consumed the materials. This had major implications as it allowed a much higher degree of natural exploitation. Without rail systems Americans would not have been able to execute the massive extraction of natural resources that has occurred over the last century and a half. It was these systems that bridged gaps between paper operations and the timberlands, between iron works and their fuel buried in a coal seam hundreds of miles away. This revolutionary breakthrough in previous limits on speed, size, and distance was also leaving its mark on agriculture.

### **Agriculture**

Coal power had a large role to play in the development of agriculture from mostly small family oriented farms in the late 18<sup>th</sup> and early 19<sup>th</sup> centuries to the large mechanized operations that came later in the century. Its influence was twofold: coal-power provided new methods of transportation with the steam engine to open markets up to agricultural areas, giving incentives for farmers to produce a surplus, while the metalworking industry built upon coal produced the interchangeable, mechanized tools farmers needed for greater crop yields. While other coal-driven development altered the landscape, probably none had a greater impact than agriculture. Prior to the digging of canals or development of steam power, a nationalized market for agriculture did not exist (Cochrane 1993). The only methods for travel were along existing waterways, or over old Indian trails. This was important, because it maintained the integrity of

small local systems of trade and food production. People lived close to where they got their food, and often had an intimate knowledge about how it was produced.

This changed rapidly however, with the introduction of coal power through the steam engine. After 1820, steamboats began to operate regularly up and down the Eastern Seaboard, throughout the Great Lakes, and then eventually on the rivers in the western US (Cochrane, 195). Using this new power source it was possible to transport large loads of agricultural items such as cotton, grain, and even livestock on the Ohio and Mississippi rivers. The result was profound as farms beyond the Appalachians gained access to markets in the major cities of the East Coast in the following years (Cochrane, 195). As such, distances between consumers and markets grew with the railroad system.

While coal shipping was important to the building of canals, the new ability to move large objects on steam-powered ships led to state-funded canal construction projects, leaving a large impact on existing waterways that were expanded or on the land that was removed for new canals. Canal projects grew at a quick rate: only 100 miles of canals existed in 1815, by 1840 over 3,300 miles of canals had been excavated, and by 1860, as seen in figure 3-2, canals covered most of the Northeast (Cochrane 1993). A new system was soon usurping canals as the major method of transportation however, as coal powered development progressed into the middle of the century.

As railroad systems expanded from under 100 miles in 1830 to more than 30,000 miles in 1860, they became the chief method shipping agricultural freight (Cochrane 1993). As Cochrane points out, one of America's problems during the early 19<sup>th</sup> century was the great expanse of its own country, which limited growth to the regional level (pg 66). Rail provided a cheap and quick solution to this problem. Although rates were higher than found with steamship transportation, railways began to carry agricultural freight because they were faster and more reliable (Cochrane

1993). Also, and perhaps more importantly, these rail systems connected places that were nearly impossible to connect with waterways. Thus, farms between 1820 and 1860 gained access to markets in most of the Northeast, and much of the South along with portions of the Northwest, further expanding human control over larger distances. The most important connection was that between the agricultural surplus found in the Midwest and the large markets in growing cities along the East Coast, because it paved the way for specialization and growth in agricultural operations (Cochrane 1993).

While coal-powered transportation worked to expose agriculture, especially in the Midwest to larger national markets, it was not the only influence coal power had on the growth of the agricultural sector during the 19<sup>th</sup> century. As previously discussed, coal was integral in the creation of iron products. Additionally, it enabled the growth and specialization of metalworking industries, allowing for the creation of large factories making interchangeable parts. This new method of making metal products was very important for agriculture at the time because it improved farming equipment.

One such improvement was the created by the famous John Deere in 1837, when he developed a plow with a steel cutting edge (Cochrane, 190). Almost as important as this development, was the ability of Deere to produce the plows in large quantities. By 1857, the plant making these plows in Moline, Illinois, produced 10,000 plows per year, another indication of the increases in the productivity of industry (Cochrane, 190). This large-scale production provided farmers of the Midwest with an effective and cheap plow that could easily cut through the heavy sod frequently encountered in the region.

Along with more efficient plows, advances that coal provided in metalworking also produced a slew of other agricultural tools. An important one was the invention of a mechanical combine by Hussey and McCormick in the 1840's. The combine enabled farmers to harvest

twenty-five acres of wheat in a single day (Cochrane, 187). Cochrane makes a point to mention that these improvements all came at the same time, the principle being that an invention which improved one stage of farming such as plowing and planting, was not that great if there was no improvement in harvesting. This is where the importance of coal power becomes extremely tangible in development occurring during the mid 19<sup>th</sup> century. Without the drastic increases in speed, size, and distance coal enabled, farming improvements would have been slow and haphazard, leaving bottlenecks along the chain of production, and ultimately discouraging large mechanized agriculture.

Coal-driven industrial growth and the demand it created as populations moved into cities, was crucial for the development of agriculture because it pressured farms to specialize in the production of one or two products. For example, flourishing industry in New England and the Mid-Atlantic, created demand that forced farms in the region to focus on producing only a few different products. Farms no longer produced a variety of items; rather they merely concentrated on dairying, cheese and butter production, or market gardening (Cochrane, 190). Additionally, the expansion of agricultural markets to the west through railways forced many farms on the East Coast to specialization through competition. For example, the production of many livestock products or wool in the east gave way to more perishable products that could not survive the journey (Cochrane, 190). The result was the widespread specialization of farms in the east by 1860.

The coal-based growth of industrial demand, the expansion of railways in the United States, and the subsequent increase in agricultural production provide important insights into the development occurring at the time. This development, characterized by rapid increases in the speed, size, and distance of production, helped American industry to break through the environmental limits that initially slowed industrial growth. As such, these characteristics are

crucial to understanding how coal power had a profound influence on the development of the United States in the mid 19<sup>th</sup> century. Now it remains to analyze how the characteristics of this development may have influenced American feelings towards the environment.

## Chapter 4

### The Influence of Coal on American Views

Coal? Wyoming has enough to run the forges of Vulcan, weld every tie that binds, drive every wheel, change the North Pole into a tropical region, or smelt all hell!

-Fenimore Chatterton, Wyoming's secretary of state, 1902.

The age that is to witness a rail road between the Atlantic and Pacific, as a grand material type of the unity of nations, will also behold a social organization, productive of moral and spiritual results, whose sublime and beneficent character will eclipse even the glory of those colossal achievements, which send messengers of fire over the mountain tops, and connect ocean with ocean by iron and granite bands.

-Charles Caldwell, *New-England Magazine*, 1832.

The discovery and widespread adoption of coal as an energy source marked a significant change in American opinions that occurred during the mid 19<sup>th</sup> century, specifically between 1830 and 1860. As the previous chapter already discussed, this was an age of profoundly new industrial growth, spurred by the discovery and development of coal power. This newfound power left a remarkable legacy on the landscape of the United States with new styles of factories and networks of transportation systems. The most significant of these innovations was the railroad. This new invention changed how people and goods would move around the country. What made it so innovative were the marked gains in speeds, sizes of cargo, and distances covered. Continuing with the driving questions of this thesis, this chapter discusses the impacts this development had on the American people. While the railroad changed the landscape of America forever, I argue that these gains in speed, size, and distance also had an important impact on the people themselves. The development that accompanied coal has certainly left an



environmental legacy, but equally importantly, it also left a mental legacy. Americans, with a newfound power, began to ignore limits, change their relationship with the environment, and create a new idea of progress. In order to tease out what this mental legacy was exactly, I reviewed articles pertaining either to coal or railroad development, from popular periodicals in the mid 19<sup>th</sup> century. The documents range from the early 1830's to the late 1850's because it was during this time when coal power was beginning to proliferate throughout the country. The literary review for this thesis revealed that Leo Marx in *The Machine in the Garden* had, more than any other work, highlighted documents from the period that discussed coal power and what it meant for society. As such, I used his book as a guide to select the primary documents that I draw upon for this chapter. Additionally, the book had aimed to garner the attitudes of the public as a whole. Therefore, primary sources cited in *The Machine in the Garden* would also work well for the purposes of this chapter, as I wanted a snapshot of the public consciousness during the mid 19<sup>th</sup> century. While the sources do not provide an exhaustive overview of opinions from the period, I do believe they do a nice job of capture the popular American viewpoints from the time. After pouring through sources cited by Marx and reviewing them for relevance, I selected six articles, which including information from the literature review, serves as primary evidence for this chapter. While my search resulted in dozens of sources, these six provided the best evidence of the aforementioned changes occurring at the time. Each one specifically discusses coal and how it would improve or change society. Other articles were not selected because they failed to discuss the influence of coal on American society. Additionally these six articles contained impassioned arguments for coal power, providing powerful evidence of the influence this new development was having on Americans. Further evidence for this chapter comes from *Nature's Metropolis*, by William Cronon, as well as several excerpts from the *Machine and the Garden* by Leo Marx.

The articles for this chapter came from several prominent periodicals, representing attitudes towards coal power between 1830 and 1860. These included *Scientific American*, *The Merchants' Magazine and Commercial Review*, *Harbinger*, *Putnam's Monthly Magazine of American Literature, Science, and Art*, and *New-England Magazine*. *Scientific American*, *Harbinger*, and the *New-England Magazine* represent a public opinion viewpoint, while the other three represent views from within industry. As such, these publications provide an effective lens with which to explore how popular viewpoints may have shifted during the period in response to the new changes in speed, size, and distance that coal power created.

In an effort to organize information, the chapter is divided into three sections. The first section discusses evidence of the shift regarding limits. This shift is highlighted first because it has a strong influence on the other two viewpoints that shifted during this period. The third section reviews evidence of changes in attitudes towards progress, building off of new ideas of limits during the mid 19<sup>th</sup> century. Finally, the chapter will use the primary documents to evidence a changing relationship between Americans and their environment.

Before getting into the analysis, it is important to touch upon the ideas of the authors who have provided guidance for this chapter. First, *Nature's Metropolis* by Cronon, offers the idea that coal development allowed Americans to overcome environmental limits. Secondly, Marx points to the idea that the new abilities derived from coal power had an influence on how Americans viewed the environment. Additionally, he discusses that this new power under the control of humans lead to a different definition of progress. As a result, analysis of the articles used for the chapter incorporated these ideas to look for instances where articles reference exceeding limitations, differing views on the environment, and the influence of human-controlled power on the concept of progress.

## Limits

The new ability for humans to go beyond any previous limit, an ability garnered from coal power, was crucial to defining a new attitude within society. Unlike the previous ideas of progress, which consisted of taming wilderness, the new frontiers of power did not seem to have limits. Often authors would not even attempt to describe the utopia that progress would eventually lead to, as they did not possess the mind to imagine such a place. Additionally, this path of progress required a rejection of limits, because progress itself was based on unlimited growth, whether in speed, size, or distance.

Limited since antiquity by the availability of fuel sources (wood, water, and muscle), Americans were soon confronted with an energy source deposited with such abundance and availability that few knew what to do with it all. By the 1840's the great forests of the new world, that had once seemed so boundless, were now imparting a harsh reality on the United States. The *Merchants' Magazine* in 1841 exemplified this reality, on page 62.

Even in the United States, boundless as the forest seems, there is a deficiency of wood in certain portions of the country...and for many years the community has been anxiously seeking some substitute for the rapidly diminishing forest.

As society ran up against the limit of wood availability however, miraculously a new source of energy was discovered. Importantly, this new source of energy had two key characteristics that influenced American attitudes towards limits. The first was that coal was unbelievably abundant. After the first few explorations, people were beginning to literally find it right beneath their feet. Second, coal was easily accessible, allowing large amounts to be excavated with relatively little effort. Therefore, in the course of a decade, fuel went from being anxiously scarce, to overly abundant. Furthermore, the combination of the fact that coal deposits were beginning to be found everywhere and that it was hard to accurately assess just how much was under the ground, made

the natural resources of the country seem nearly limitless once again and led to gross overestimations of how much coal the US really had at its disposal. More evidence of this comes from the *Merchants' Magazine*:

[Coal] is found almost everywhere, and generally easy of access; often in mountains, and so situated that the mines can be drained without machinery into the natural water-courses of the country (pg 68).

...we may safely conclude that there is stored up, in that region [coalfields between Alleghany and Rocky Mountains], a greater mass of fuel, in the concentrated form of coal, than is to be found in all Europe; probably greater than is afforded in all other parts of the ancient world (pg 68).

The amount of bituminous coal consumed in the west, at Pittsburgh and other places, is great, but the source of supply is so near at hand, that it can scarcely be yet enumerated among the branches of internal trade (pg 69).

With coal of so excellent a quality, and so abundant in quantity, a new feature is developed in the character and resources of the United States (pg 70).

This set of quotes provides some important insight into the several crucial aspects of the new deposits of coal, which made it seem limitless to Americans. The first quote shows how coal had a ubiquitous quality; it was found seemingly everywhere. A second characteristic of coal, evidenced by the quote from page 70, is that it was generally of very high quality. As evidenced by Chandler, American coal, especially the anthracite found in Northeastern Pennsylvania, was often superior to coal imported from Europe. Third, the first and third quote illustrate that in addition to being of high quality and found everywhere, American coal was also very easy to extract. The fact that coal was so ubiquitous, of high quality, and easy to mine helped to craft the attitude expressed in the second quote, that the United States possessed a seemingly limitless quantity of coal, far greater than any previous civilization had ever known.

The second characteristic of coal was that the energy it provided led to unprecedented growth in human capabilities of speed, size, and distance. What was previously deemed as

fantasy was soon becoming reality before many American's eyes. Charles Caldwell describes some of this growth on page 294 of his article in the *New-England Magazine* from 1841.

Between these two towns [Liverpool and Manchester] as was recently stated, on a public occasion, passengers are conveyed, a hundred or more by a single engine, at the rate of thirty miles an hour; and they can be and have been conveyed with twice that fleetness...A single engine can travel, with nearly or quite a hundred tons, from fifteen to twenty miles an hour. Engines have done *this*, and *can do more*.

Caldwell nicely illustrates these advances in speed, size, and distance describing developments in railroad technology. The sizes of the loads he portrays, as well as the speed at which they moved were revolutionary for the time. Previously, people could only travel as fast as horses, roadways, currents, or wind would allow. Usually this meant a meandering pace of around five miles an hour. These unprecedented gains transportation soon captured the imagination of Americans as railroads began to spread throughout the country. Figure 4-1 shows this spread, as coal power fueled the growth of railroads in the United States (Thompson, 149).

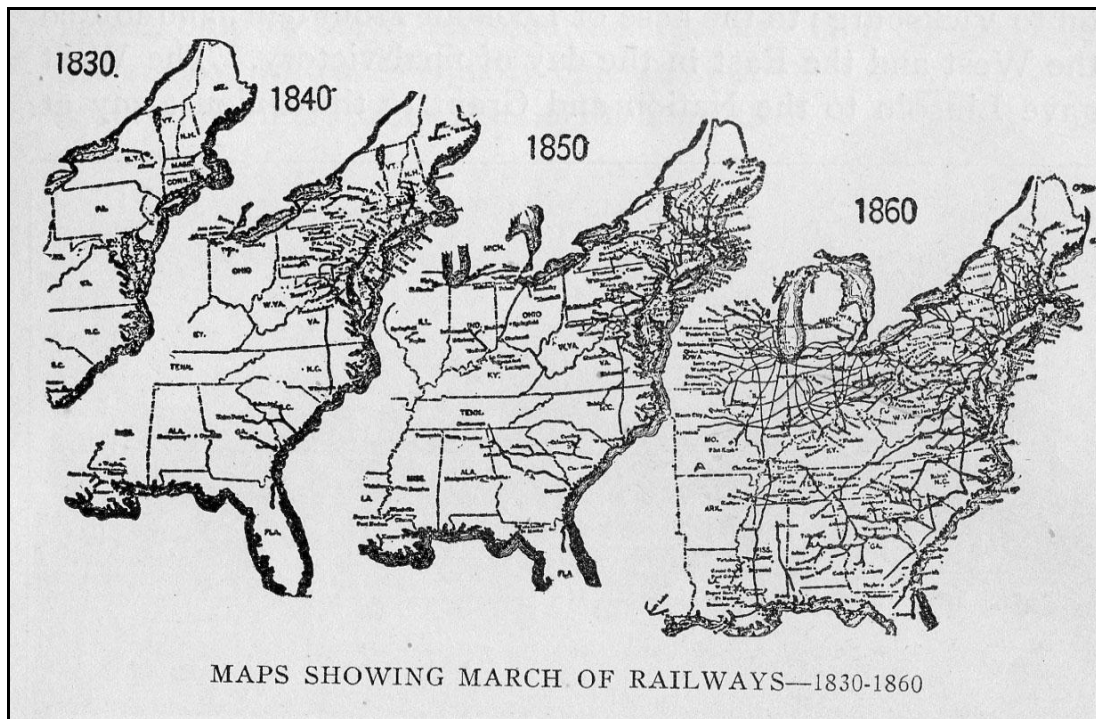


Figure 4-1 Map illustrating the spread of the railroad between 1830 and 1860.

Additionally, coal revolutionized marine transport, making distant lands increasingly accessible. For example, the idea that products could go from strange and exotic places like China, and within the same month arrive on their doorstep caused one to pause and, as one author writes, “think of *these* things!” (*Putnam’s “Statistics and Speculations Concerning the Pacific Railroad.”*, 275). In that thought, America perceived a future characterized by continued growth and improvement.

Further evidence of these changes, spurred by aspects of coal-powered development, are apparent throughout many of the selected articles from the period. This evidence comes from the supernatural attribution to coal power, clearly made distinctions between the current generation and past generations, and the expected influence of coal power on every aspect of society.

In reading through the material chronicling the rapid advancements of technology at the time, one is bombarded with hyperbolic language of incredulity. Towns were built in a day, railroads and canals crossed the landscape in every direction, and steamboats moved at the speed of lightning (*Putnam's* "Statistics and Speculations Concerning the Pacific Railroad," 271). As with the quote by Fenimore Chatterton opening the chapter, these descriptions might be viewed with humor today, but they provide crucial evidence of this new mind-set that there were no limits. Most often, advances were described with supernatural language, because they seemed as if uprooted from reality. Caldwell, once again provides a wonderful example of this hyperbolic tongue, on page 291 of his article in the *New-England Magazine*, in describing the new mobility coal power would afford to the military defense of the country:

With the expedition of magic, the whole embodied prowess and power, and all the military enginery of the nation, might be brought to bear on any single point to discomfit and destroy an approaching enemy.

Language like this bestowed a supernatural quality to these new advances and helped to evoke the idea of a limitless future, as humans now possessed and directed power never before known by any civilization. These descriptions were so far removed from the limited life of the past that Caldwell felt it necessary to qualify his use of language to assuage the doubt of his readers on page 292, "Extravagant and untrue to nature as I fear some may deem this picture of the future condition of our country, it is no fancy piece, thoughtlessly sketched in a moment of enthusiasm." Ironically, these descriptions *were* based on a moment of enthusiasm, the same enthusiasm which led Americans to believe they no longer lived in a world governed by limits.

This enthusiasm is also palpable in the predicted impact of coal power. Since coal afforded a future of limitless power, there was also no limit to its improvement of society. Caldwell shared this belief that coal power, largely through the railroads, would not only have a

positive influence on American society, but would even, “completely civilize the human race”. In addition to completely civilizing humanity, Caldwell wrote on how the railroad would improve social morality, the connection of intellectuals to the public, the regionalism of the country, education, and even the ‘elegance’ of society. As such he offers yet another example of how coal power changed society’s belief of what was now possible.

Perhaps the most important piece of evidence for this shift however, comes from a clear definition of a ‘new age’ for the United States. Many of the articles discuss both the advantages of this age and how it is different from the previous age. This old age was overwhelmingly characterized by limits of speed. The old age was, in fact so slow, that when the very idea of railroads was first raised to attention, effort was made to curb speed predictions so that the idea was not laughed into obscurity. Evidence of this comes from the article, “Rail-roads” on page 191 in the *Harbinger*, 1846.

When the idea of Rail-Roads was first suggested...the witnesses who appeared as the British House of Commons, were directed to make a very large deduction in their statements of the speed which it was calculated could be obtained, lest the whole project should be discarded with incredulity and contempt.

This quote shows just how profound these changes were, and how unbounded they were compared to ideas of the previous age. The periodical, on the same page, goes on to describe the old age, known to many historians as the age of wood and muscle.

Men had been so accustomed to lumber along the road with their crazy vehicles, that they could not get an idea of locomotion, without a prodigious waste of horse-flesh. Their fathers had always gone to “mill” and to “meeting” in this way, and surely none but an idiot could suppose that any change in their modes of conveyance would be an improvement...Five miles an hour was the most that they had ever travelled, and in all conscience, no good Christian could wish to go faster...and the swiftness of the wind is deemed a safer as well as a pleasanter rate of travelling, than the moderate jog-trot, in which our respectable grandmothers rejoiced.



This quote gives a wonderful picture of the two contrasting view points, one from the age of wood and muscle, and the other from this new age of coal power. Initially, the new speeds, afforded by coal power, were seen as ridiculous, showing how the older age had a clearly defined sense of limitations suffered by travelers since antiquity. However, as the excerpt progresses the tone soon changes to view the limitations of the old age with incredulity. It even begins to mock the older age, illustrating that their grandparents lived in such a backwards time that they “rejoiced in a moderate jog-trot”. This distinction shows how the public attitude towards limits soon changed from acceptance to outright denial.

Those fortunate enough to live in the new age, in contrast, did not suffer from any of the limits experienced by their ancestors. Their age was new and bright, filled with boundless opportunities, improvements, and progress. This was reinforced by the commonly held belief that more happiness and improvement had occurred since the advent of the age of coal than in the three previous centuries combined. Charles Caldwell, yet again, provides crucial evidence of this belief on page 300 of the *New-England Magazine*.

...something more than the dawn of a new era presents itself to us...It is when we contemplate the present rapidity of that progress, and the certainty that it cannot fail to be daily increased, by the constant accession of fresh causes and stronger powers, giving additional impetus to it...effulgence of the prospect dazzles, while its grandeur overwhelms us.

This quote, perhaps more than any other, exemplifies both the indoctrination of world without limits and the forces at work which caused this indoctrination. It was this rapid progression, largely in the speed, size, and distance of transportation that overwhelmed the nation with an undying optimism that limitless growth was to define this new sparkling age, and that the United States was going to lead the world in this type of growth.

Overall, the shifts in American attitudes regarding limits were largely driven by the ubiquitous nature of coal fields and the new growth afforded by coal driven steam power. This shift is evidenced by the hyperbolic descriptions of new technologies, the believed influence of coal throughout society, and the clear distinction between two ages, both of which were either defined by limits, or a lack of limits. Interestingly, the juxtaposition of these findings with the those of Nash, present a paradox inherent in the age. As the United States was beginning to value wilderness as a means to instill wisdom and virility into the populace, it was at the same time beginning to value a way of life that was at odds with wilderness. This paradox led to the battle between two sides of environmental management that surfaced in the late 19<sup>th</sup> century. The one side, conservationism was represented by John Muir and championed the unflinching protection of natural spaces. The opposing view point, utilitarianism, championed by Gifford Pinchot, was driven from this new mentality that required the use of natural resources to fulfill its unlimited growth model (Nash, pg 170). These two sides of environmental management had their largest showdown over the Hetch-Hetchy damn in Yosemite National Park, and continue to materialize in environmental management today.

### **Human-Environment Relationship**

The rapid increases in speed, size, and distance had profound impacts on how Americans viewed their relationship with nature. Prior to the advent of coal-powered transportation, people had no choice but to respect the barriers nature placed on mobility. Examples of these natural restraints included the seasonality of weather, large waterways, and mountain ranges. Despite these barriers, Americans had always believed in their superiority over nature. Nash, in *Wilderness and the American Mind*, discusses how this superiority stemmed largely from the

socially created dichotomy of civilization and wilderness (Nash, xi). He illustrates this using the frontier ethic, where wilderness was converted to civilized homesteads. Americans believed they were the superior species on the planet, and as such, nature could be tamed to fulfill human purpose. Despite this widespread belief, human activity was still constantly kept in check by nature. These checks were most constraining in the transportation sector.

Coal power and steam began to eliminate physical barriers as the railroads provided an exponentially more effective means of travel than was previously possible. In nearly a decade the once imposing mountains, rivers, and oceans were soon made crossable, and at drastically faster speeds. Figure 4-1 shows an example of how river barriers were now conquered by the development of railroads, as a railroad bridge crosses the Susquehanna River in Pennsylvania (Thompson, 153).



Figure 4-2 Train crossing the Susquehanna River.

The freezing of waterways no longer impeded travel in the winter months, as the bulk of transportation shifted to railways that crisscrossed the country. This revolution in transportation led to an important new attitude, that humanity now wielded a new power greater than the natural

forces that had restricted people for millennia. Evidence of this attitude comes from pg 298 of Charles Caldwell's observations in the *New-England Magazine*, in 1832.

Nor in speaking of the magnificence of a system of Rail-roads, in full operation, do I allude merely to the external or visible sublimity which it exhibits...The immense power, which it manifests, and which is developed, controlled, and directed by human means, excites, in those who see and contemplate it, an exalted idea of the dignity of their race. It awakens in them, therefore, higher respect for themselves, as a portion of that race.

In this quote, he is clearly arguing that humans are in control of their natural environment. Furthermore, he seems to believe that this control has a certain impact on the controller. He states that people who witness and think about this control will soon realize just how superior and dignified the human race is in comparison with the natural world.

While one movement was finding sublimity in the grandeur of nature, another was attributing the same qualities to the grandeur of this new human-wielded power. In this new point of view, man-made structures, such as railroads which were stretching across the entire expanse of the continent, held the same socially benefiting qualities of wilderness. Caldwell gives further support of this movement, on page 293 of the *New-England Magazine*.

Objects of exalted power and grandeur elevate the mind that seriously dwells on them, and impart to it greater compass and strength. Alpine scenery and an embattled ocean deepen contemplation, and give their own sublimity to the conceptions of beholders. The same will be true of our system of Rail-roads. Its vastness and magnificence will prove communicable, and add to the standard of the intellect of our country...

In this excerpt, Caldwell acknowledges the wilderness that Nash discusses. He explicitly states how grand landscapes of wilderness, whether alpine or marine, elicit strength and bequeath sublimity on those who view and contemplate them. However, he also points out the other movement which held that new human-based sources of power would impart similar qualities of sublimity and magnificence on the American public.

Moreover, this human-controlled power was in certain ways better than these natural sources of wisdom and strength. He goes on to discuss how this power was somehow intrinsically different from any sources of wisdom and strength, natural or human, than had ever been seen before. Importantly, this new power would produce effects far greater than any ever before bestowed by nature.

Art has never yet prepared, earth beheld, or imagination conceived, a picture so striking. It is all in action, under a power that is stupendous, and its grandeur and magnificence are overwhelming to the mind. The rush of the waters of Niagara is sublime. But it is not comparable to the panorama I would delineate, had I powers adequate to it...uncomputed millions of wealth...surpassing grace and majesty of movement, and the fleetness of the antelope, at the top of its speed. Nor can a state of things so splendid and impressive, fail to be productive of corresponding effects.

Striking in this quotation is how this new power was radically different and superior to any ever before encountered in nature. It was not even comparable to Niagara Falls, which at the time was admired by the entire Western world, because it seemed limitless. These comparisons made by Caldwell in the early 1830's give substantial evidence to the new attitude coal power incurred in many Americans towards the physical environment, however he was not alone in this sentiment.

Other articles also illustrated how this new power was inspiring and transcendent. It was clear that people no longer felt bounded by the physical barriers that had once impeded travel and trade. The article out of page 69 of the *Merchants' Magazine*, in 1841 reinforces this idea.

The ocean is no more faithless and uncertain. It has been bridged by steam, and the force of the waves and the power of the storm, terrible as they have been throughout time to those who go down in ships to the great deep, are shorn of their terrors and deprived of their destroying energy, by the power created by [coal].

It was a widespread belief that the new power afforded to America by coal was even greater than the strength of the unruly Atlantic or a powerful storm. Thus, something of the sublime was seen in this new type of energy, which was used to the financial benefit of a young America.

Additionally, new conveniences gained by breaking through these barriers, such as year round trade and expedient travel, led to what I have dubbed the *power ethic* which quickly replaced the frontier ethic that had defined the country since its infancy. This power ethic represented a new mindset of progress which drastically altered the way Americans interacted with their physical environment. Instead of the past, where industry largely worked *with* nature (out of necessity), evidenced by the use of existing waterways for trade, trade was now based on working *against* natural systems. This trend is evidenced by another excerpt from page 69 of the *Merchants' Magazine*:

[Coal] appears on the water; sails are furled, the boatman reposes on his oars, and the rivers and lakes are made to convey passengers and their goods with certainty and speed. The current of the Mississippi is no longer an obstacle to the ascending trade of that fertile valley.

As discussed in the literature review, prior to coal most travel flowed down rivers, begrudgingly working with natural systems. However, with a new power at their disposal, Americans went to work maximizing convenience and speed by working against natural systems.

This rapid change in the American relationship with the physical environment meant that the nation controlled its own destiny, not just in relation to the rest of the world, but also in relation to the environmental systems, which had governed life since the dawn of history. These changing attitudes helped pave the way for a new mindset regarding the progress of the nation.

## Progress

The replacement of the western frontier with new frontiers of coal power brought about a distinct change in what Americans viewed as progress. Additionally, it changed the steps viewed as necessary to achieve that progress. Prior to the proliferation of coal power in the middle of the century, progress in the young republic was characterized by conquering wilderness through the establishment of pasture, agricultural fields, and towns. Through these encounters, Americans believed they were taming and civilizing the land, and through it, themselves. After coal power began to change American life however, ideas of progress changed drastically from creating homesteads to increasing speeds, sizes, and distances. The way these frontiers rapidly changed the lives of nearly every American, served as the impetus for a shift in what was deemed progress. First, the timing of coal development played a role in effecting this shift. It seemed like divine intervention to many people that the nation would find a brand new source of energy, known to few people at the time, when the old source of energy (wood) was quickly disappearing. Additionally, the energy that replaced wood was markedly superior. Coal provided a much more efficient and dense source of energy. Due to these circumstances, many Americans held the sentiment that the discovery of coal was a result of divine intervention. This belief, combined with the superior aspects of coal as a fuel, helped to convince the nation that coal was the new vehicle of progress. The sentiment is reflected in several of the articles from the periodicals listed above, the most powerful coming out of the *Merchants' Magazine* and Commercial review, in 1841 on page 71.

...the distant parts of the Union really made one country by bringing them within a few days' travel; the arts and sciences of the old world transported to the new; our machinery increased and perfected until its power is equivalent to that of England; and the country rich and prosperous, and under the guidance of patriotism and intelligence, moving onward in that career of glory and greatness which is marked out as it were by the finger of divine Providence.

Moreover, this finger was meant to be followed. The advent of coal power frontiers soon became a roadmap to improving both industry and society. As the same article champions, "...we have ill read the signs of the times if [coal] is not destined to exert a mighty force upon the fortunes of the United States." The exploration and development of these new frontiers were quickly becoming a means of improvement, and even a component of nationalism and identity. In *Wilderness and the American Mind*, Nash posits that frontier life was an important part of American identity. He goes on to discuss the crisis presented to this identity when the frontier closed in 1890. I would agree with Nash that this crisis did lead to a new appreciation of wilderness. However, I would also add that the resolution of this crisis was due in part to the advent of these new frontiers of power, as they served to spread luxuries of the age to a much wider swath of the population. For example, books, which were usually a privilege of the wealthy, were able to reach much wider audiences. Coal increased the output of printing industry and through that, bestowed a luxury to the masses ("Thoughts", pg 292).

Second, increases in size also provided people with tangible examples of progress. An example of this is simply the increasing scale of innovations. Evidence of this increase is shown in figures 4-3 and 4-4, which show the growth of the locomotive (Thompson, 60 and 151).



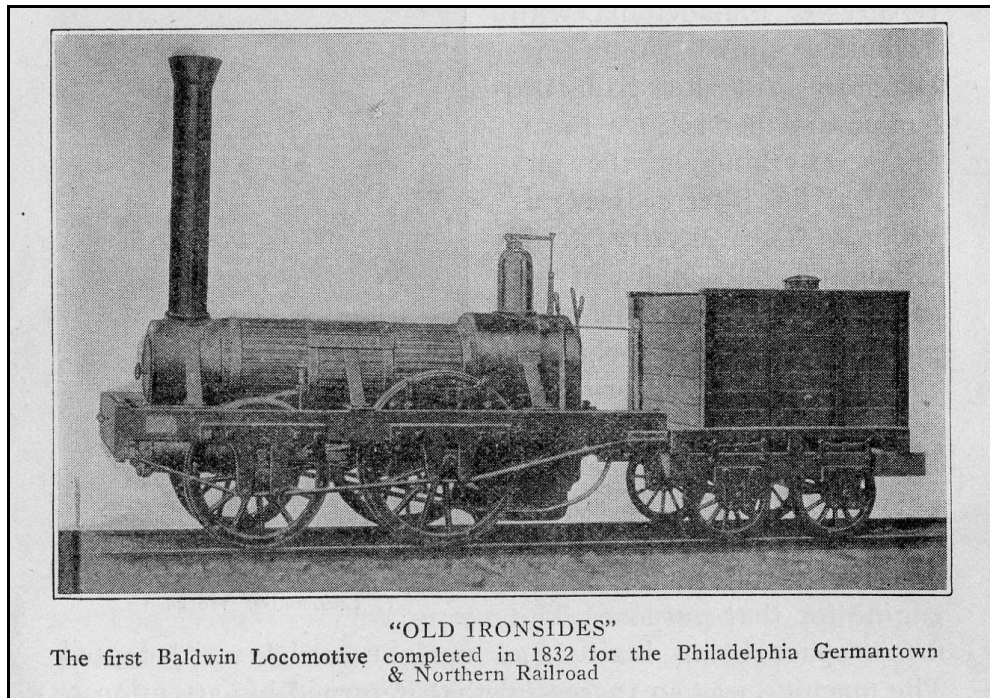


Figure 4-3 Baldwin locomotive of 1832.

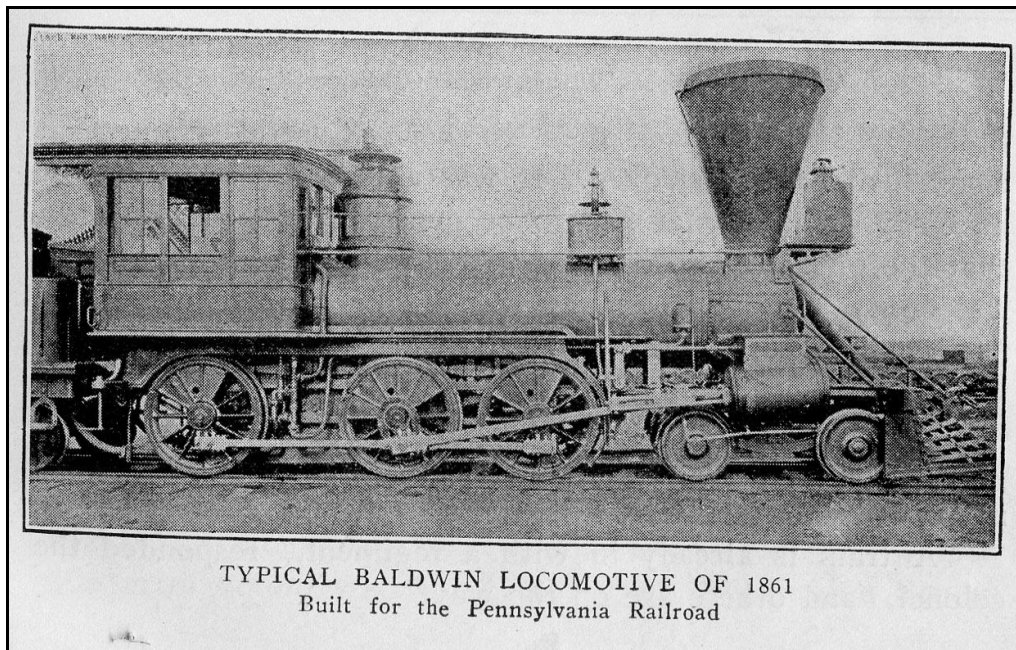


Figure 4-4 Baldwin locomotive of 1861.

These increases resulted in obvious improvements in both industry and personal life. Chapter 2 already discussed the benefits these improvements had on industry, a fact not lost on those living during this time, as *The Merchants' Magazine* illustrates on page 62,

...without this important agent [coal], most of the mechanical arts would be useless; that steam could not be generated; that tin, lead, copper, and iron—and, indeed, nearly all the metals--would be unknown, we cannot but acknowledge that to this ethereal element civilized society is indebted for the greatest portion of its superiority over savage life.

Nearly every innovation, whether it is in industry, or travel, was almost exclusively due to this new source of energy. This powerful connection between coal and innovation served as reinforcement of progress defined through increases of speed, size, and distance.

Because of its influence over a wide variety of innovations, the benefits of coal power were projected to permeate nearly every facet of society. Many of the articles claimed the development of coal power would not only continue to improve industry, but it would improve communication, unify the rural with the urban, erase regionalism, and distribute more wealth. Beyond those, coal power would improve public morality, intellect, manners, education, public taste, and promote happiness and prosperity. *The Merchants' Magazine* illustrates this attitude:

The internal improvement of the country, the providing of means of bringing its produce to market, and of intercommunication between different portions of the Union, the advancement of the manufacturing arts, the development of its resources, all depend upon [coal]; and if we would promote the permanent improvement of our species, no better mode can be devised than to encourage, by all proper means, the working of our coal and iron mines (pg 71).

This viewpoint is also shared by Charles Caldwell in the *New-England Magazine* in 1832, on page 298. Referring to the new abilities of the railroad, he assures, "...it cannot fail to be favorable in its influence, on public taste, refinement, and morality." What is important to highlight about these quotes is how broadly coal is applied to progress. *The Merchants' Magazine*

boldly claimed that the development of coalmines would promote the *permanent improvement of the human species*. That is an extraordinary claim to make and yet it illustrates an important quality of coal power as it relates to the American idea of progress. The initial impact it had on society, especially in saving labor, led Americans to believe that the development of coal power could only have a positive impact on society. This attitude helps to explain why increases of speed, size, and distance have become synonymous with progress in the United States.

The third piece of evidence, is the shifting attitudes towards the previous generation expressed in many of the articles. This expression usually materialized in distinctions between the two generations, one from an old age and the other living in the dawn of a new age. Driving this was the nature of both coal power and the innovations it brought. Both were profoundly different from anything western history had ever known. Additionally, innovation was occurring in leaps and bounds at the time when these articles were written. Excerpts from page 271 of *Putnam's* in 1853 help to illustrate just how profound this new age was thought to be.

And the Iron Horse...which outruns the laggard winds...he too shall build an empire and an epic. Shall not cities be formed from his vaporous breath, and men spring up from the cinders of his furnace? Shall he not run from ocean to ocean, an iron Mercury, the swift herald of the State, beautiful but bearing terror, swallowing the ground with fierceness and rage? Today's pigmy may be tomorrow's giant.

One important aspect of this excerpt is the language with which it is written. The future America, which was surely just around the next bend in the train track, would be an empire of epic proportions. Additionally, cities would not be built, but rather formed from “vaporous breath” as men appear from the furnace of a locomotive. Most important, is the superlative nature of these predictions. Not only would the United States progress over the next few years, it would also birth a radically new age. The hyperbolic and positive nature of this new age also had

implications. These visions were so alluring, that they tempted Americans to pursue them no matter what was at stake. In the same article, the author illustrates this attitude in stating:

Thus the project of communication by rail between the two oceans, which not many years ago floated before our imaginations...The desire has given way in the mind of the country to a determination to have our long rail at all events, and at any cost.

Thus, Americans were looking at a new age, where progress was based upon increases of speed, size, and power.

These three pieces of evidence help to show how American ideas of progress changed from improving wilderness into agricultural land to the development of industry and railroads to further increase the ability of the country to travel at ever greater speeds, with larger loads, over longer distances. Additionally, they give insight into the nature of this new type of progress. It was assumed to have exclusively positive impacts on American society, and as a result was pursued aggressively, no matter what the consequences of that pursuit may be. What was once a superiority only held in the human mind, was soon materializing in the subjugation of wilderness through the power of coal.

In conclusion, the thirty years between 1830 and 1860 experienced the first great energy revolution the world had ever seen. This energy revolution, made possible by coal, had a strong influence on the public in the United States. Through rapid increases in the human capabilities of speed, size, and distance, Americans experienced a shift in attitudes toward limits, their relationship with the environment, and progress. These often mutually dependent attitudes, fundamentally changed how Americans interacted with the physical systems they relied upon.

## Chapter 5

### Findings and Conclusions

In summary, this thesis produced several findings that combine to offer an answer to the two central questions posed in the introduction. In reviewing the literature, it found that most authors who have written about the period of American environmental history between 1830 and 1860 have discussed the growth of railroads, changes in limitations on life, and some changes in attitudes. Additionally, the literature illustrates that life in America before coal development was difficult and arduous because of rough terrain and dense forests, which limited travel to certain corridors, hindered agricultural production, and inhibited the growth of cities. While the literature does discuss some of the changes that occurred during the period, it largely does not discuss the subsequent changes in American thought towards limits, the environment, or progress.

The advances coal brought to American life resulted in a much different country than had existed prior to the 19<sup>th</sup> century. Coal brought about the development of the canal and railroad systems. These systems revolutionized transportation, making it fast, safe, reliable, and capable of covering the vast territories of the United States. It also broke industry free from the constraints of seasonal fluctuations in temperature and precipitation and the limited supply of wood from dwindling forests. This meant many industries could run year round and resulted in the growth of large-scale urban factories, as manufacturing could now occur far away from the extraction of natural resources. The increase of production that came from large-scale urban factories allowed many luxuries to become universal throughout American society, seemingly making life better for everyone. Additionally, coal revolutionized agriculture through railroads and large factories. Railroads connected rural agricultural areas with large markets in urban centers like Chicago, New York, and Philadelphia. This gave farms motivation to shift from

subsistence to production agriculture. To help this process, factories began to pump out a variety of machinery that allowed farmers to overcome the scarcity of labor, which characterized agriculture during the mid-19<sup>th</sup> century.

These revolutionary changes in transportation, industry, and agriculture in turn influenced how Americans thought about limits, the environment, and progress. As evidenced by primary documents in Chapter 4, these developments had an impact on American views in a variety of ways. First, they changed how Americans viewed limits, as age-old environmental obstacles seemed to fall to the wayside as coal powered development progressed. The new ability to overcome weather, distance, and physical obstacles gave the impression that a new age had dawned where anything was possible. This led to the attitude that environmental limits were a thing of the past and America was now in a new future where growth could be unlimited.

Second, this newfound power influenced how Americans perceived their relationship with nature. It was now widely believed that humans were not only mentally superior to nature, but now society was physically superior to nature. The United States wielded a power greater than the fury of oceans, current of rivers, or the wrath of storms. This power was so great that it was deemed sublime and transcendent, similar to the majestic landscapes, which made America famous throughout Europe. Additionally, this new power brought about the power ethic, which changed how Americans interacted with natural systems. Instead of working with natural systems, as they had prior to coal power, most effort was now put into working against these systems.

Finally, improvements in size, speed, and distance that coal delivered changed the way Americans viewed progress. Before coal, progress was seen as the improvement of land from unruly wilderness to an agrarian ideal. Afterwards, progress was measured by improvements in size, speed, and distance that things could be produced and travel. The advent of coal power was

deemed a divine intervention, giving it legitimacy as the new path towards progress. This resulted in an ideal of progress based wholly upon unlimited growth.

Thus, this thesis proves that coal had an integral role in shaping the development of the United States during the mid-19<sup>th</sup> century. Moreover, this development resulted in the shifting of attitudes and ideals central to American society. This is crucial because it adds to existing literature on American environmental history. Previously, no work has focused directly on the impact the physical changes incurred by coal power had on American views towards the environment. As a result, it builds upon existing work to provide a more complete understanding of a period that drastically altered the course of American history.

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**Research  
Experience**

REU Program, The Academy of Natural Sciences, Philadelphia, PA.  
June 1<sup>st</sup>- August 10<sup>th</sup>, 2008

A summer research fellowship, funded by the National Science Foundation, where I conducted my own scientific research project. The goal was to discover if and how climate change is affecting temperate lakes in the United States. Working 35 hours a week I compiled data from the EPA, tested the data with statistical programs, and developed a presentation of my findings that was given at a symposium at the Academy.

Cooperative Wetlands Center, University Park, PA.  
January 2008- May 2008.

In a research assistant role, I helped to sort samples in a USDA BMP research project. The goal being to ascertain the effectiveness of riparian borders in the Spring Creek watershed. I worked independently for 10-15 hours per week between classes sorting macro-invertebrates from stream samples.

Cooperative Wetlands Center, University Park, PA.  
January 2009-May 2009.

Assisting a PhD candidate with a project focused on how human disturbance affects microbial habitat source-sink dynamics in wetlands. My responsibilities are to independently weigh soil samples, and conduct pH analysis. I also assisted in the drilling of wetland water sampling wells.

**Education  
Experience**

Shaver's Creek Outdoor School  
Spring 2007-Spring 2010.

As a Learning Group Leader at Penn State's Outdoor School program, I taught fifth graders earth system science and natural history. My

responsibilities included the management of four college age counselors who assisted me with the children, creating lesson plans for teaching concepts, and organizing games and activities.

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