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Agricultural Policy Reform: An Argument for a Soil Erosion Tax

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Agricultural Policy Reform: An Argument for a Soil Erosion Tax

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Introduction: Agricultural Policy in a Complex World

There seems to be general discontent with US agricultural policy. Fiscal conservatives want to eliminate farm bill spending, which is in their eyes, the epitome of wasteful big government.[1] Environmentalists want to end a government policy that shovels billions of dollars into subsidies, which supposedly encourage farmers to plant fencerow to fencerow while ignoring the destructive ecological footprint of modern agriculture.[2]

Fiscal conservatives who want to eliminate farm bill spending entirely are applying free market theory without appreciation for the historical context of modern farm support. Reducing farm bill spending has long been a goal for policy makers, but the farm support system is fragile and its removal has proved complicated. If nothing else, the relatively recent failed attempt to phase out farm support payments in 1996 should serve a reminder that eliminating or phasing out farm bill spending could devastate rural America and drag the whole of the nation's economy down with it.[3] Though many policy makers would like to see farm bill spending decrease, it is undoubtedly tricky to deflate any multibillion-dollar bubble in the economy without destroying a lot of people's livelihood. Yet some libertarians and fiscal conservatives insist that US agricultural policy is an unjustified violation of the free-market. From the onset of classical economic theory in the 19th century, Adam Smith and David Ricardo, critics of their time, encourage us to respect the freedom of markets so as to promote specialization and the subsequent economic growth. From their historical context of the Mercantilist era, they were wise to suggest the removal of state policies that were corrosive to the economy; tariffs and other forms of what was virtually legal economic warfare amongst the rival nation

[1] Dan Morgan, "The Farm Bill and Beyond," Economic Policy Paper Series (2010), German Marshall Fund of the United States, 15.
[2] Craig Cox, Andrew Hug, Nils Bruzelius, *Losing Ground*, Environmental Working Group (Washington: 2011), 29.
[3] Daryll Ray, *1996 Farm Bill: A Pattern for Future Legislation or Failed Experiment,* Agricultural Policy Analysis Center (2001) University of Tennessee.

states of Europe.[4] But just because the removal of mercantilist government economic policies was preferable during the time of Smith and Ricardo, it does not logically follow that governments ought to always keep out of economic affairs. A faith in the invisible hand is equivalent to the Naturalistic Fallacy; just because there are natural tendencies for things to happen (like Hurricane Katrina, for example, or the boom and bust of speculative agriculture that led to the dust bowl), it doesn't not follow that these are good things. Smith advocated for free trade because it was in the interests of the public and general welfare from his historical context. If some government policy would change market conditions in the interest of the people (many do), Smith, given his reasons for advocating for free trade, should then agree that the state ought to intervene in the market for this instance. Free-market economics does not mean zero government involvement; it means setting the optimal conditions of free competition. Occasionally this has meant the breaking of trusts and monopolies that were corrosive to free competition and public welfare. Ultimately there's no such thing, literally, as a totally free market, devoid of government involvement – other than anarchy – because every society puts forth the conditions under which markets operate. And so the ultimate question of political economics is, what conditions ought we set for our markets? The question is not should the government intervene in markets?, but in what ways should the government do so. The goal of this essay is to determine the conditions the US federal government should set for agricultural markets, and it takes for granted the justification for having an economic agricultural policy of some kind.

Some environmentalists are appalled by the spending on subsidies and the lack of conservation measures present in US agricultural policy. They would have policy makers step up conservation compliance measures and finally beat back agribusiness in the fight for conservation.[5] I argue that these kinds of environmentalists are unpragmatic in thinking that the best course of action is to construct new public policies that will overcome the interests of farmers and

[4] Laura LaHaye, "Mercantilism," *The Concise Encyclopedia of Economics*.
[5] Cox et al., *Losing Ground, 29.*

agribusiness, the interest groups who effectively write the farm bill. But more importantly, such environmentalists should pick and choose their battles. Farmers and agribusinesses are indeed concerned with conservation and sustainability; after all, the longevity of their industry depends on it. The problem is that market forces push farmers, like any supplier in any market, into remaining financially competitive. Short run market forces determine farming practices. Long run ecological and economic costs, like soil erosion, are discounted over time, meaning that only a fraction of the real ecological costs of farming practices is considered in farmers' present decision making. For this reason, US agricultural policy must internalize the externalities of farming, so that price effective farming coincides with sustainability. The most straightforward way to achieve this goal is to tax farmers the additional social cost of their farming practices.

In order to argue with any good sense about agricultural policy one must understand the history of agricultural policy and also the state of modern agriculture. And the closer one looks at the present state of agriculture, the more the global agricultural economy appears a complex and problematic system. The Earth has 13.5 billion hectares of land and approximately 7.1 billion mouths to feed. Despite the fact that we produce enough food to feed the world, 854 million people suffer from malnourishment due to disproportionate distribution (and even if it were distributed, simply in the sense of made available for purchase, those who are malnourished would still lack the purchasing power for sufficient food).[6] The global population is still growing, so that we expect another 2 or 3 billion mouths to feed by 2050, with the greatest growth rates in nations with lower incomes and purchasing power and higher levels of soil degradation.[7] This increased population will mean increased demand for agricultural commodities, but beyond simple population growth, the demand for agricultural commodities will greatly increase due to rising incomes in developing nations, bringing families out of poverty into the

[6] Pedro A Sanchez and M. S. Swaminathan, "Cutting World Hunger in Half" *Science* Vol. 309 (January 2005), 357.
[7] Douglas L. Karlen and Charles W. Rice, "Soil Degradation: Will Human Kind Ever Learn?" *Sustainability* Vol. 7 (2015), 12490.

middle class and increasing demand for less resource-efficient foods like meat and dairy. One OECD study predicts that 3 billion people will enter the 'middle class' over the next 20 years (as defined by a daily income of $10-$100 dollars/day), and if we assumed that each of those 3 billion people consume one-tenth a pound of beef a day, this would mean a 73% increase in beef consumption by 2050.[8] It takes about six to eight pounds of feed grains (often corn or soybeans) to produce one pound of beef, and so as demand increases for meat (especially beef) demand for other agricultural commodities will grow significantly. In the best-case scenario in which we solve the problems of poverty and malnourishment, we still need to double food production in order to feed everyone.[9] Demand is growing, but due to land degradation across the globe, the resources to supply demand are decreasing. As the world's largest producer and exporter of agricultural commodities, the United States must be prepared for these incoming trends.

Between 1961 and 2000 global food production increased 146% while land used for agriculture increased only 8%. However, this amazing rate of increased production efficiency should not be expected to occur again. The improvements of that time period were the result of the 'Green Revolution' in which farmers in different areas of the developing world began, for the first time, applying fertilizers, planting with selective genetic traits (e.g. Bt corn), nutrients, and irrigation. And though the Green Revolution has greatly contributed to global agricultural production and economic development in the productive areas concerned, soil resources have been severely degraded in many instances from this agricultural intensification.[10] The Food and Agriculture Organization (FAO) of the United Nations reported in 2011 that 25% of all agricultural land on Earth is 'highly degraded', meaning that it cannot be used reliably for food production.[11]

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[8] United Nation's Secretary-General's High-level Panel on Global Sustainability (2012), *Resilient People, Resilient Planet: A Future Worth Choosing*. New York: United Nations, 35.
[9] Jonathan A. Foley, "Can We Feed the World and Sustain the Planet: A five-step global plan could double food production by 2050 while greatly reducing environmental damage," *Scientific American* (November 2011), 62.
[10] Karlen and Rice, "Soil Degradation," 12495.
[11] FAO. 2011, State of the World's Land and Water Resources for Food and Agriculture. Summary Report. Food and Agriculture Organization of the United Nations, Rome, 18.

Urban-sprawl development poses another limit to increasing agricultural production. In the US between 1987 and 2007, 41 million acres of farmland was developed into urban areas. This is 41 million acres of some our *best*, most fertile land that will not be used for agricultural production in the foreseeable future.[12]

One study estimates that the Ogallala Aquifer, which has been the source of irrigation on the Southern Plains of the US since the 1940s after the dust bowl, will be depleted in the next 80-100 years.[13] A similar decline of water resources is occurring in Northern China, where 4/5th of cropland is irrigated and ground water levels are decreasing at a rate of 0.5 – 3 meters/year (along with increased nitrate contamination in the remaining groundwater from excessive application of chemical fertilizers).[14] Despite being unsustainable at its current rate of use, irrigation plays a huge role in productivity – 40 percent of the world's food comes from the 18 percent of the world's cropland that is irrigated.[15]

These issues are but a few of the blemishes in the relationship between our agriculture and ecology. But none of these previously mentioned issues singlehandedly represents this flawed relationship as well as soil erosion. Soil erosion is a nearly inevitable result of practicing farming; whether the soil is tilled or not, whether we use cover crops and strip cropping, whether we plant close to watersheds or leave buffer-zones, farming leads to soil erosion by wind and water. And the erosion of soil is no small matter for farmers. Soil erosion is known to decrease yields and productivity.[16] Many farmers implement these just aforementioned conservation measures, but if the current trends of soil erosion (and land degradation generally) remain, agriculture will suffer in the long run.

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[12] Nikos Alexandratos and Jelle Bruinsma, "World Agriculture Towards 2015/2030: The 2012 Revision", *Food and Agriculture Organization of the United Nations*, ESA Working Paper No. 12-03 (2012), Accessed November 18, 2015, www.fao.org/economic/esa.

[13] Leonard F. Konikow, "Groundwater depletion in the United States (1900–2008)," U.S. Geological Survey, Scientific Investigations Report 2013–5079, p. 63 http://pubs.usgs.gov/sir/2013/5079 (Available only online.)

[14] Matthew J Currell, et al, "Sustainability of Groundwater Usage in Northern China: Dependence on Paleowaters and Effects on Water Quality, Quantity and Ecosystem Health," *Hydrological Processes* Vol. 26, 4050-4066.

[15] Sandra Postel, "Safeguarding Freshwater Ecosystems," *State of the World 2006: A Worldwatch Institute Report on Progress Toward a Sustainable Society,* (2006), 41-60.

[16] Rattan Lal and B.A. Stewart, *Soil Degredation*, (New York: Springer-Verlag, 1990).

Some farmers and agribusinesses are more aware than others of this problematic paradigm, and work hard towards achieving sustainable agriculture, but their efforts are in conflict with short run market forces and the global 'price-war' of agricultural commodities.

This essay seeks to explore policy solutions for reconciling private enterprise with sustainable agriculture. In order to gain a practical grasp on the complex issue of sustainable agriculture, this essay will focus on soil erosion. How can US government policy reconcile the economic security of farmers and the longevity of our soil resources? This essay answers that question by suggesting a traditional economic approach for creating a new kind of US agricultural policy, one that uses a soil erosion tax in order to reflect the long run costs of ecological damage into the present acts of farming. This proposed soil erosion tax would establish short run market forces that push farmers towards practicing agriculture in a more permanent and sustainable way. Secondarily, the recommended policy would continue to support farmers against downside risks so that the additional tax-cost doesn't put farmers out of business, but merely incentivizes conservation practices. Finally, the new agricultural policy must consider any externalities of implementing a soil erosion tax, such as decreased exports and perhaps the increased price of food.

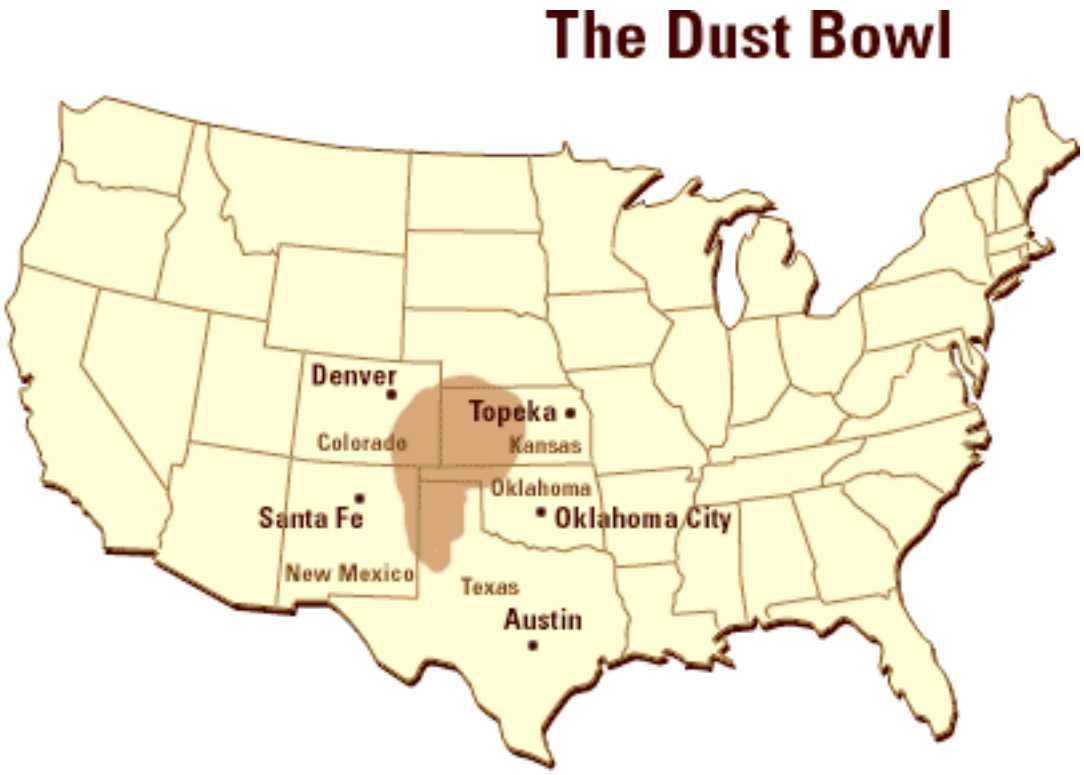
The goal of reconciling private agriculture and ecological conservation is nothing new. And so in order to see why a break from the mold of previously failed conservation policies is necessary, this essay utilizes a historical case study approach. The first part of this essay is an examination of the American dust bowl events. This historical model will be used to gain a better understanding of the paradigm between private enterprise and agricultural sustainability. It is from the historical lessons of the dust bowl that it becomes clear why we have a government agricultural policy, and why a successful agricultural policy for the future must incentivize conservation farming while respecting the autonomy and decision making of individual farmers. Part B of this essay will then examine our current predicament and the plausibility and ramifications of this essay's suggested policy solution: a soil erosion tax.

Part A

The Dust Bowl: An archetype of agriculture and ecological limits

The 'dust bowl' was a decade on the southern plains, in the 1930s, plagued by drought, failed crops, soil erosion by wind, dust storms, and black blizzards. Speculative growth in agriculture led to oversupply and an extreme supply glut in the late 1920s and early 1930s. Suddenly, many farmers couldn't afford to plant crops on the land they had torn and plowed the native sod from. Millions of acres were left bare and uncovered by vegetation when drought hit hard and lingered through the decade of the 30s. The typical winds of the Great Plains turned into highly atypical and terrifying dust storms. Although the entire American Great Plains suffered drought and dust storms throughout the decade, the 'dust bowl' refers to the worst hit areas: north Texas, northeastern New Mexico, southeastern Colorado, the western half of Kansas, the western Oklahoma panhandle, and parts of southern Nebraska.[17] George Borgstrom, an expert on world food problems, ranked the dust bowl one of the three worst ecological mishaps in human history[18]; but unlike the deforestation of the Chinese uplands (in approximately 3000 BC) and the erosion of Mediterranean lands due to overgrazing livestock (occurring over centuries since ancient times) the dust bowl took only 50 years of human settlement to accomplish. [19]

[17] Timothy Egan. *The Worst Hard Time: The Untold Story of Those Who Survived the Great American Dust Bowl,* (Boston: Houghton Mifflin Company, 2006) xi.
[18] George Borgstrom, *World Food Resources* (New York: Intext Educational Publishers, 1973), 203.
[19] Donald Worster, *Dust Bowl: The Southern Plains in the 1930s* (New York: Oxford University Press, 1979), 4.



A map of the Dust Bowl Region[20]

Examining the history of the dust bowl is useful in considering agricultural policy today, because it illustrates the relationship between agriculture, ecological limits, and economic policy. The account that follows is indirectly related to the argument for a soil erosion tax in that it explains the origins of farm support system. The history of the dust bowl is directly related to the argument for a soil erosion tax in two ways: first, that the dust bowl was an emphatic example of the natural market tendency for farmers to ignore ecological limits in favor of short run market forces, and secondly, that a successful conservation policy that incentives more ecologically friendly practices must do so in a pragmatic way that respects the autonomy and private decision making of farmers. This second point is like the idiom, you can lead a horse to water, but you can't make it drink; policy makers would do well to learn from failed conservation policies of the dust bowl era and

[20] Image taken from PBS website and from the film *Surviving the Dust Bowl*: http://www.pbs.org/wgbh/americanexperience/films/dustbowl/

since, and apply an objective tax code that incentivizes conservation practices while allowing farmers to freely make the decision to change on their own terms.

Section 1: Pre-Dust Bowl Forces

First, what caused the dust bowl? Identifying the causal chains of historical events can be incredibly complex - there are many different contributing factors to political ecological events. One might answer this question with drought, or industrialized commercial farming practices, but these are each necessary and not sufficient causes. Also not sufficient, but more fundamental causes of the dust bowl are the social, political, and economic forces that pushed American agricultural practices to behave in that given way. This section will illustrate some of these underlying causes.

The answer to this question is deeply multifaceted; there are a combination of ecological, economic, policy, and cultural forces that led to the ecological imbalance of the 1930s dust bowl. And though it may seem impossible to identify that which is common to all of the diverse causes of the dust bowl, Donald Worster's *Dust Bowl: The Southern Plains in the 1930s* does exactly that, by blaming the cultural values of America - values best described as 'capitalism' - as the underlying force of the various different events that created dust bowl.[21] Paul Robbins writes in his teaching textbook, *Political Ecology: A Critical Introduction*, a critical survey of this growing field:

> Donald Worster in a prominent example [of critical environmental history] turned his attention to the American Dust Bowl, where drought and intensive farming methods together contributed to soil loss, blowing dust clouds, and the disruption of millions of rural lives, including bankruptcy and starvation in the 1930s. His work concludes that the ravages of the landscape were a nearly inescapable result of increased risk-taking farming behavior growing

[21] Worster's *Dust Bowl* has been the most useful and influential source for the Part A of this essay.

from a capitalist agricultural economies established in the previous decades.[22]

Worster provides an extensive analysis of the dust bowl crisis addressing why the dust bowl occurred, what happened, and what policies were enacted in response (and why such policies proved not fully effective). Most importantly, Worster's account of the genesis of US agricultural policy and soil conservation illustrates the impracticality of localized community oversight and voluntary conservation compliance, providing historical justification for a different approach to agricultural conservation policy.

Worster describes the dust bowl as the failure of farming practices to ecologically adapt to the southern plains.[23] He argues that our cultural values are the primary cause of this adaptive failure, specifically the set of American values he calls the "capitalist ethos." Worster claims that the way we use the land is dependent on our cultural ecological values. He summarizes American ecological values, as taught by the capitalist ethos, in three maxims: 1) "Nature must always be seen as capital," in other words, the land is seen only as an input of production, not as the complex ecological balance that it really is; 2) "Man has a right, even an obligation to use this capital for constant self-advancement," by which Worster means that the land must be used to maximize and produce greater wealth each year; and 3) "The social order should permit and encourage this continual increase of personal wealth," in other words, that there be no community interference between a farmer and their profit maximization.[24] These cultural-ecological values in their summation encouraged an unbounded optimism in the American plains settler. Though there was surely an element of greed in the speculative growth agriculture before it's collapse in the 1930s, this was not a black and white problem where ambitious and greed-driven farmers were entirely to blame for their own demise, as most plains settlers were opportunity-seeking immigrants, desperately hoping for more than the land could be safely asked to provide. Indeed, illusionary optimism is common to

[22] Paul Robbins, *Political Ecology: A Critical Introduction*, Malden: Blackwell Publishing, 2004, 66.
[23] Worster, *Dust Bowl*, 43.
[24] Worster, *Dust Bowl*, 6.

every epoch, as we tend to believe that we walk the path of progress. No one would convince the plains settler that they could not farm the dry marginalized land of the southern plains. Ultimately even the black blizzards of the 1930s would fail to restrain this optimism.

The identification of American cultural values (the capitalist ethos) as the common denominator amongst the various forces that created the dust bowl is a good theory. The dust bowl crisis was the result of human behavior and our behavior is reinforced by our enduring cultural values. Cultural values are heavily influenced by the way we organize society for production and so unsurprisingly, greater productivity is an eagerly embraced cultural value. In the decades leading up to the dustbowl, due to both ignorance and hubris, our cultural values led to greatly speculative and irresponsible agriculture. Millions of acres of native sod were exchanged for the hottest cash crop, wheat, changing the land that had depended upon prairie grass for millennia and the wind erosion that resulted was catastrophic. Ecological limits in our relationship to the earth were ignored in preference for immediate profits and increased productivity.

However, Worster's theory does not provide a viable solution. Placing of blame on cultural values implies that alternative values are possible. Instead of our endless crusade for greater wealth and producing the maximum wealth from the soil for our personal improvement, Worster believes our culture could reinforce values that treat the soil and the whole environment as more than a commodity to be squeezed of its value. The Plains Indians serves as his model for alternative cultural-ecological values. In contrast to the American capitalist ethos, Worster describes the spiritual conservation ethic of the Native Americans who had lived on the plains in a relatively better state of human-ecological harmony. Unlike the supposedly autonomous and nature dominating westerner, the Native Americans of the plains understood that they were a part of the natural balance, dependent on the grasslands. They did not have an American-style growth culture. They used nature with complete (and spiritual) reverence, restraining their wants and numbers to respect the limits of the land. While western values, rooted in Christianity, promote excessive propagation, Plains Indians deliberately restricted their frequency of

births. Worster says that these earthly holistic values, of intimacy with the land and scaling their 'needs' to a limited world and scarce resources are common amongst old-world cultures that have stood the test of time.[25] American plains settlers (along with the whole nation) clearly lacked these traits, proudly self-identifying as 'sodbusters'.[26] However, beyond citing Native American values, as ecologically superior, Worster is vague on the topic of alternatives to commercial farming and provides no specifics on how to achieve this cultural revolution.

Worster's lack of alternatives should not however diminish the weight of his primary argument, that the cultural impetus that we might call capitalism is a driving force for all of the underlying economic and political forces that developed into the dust bowl of the 1930s. If we accept his thesis, then the next step is to look at the specific ways those values were manifest. The various political and economic forces are also highly relevant in understanding what caused the dust bowl. After all, this essay seeks to draw lessons for agricultural *policy* solutions in the present, and the revision of cultural values is not a practical policy solution.

The dust bowl comprised some of the most marginal land on the Great Plains, least suited for agriculture. On an expedition into the newly acquired American lands of the Louisiana Purchase, Zebulon Pike followed the Arkansas River up into the Rocky Mountains and witnessed sprawling sand dunes in part of the Southern Plains. What he saw was likely some riverbed blowing out during a dry season. Pike's report in 1806 suggested that the interior plains, soon dubbed the Great American Desert, were an insurmountable restriction to Western expansion. Though its aridity was indeed exaggerated, Pike saw the ecology on its own terms, unlike the settlers that would follow.[27]

Before settlers came to the southern plains, they settled upon the more fertile soils of the Great Plains. The Homestead Act of 1862, the legislative embodiment of Jeffersonian Democracy, was a force for settlement on the plains for decades, even after its ironic reversal in 1936 with the creation of the resettlement

[25] Worster, *Dust Bowl*, 77.
[26] Worster, *Dust Bowl*, 96.
[27] Worster, *Dust Bowl*, 80-81.

administration, which aimed to evacuate areas of homestead land.[28] The original Homestead Act allowed settlers 160 acres of property after 5 years of making 'improvements' on the land, by which the government meant cultivation.[29] Homesteading was Jeffersonian because Thomas Jefferson idealized the small farmer as the true American and envisioned an American democracy comprised of more and more small farmers. But because the population would inevitably grow and the opportunity for each person to farm would diminish if constrained to limited land, the nation would need to continuously acquire more land. The spirit of the Homestead Acts was an expression of growth culture; we will not have peace and justice unless our economy (in Jefferson's eyes, our land) is constantly growing.[30] Today, the legacy of the homestead acts is mixed. In many cases it indeed contributed to opportunity and prosperity on the land for many hardworking farm families and established farming operations in fertile areas. But as market forces demanded more production from each farm unit, and the more fertile lands had already been claimed so that homesteaders began farming less desirable land like southern plains, the Homestead Acts became "almost an obligatory act of poverty."[31] Even the Enlarged Homestead Act of 1909, which increased the acreage allotment from 160 to 320 acres[32], proved adequate only for a few years until market forces (a massive surge in settlement and increase in aggregate market production) pushed the operating costs even higher than what 320 acres of crops could cover.[33]

Despite hardships, the optimism of the frontier was unquenchable. There was an ideological backlash to those who spoke of a Great American Desert. Charles Dana Wilber, a town builder in Nebraska provides an explicit example of faith in the cultivation of the southern plains. Quoting the book of Genesis, Book 2, Chapters 5 and 6 in his journal, Wilber wrote "But there went up a mist from the Earth and watered the whole face of the ground; for the Lord God had not sent rain upon the

[28] Worster, *Dust Bowl*, 229
[29] Worster, *Dust Bowl*, 82.
[30] Worster, *Dust Bowl, 80.*
[31] Egan, *The Worst Hard Time,* 268.
[32] Worster, *Dust Bowl*, 87.
[33] Worster, *Dust Bowl*, 92.

earth, (because) and there was no man to till the ground." Wilber interprets this biblical passage as meaning that the earth began first in a state of desert, of dew rising into mist under the heat of day then falling onto the earth again at night, until man came and tilled the land and brought about vegetation:

> Everywhere under these new conditions of husbandry, the clouds will gather into larger clouds and overspread the heavens; and the impending shower will fall upon the farm and garden, not by grace or fortuity, but by an external law… In this miracle of progress, the plow was the avant courier – the unerring prophet – the procuring cause. Not by any magic or enchantment, not by the incantations or offerings, but, instead, in the sweat of his face, toiling with his hands, man can persuade the heavens to yield their treasures of dew and rain upon the land he has chosen for a dwelling place. It is indeed a grand consent, or rather concert of the forces – the human energy or toil, the vital seed, and the polished raindrop that never fails to fall in answer to the imploring power of prayer of labor.[34]

Wilber argued that rain would follow the plow, and as absurd as it sounds, he wasn't alone. Scientists (or quacks) assured settlers that the steam from locomotion traffic would increase precipitation.[35] Never underestimate the desire to rationalize our unfounded desires.

Twenty inches of rainfall had been the standard threshold for growing crops without irrigation, but the southern plains and much of the western Great Plains were below that threshold. In addition, it takes 22 inches of rain in the Oklahoma panhandle to deposit the same amount of moisture into the soil as 15 inches or rain in the upper-Mississippi River valley. The vegetation that had evolved under these conditions was unlike that of any cash crop; mesquite, a native plant, sends its roots down as far as 150 feet in order to find water. [36] Unsurprisingly, the feasibility of small agricultural holds on the more arid areas of the plains was seriously

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[34] Henry Nash Smith, "The Rain Follows the Plow: The Notion of Increased Rainfall for the Great Plains, 1844-1880", *Huntington Library Quarterly* Vol. 10, No. 2 (Feb, 1947), 188-189.
[35] Egan, *The Worst Hard Time*, 25.
[36] Egan, *The Worst Hard Time*, 22-24.

challenged not long after the 1862 homestead legislation. Drought and grasshopper plagues ravaged the Great Plains in the early 1870s prompting a wave of outmigration, mostly people leaving Kansas.[37] In 1878, director of the US Geological Survey, John Wesley Powell suggested sweeping revisions of the Homestead Act in his *Report on the Lands of the Arid Region of the United States*. Everywhere west of the 100 Meridian (roughly down the middle of the Dakotas all the way down to Texas) he reported that there was not enough rainfall for raising crops and that a 160-acre allotment was insufficient for a single family. Powell proposed that instead, the government provide 2560 acreage 'pasturage farms' in order to raise livestock. The proposal was denounced not only as elitist and un-Jeffersonian, but also too pessimistic about the region itself. But when drought hit again in the 1890s, and entire communities of farmers in the western Dakotas and eastern Montana were abandoned, Powell's suggestions gained some credibility. [38] During and after the 1930s, Powell's report was popularized again. Some New Dealers referenced Powell in their belief that the key to successful agriculture in the region was decreasing the number of, and allowing for, larger farming units.[39] Certainly that's where the market forces were headed in the 1930s – the decade was a crisis of overproduction, and in theory, the free market equilibrium would have been 'naturally' accomplished when the less efficient farming units went into bankruptcy, and the total number of farming units decreased, along with aggregate production. Given this fact of market equilibrium, politically aiding the removal of farming units might have been wise. But Worster disagrees with Powell. In accredit to Powell's views, Worster says that at least he recognized ecological reality, rather than an optimistic fantasy, and that he certainly wasn't an elitist, but genuinely hoped to make total westward expansion redeemable in the face of likely failure. But to Powell's discredit, Worster thinks he saw only the economic circumstances of his day and assumed that one adjustment of farmers' income would create a sustainable plains settlement, when in fact a real solution would need to address the fact of

[37] Egan, *The Worst Hard Time, 65.*
[38] Egan, *The Worst Hard Time*, 57.
[39] Worster, *Dust Bowl*, 85-86.

economies of scale, the trend of farms becoming larger and for a fewer number of farmers in the whole market. He failed to see the economic trajectory on which we all travel.

Though settlement policy was not revised in the late 19th century, the hardships on the semi-arid plains did trigger an agricultural adaption effort that became known as dryland farming. It was the advent of new agronomic practices that made farming regions like the southern plains relatively reliable (at least during the fortunate years). The introduction of 'drought resistant' Turkey red, a variety of Russian winter wheat, introduced to the plains by Germans from Russia, provided a feasible cash crop for the land. *Campbell's Soil Culture Manual*, by the South Dakota homesteader Hardy Webster Campbell, became a government-endorsed must-have for every plains settler, though its agronomic suggestions were quite primitive. Campbell emphasized that small amounts of rainfall could be stored in the ground by increasing the moisture retention of soil. He prescribed that the ground be pulverized by disking, leaving a smooth surface. The subsoil should be packed, strengthening the root-bed (and supposedly pulling up ground water through capillary action!). To protect from evaporation, Campbell called for cultivation after each rain to build up fine dust mulch (in the hindsight of the dust bowl, clearly a poor idea). Later he adjusted his methods to advocate mulch made from soil clods, known as aggregates, not dust.[40]

With the improved confidence of dryland farming agronomy, and the Enlarged Homestead Act of 1909 (which was amended in 1912 so that the time allotted for improvements to the land decreased from five to three years), a new surge of settlement came like nothing before. In 1912, there were 24,000 new homestead entries; in 1913, there were 53,000 entries. The rate of settlement decreased, but stayed above 30,000 entries annually until the 1920s. And the size of farm units grew from averaging 256 acres in 1890 to averaging 813 acres in 1930. The increase in agricultural production was both spurred by and coincidentally

[40] Sarah T Phillips, "Lessons from the Dust Bowl: Dryland Agriculture and Soil Erosion in the United States and South Africa, 1900-1950." *Enviromental History* Africa and Envromental History 4.2 (1999): 249.

matched increased demand, due to growing urban centers in America and growing exports, especially during WWI. The price of wheat was favorable between 1909 and 1914 at around $1 per bushel, but in 1919, the price rose to $2.50. Just to emphasize the magnitude of the increased demand due to foreign markets, this rise in prices coincided with a 70 percent increase in wheat production from 1917 to 1919.[41] Increased wheat planting, instead of other corps, and a bountiful harvest year were largely responsible for this increase, but also, of the 13.5 million acres increase in wheat acreage from 1909-1913 (years later used to calculate 'parity' - the golden standard for supposedly fair farm unit purchasing power) 11 million acres were on newly plowed land. [42] With such an increase in production, one would expect prices to lower, not skyrocket to $2.50. Global demand for agricultural commodities was incredibly high following the blockades and burnt crops of WWI.[43]

If 1910 – 1930 was the time in which the seeds of the dust bowl were planted, one force behind the dust bowl must be industrial agricultural technology, which came in the form of a tractor and was just then arriving on the scene. Fordism was being applied to agriculture on the plains, not only in the implementation of modern machinery, but also with the widespread application of commercial monocropping (specializing in a single cash crop, in contrast to diversified, or even subsistence farming). New technology dramatically increased labor efficiency; from 1910 – 1930 the labor involved in agriculture decreased by one-third while production rose by one-third. In 1830 it had taken 58 hours to harvest one acre of wheat, but in 1930, it took less than three hours on the most advanced farms. The tractor, along with the disk plow and the harvester-thresher (named the combine for its dual function) that were pulled behind it, completed the industrial mechanization of an early 20th century farm. But these machines were an investment, and often required mortgages. From 1910 to 1920, the average cost of implements on an average Kansas farm went from $292 to $980; farming was

[41] Egan, *The Worst Hard Time*, 44.
[42] Worster, *Dust Bowl*, 88-89.
[43] "The Economics and Political Economy of International Trade Cooperation," *World Trade Report (2007)* 39-40.

becoming an increasingly capitalized industry. When prices depressed after the recovery of European markets, smaller, less efficient farm units were squeezed out of the US market, often because they defaulted on their machinery mortgages.[44] Economies of scale are a reality; those who pioneer larger and more industrialized farms set the pace, and those who can't keep up must drop out.

In 1920, the price of wheat was approximately $2 a bushel. In 1928, many were predicting $1.50, but after a neither perfect nor disastrous harvest, the price of wheat came in around $1.00.[45] In 1930, wheat went for 30 cents a bushel – there was so much excess supply it was piling up outside the grain elevators. Despite a small drought on the southern plains that year, bumper crops in the northern plains brought in far more wheat than what was demanded for consumption. 'Suitcase farmers' – farmers who were not permanent residents of their land - had been eagerly tearing up sod in order to get their share in the wheat bonanza, but when prices depressed, they were the first to abandon their land, leaving their fields fallow and uncovered, letting the soil dry up and blow into dust.[46] The price of wheat was falling, along with other agricultural commodities because the supply had increased while demand had decreased due to the beginning of the Great Depression. Farmers' revenue was simply insufficient to cover operating costs. But for those who couldn't leave the land so easily, there was seemingly only one option: plant more. The fall of 1930 saw more 'virgin' soil plowed up than ever before.[47] Farmers were digging deeper into their own grave, searching for a miracle, but instead the 1930s only brought the rural economy into the grave with them.

Section 2: The Dust Bowl: The Event Itself

What was plains ecology like before American/Anglo settlement and development? One of the biggest challenges to critical environmental history is

[44] Worster, *Dust Bowl,* 92.
[45] Egan, *The Worst Hard Time*, 74
[46] Egan, *The Worst Hard Time*, 87.
[47] Egan, *The Worst Hard Time*, 80.

simply the lack of historical data on the environment.[48] Nonetheless, Worster identifies several basic aspects of this ecology that seem certain. There existed an array of biodiversity with the primary producer being one of the several prairie grasses that sprawled over the land seemingly forever in every direction. Short-grass parries where more common in the drier southern plains, and tall-grass in the wetter north. Worster cites estimates that Buffalo grass on the southern plains once supported 30 million bison.[49] Though the grass would sometimes die during droughts, it would remain rooted and still hold the soil in place.[50] With western settlement, ecological reality was traded for economic realism. Native sod has little economic value and was torn up in favor of cultivated fields at incredible rates through the early 20th century. In 1879, 10 million acres of the Great Plains were plowed. Fifty years later in 1929, that number was 100 million acres.[51] When the extended drought of the 1930s hit, planted crops failed to grow and the earth was left bare for plains wind to lift the precious soil into black blizzards, carrying it sometimes all the way to the Atlantic. The dust bowl occurred specifically on the southern plains (in north Texas, western Oklahoma, southeastern Colorado, western Kansas, and southwestern Nebraska) because this semiarid land proved too volatile an ecosystem to survive the destruction of its native sod. Agriculture had pushed the land beyond its breaking point. In the words of Worster, "Here on the edges of the fertile earth man needed to summon all of the cooperative, self-effacing, cautious elements of his nature to live successfully; Americans however, found precisely those qualities the hardest to nurture and express."[52] Following the immediate demands of the market, farmers tended to disregard the ecological limits of their environment. With the onset of the dust bowl, the ecologically destructive inhabitants of the land were finally reaping what they had sown.

The extended drought of the 1930s came at an especially inopportune time. The farm economy was already in shambles. In part, the expansionary growth of

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[48] Paul Robbins. *Political Ecology: A Critical Introduction*, (Malden: Blackwell Publishing, 2004) 62.
[49] Egan, *The Worst Hard Time*, 25.
[50] Worster, *Dust Bowl*, 71.
[51] Egan, *The Worst Hard Time,* 267.
[52] Worster, *Dust Bowl*, 97.

agriculture on the southern plains was spurred by years of generous precipitation; from 1926-1930, Boise City, the seat of Cimarron County Oklahoma, averaged over 19 inches of annual rainfall. In 1932, drought hit and annual precipitation was only 12 inches that year. In 1934, there was less than 9 inches of annual rainfall and over the five years between 1931 and 1936, the county averaged just less than 12 inches. The effect of the drought on yields was devastating. In the 1920s, farmers in Cimarron County averaged yields of 13.1 bushels/acre, but throughout the 1930s, they averaged a meager 0.9 bushels/acre.[53] Without the drought, the dust bowl would never have come about.

The measured amount of soil lost on the Great Plains due to erosion in the 1930s is not exactly known, but the estimates are extreme. Before the dust bowl, Americans had mostly ignored the possibility of soil limitations. In 1909, a report by the Bureau of Soils stated, "The soil is the one indestructible, immutable asset that the nation possesses. It is the one resource that cannot be exhausted; that cannot be used up."[54] This is entirely false. Soil erosion by wind and water on cultivated land has depleted soil resources over the past century by operating with erosion rates greater than soil formation rates.[55] In the 1930s, the US suffered the most extreme and sustained wind erosion ever recorded, across the whole plains. Wind erosion severity is strongly associated with the type of soil – sandy soil is eroded more easily than clayey soil. The dust bowl occurred where it did mostly because the soil was more easily susceptible to wind erosion.[56] The intense dusters and black blizzards of the dust bowl left their mark in ecological damage. In the single year of 1935, an estimated more than 850 million tons of topsoil had blown off the southern plains. At the end of the year, there were 5 million acres deemed with "little chance of ever being cultivated again," and the USDA considered for the first time that farmers were currently on 100 million acres that "might never be productive

[53] Worster, *Dust Bowl*, 106-107.
[54] Worster, *Dust Bowl*, 213.
[55] David R. Montgomery, "Soil Erosion and Agricultural Sustainability," *Proceedings of the National Academy of Sciences of the United States of America vol. 104 no. 33* (2007), 13271, Accessed February 7, 2016, doi: 10.1073/pnas.0611508104.
[56] Worster, *Dust Bowl*, 105.

farmland."[57] In the worst hit areas, even the grasslands that had been preserved for grazing were smothered by dust, some ten feet under.[58] In Baca County Colorado alone, more than 1.1 million acres were so eroded they were estimated to never support crops again.[59] By 1938, 10 million acres had lost at least five inches of topsoil, and another 13.5 million acres had lost at least two and half inches.[60]

The social collapse of the dust bowl was nearly as violent as the ecological one. Though the whole nation's rural economy was in shambles during the early 1930s, it was farmers on the plains, especially the southern plains, who suffered most. In his book, Worster uses Cimarron County as an archetype of a dust bowl community. In Cimarron, the market value of wheat harvest was $700,000 in 1930, $1.2 million in 1931, $7000 in 1932, and $0 in 1933 (out of 200,000 planted acres, not a single bushel of wheat was harvested).[61] In 1934, only one in four farming operations remained debt free.[62] Nearly a million people fled their farms in the whole Great Plains from 1930 to 1935 and another 2.5 million left in the second half of the decade.[63] It wasn't only farmers with crops who were hurting; ranchers also faced immense overproduction and low prices. Within the dust bowl, cattle frequently dropped dead of 'dust fever' (suffocation), and in one county, 90% of the chickens died of dust suffocation in 1933. And if their economic woes weren't enough then there were the risk to human health and the casualties of dust pneumonia that came with the drought, black blizzards, and daily dusters. The worst black blizzards brought with them total blackout – zero visibility – and occasionally blinded those who survived stranded outside in the storms.[64] In the first fifteen days of July 1936, 2,500 people died in the Midwest due to weather (some from dust pneumonia, but mostly from heat and drought).[65]

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[57] Egan, *The Worst Hard Time*, 254.
[58] Egan, *The Worst Hard Time*, 158.
[59] Egan, *The Worst Hard Time*, 237.
[60] Worster, *Dust Bowl,* 29.
[61] Worster*, Dust Bowl,* 120.
[62] Worster*, Dust Bowl,* 121.
[63] Egan, *The Worst Hard Time*, 49.
[64] Egan, *The Worst Hard Time*, 220.
[65] Egan, *The Worst Hard Time*, 247.

In short, the dust bowl was a both a severe economic and ecological crisis. The next section addresses the policy response from Washington prompted by this crisis.

Section 3: Policy Response

The agricultural crisis of the 1930s was much more than a crisis of severe wind erosion. It was primarily a crisis of oversaturated markets and low farm income. The New Deal agricultural policies of the 1930s aimed first of all to address the economic crisis, and secondarily, the ecological crisis. To be sure, the two were very much intertwined. The ecological crisis was the result of the economic circumstances, namely the speculative growth of agriculture in the previous decades and the price collapse of the 1930s, and the environmental disasters of the dust bowl resulted in further economic woes. Some policies addressing the economic crisis (such as planned scarcity and conservation districts) were ecologically helpful, but others (price floors and income support) only maintained an agricultural economy of overproduction and reassured an economic culture that pushed the land beyond its limits.

In June of 1933, by Executive Order 6084, the tasks of the Federal Farm Board were transferred to the new Agricultural Adjustment Administration and the name was changed to the Farm Credit Administration (FCA). The FCA refinanced farm mortgages at rates more manageable for farmers. Because of its advantageous policies for farmers, the FCA essentially became the bank of rural America, providing loans at 5% interest, effectively replacing private banks (though many rural banks had already gone under). According to Worster, nothing could have been more radical and had it been applied in any other industry, it would have been denounced as bolshevism. In its first three years, the FCA loaned more than $600 million to farmers.[66]

[66] Worster, *Dust Bowl*, 124.

The Agricultural Adjustment Act of 1933 established the Agricultural Adjustment Administration (AAA) – a more comprehensive replacement to the Federal Farm Board. The AAA needed to address the problems farmers were facing in an oversaturated market. It did so in two ways: limiting production and providing price supports. The AAA authorized the Secretary of Agriculture to offer direct payments to farmers in exchange for participation in acreage control programs, for 'basic crops', a long list of traditional cash crops. This meant that farmers would receive a check simply for agreeing to plant less than the amount that AAA would delegate to each farm, for any given crop, each year. Acreage control payments provided the AAA with the means to restrict aggregate production quantities. The acreage control programs, they hoped, could solve overproduction in the long run, but they still needed to address inadequate farm incomes in the short run. The Commodity Credit Corporation was established in order to fix prices at the rate of a government provided non-recourse loan with the commodity serving as collateral (meaning there was no penalty for failing on the loan besides the government keeping the commodities). CCC loans were essentially a price floor at which the government would buy crops. Surplus disposal programs were also heavily utilized, paying ranchers to slaughter and paying farmers to burn crops, in order to eliminate surplus market supply. [67]

Each commodity program – government assigned acreage allotment in return for eligibility for the CCC loans that functioned as a price floor – required a vote of approval by whatever individuals produced that commodity. If more than one third of votes from producers of each given commodity were against the program, it would be nulled.[68] Nearly every year, every commodity was approved by vote expect for a few instances. One such instance was the in 1933, in preparation of 1934, the first year of eligibility, when ranchers voted down the beef commodity program due to a resentfulness for government intervention and federal aid.

[67] Wayne D. Rasmussen, Gladys L. Baker, and James S. Ward. "A Short History of Agricultural Adjustment, 1933-75." Economic Research Service, USDA, Agriculture Information Bulletin No. 391 (1976), 2-3.
[68] Rasmussen et al, "A Short History of Agricultural Adjustment," 2.

Apparently they preferred to live and die by the free market. But as the drought worsened, and their livestock were left without feed, ranchers quickly changed their minds. First, they asked for import restrictions – despite the fact that imported beef was a nearly negligible share of beef in the US market – and then finally asked for government aid. From June 1934 to the spring of 1935, the USDA bought 8.3 million head of cattle for $111.7 million, becoming the largest cattle owner in the world. The poor had canned meat and the government had 2 million hides that they didn't know what to do with.[69] Another such vote-down occurred in 1938 with the tobacco commodity program. Apparently, tobacco growers were through with being told by the AAA how much they were allowed to plant. But after a single growing season of rampant overproduction, tobacco growers quickly repented and asked for their program back. They were eligible again for the 1939 season and the government immediately bought their 1938 surplus before it could do too much harm to the domestic market.[70] These two notable instances illustrate not only the prideful resistance of farmers and ranchers in accepting government aid, but also a resistance to dialing back production, and the seemingly never-ending patience and mercy of the New Deal agricultural aid.

Though dusters had been blowing on the southern plains for sometime before 1934, ecological conditions had not yet gotten violent enough to draw the attention of Washington, which was too preoccupied with the throes of the Great Depression. After all, the drought and dust storms did to the southern plains what AAA policy makers aimed to do to the agricultural economy; cut back production.[71] It wasn't until the May 1934 dust storm, which snowed Washington with topsoil from the Great Plains, that Roosevelt and his cabinet began work on a 'drought relief package'. The most vociferous call for help from farmers was for water by means of dams, irrigation diversions, and deep-water wells. But the federal government had a different plan. On June 9th, 1934, at Roosevelt's request, Congress approved $525 million for a 'drought relief package'. $275 was for cattle owners, providing

[69] Worster, *Dust Bowl,* 113-114.
[70] Rasmussen et al., "A Short History of Agricultural Adjustment," 9.
[71] Worster, *Dust Bowl*, 155-156.

emergency feed loans, and for the purchase and slaughter of livestock, canning and distributing the meat to the poor. Another $125 million was for destitute farmers, providing jobs in public works and cash income supplements. The remaining $125 million was used to buy 'submarginal' lands from destitute farmers and relocating the residents to better environments, and also to create work camps for young men, provide seed loans for new crops, and establish a shelterbelt program in an attempt to tame the winds. Over the course of the 30s, these programs became staple parts of the policy effort toward rehabilitating the dust bowl.[72] The same year, the AAA government contracts for not planting for the following year became heavily utilized by wheat farmers on the plains. Though the policy was mostly unpopular amongst farmers who believed it was nonsensical to pay farmers to not work, most took what they could get during the enduring drought of the 1930s when they couldn't afford to risk planting.[73]

In 1935, the government began funding an emergency 'listing' program, paying farmers to plow their land into deep broad furrows perpendicular to the prevailing winds in order to mitigate wind erosion. Listing programs were widely popular with farmers. It had always been within the self-interest of farmers to list their land but broke farmers couldn't afford the gasoline required to list their fields. The self-interest of farmers and the goals of government policy were in unison with the listing programs making them very popular and successful throughout the dust bowl years.[74]

Hugh Hammond Bennett, often called 'Big' Hugh, is considered the father of US soil conservation. In 1903, Bennett began working for the Bureau of Soils within the USDA as a soil surveyor, and by 1933 when funding for addressing the agricultural crisis became readily available, Bennett had already established himself as the recognized expert in the US on soil erosion. In 1933, Bennett became director of the Soil Erosion Service (SES), one of many ad hoc New Deal agencies within the Department of the Interior. Bennett understood that the implementation of single

[72] Worster, *Dust Bowl,* 38-40.
[73] Egan, *The Worst Hard Time*, 158.
[74] Worster, *Dust Bowl,* 40

practices (such as listing or terracing the land, which the government had been providing funds for) would never be a successful conservation policy, but that a comprehensive program would be needed to address the different conservation issues on specific farmland.[75] Funding for the SEC was set to expire in 1935 but Secretary of the Interior, Harold LeClair Ickes, had faith in Big Hugh and assigned him, along with assistant director of the SEC, Walter C. Lowdermilk, to work on drafting the legislation for a permanent and comprehensive soil conservation program. But before their plans could come to fruition within the Department of the Interior, President Roosevelt made the executive decision to streamline the various soil conservation programs that were in effect into one agency within the USDA. The consolidation of soil conservation programs within the USDA would require congressional approval, and so hearings for the creation of the Soil Conservation Service were had throughout March and April of 1935. There was already significant political support for the Soil Conservation Service, but it's legislation was expedited by a series of massive black blizzards that brought dust all the way from the Midwest to the east coast, occasionally darkening the skies of Washington in midday.[76] Congress granted funding for nearly all of his proposed programs and with the Soil Conservation Act of 1935, the Soil Conservation Service was born.[77]

The Agricultural Adjustment program was the primary tool for the federal government to address agricultural overproduction until it was declared unconstitutional by the Supreme Court on January 6th, 1936. The justices' gripe was with the federal tax issued on commercial food producers used to fund the new farm support programs.[78] With the repeal of the Agricultural Adjustment Act of 1933, the Soil Conservation Service became the sole means for addressing overproduction in 1936. (The AAA was reestablished in 1937). The Soil Conservation and Domestic Allotment Act of 1936 was an amendment to the original 1935 legislation that

[75] "Bennett, Hugh Hammond," *American National Biography*, Volume 2, (New York: Oxford University Press, 1999), 582.
[76] Douglas Helms, "Hugh Hammond Bennett and the Creation of the Soil Conservation Service, September 19, 1933 – April 27, 1935," *Historical Insights No. 9*, (Washington D.C.: NRCS USDA, 2010).
[77] Egan, *The Worst Hard Time*, 228.
[78] Rasmussen et al., "A Short History of Agricultural Adjustment, 1933-75," 4.

increased funding for the SCS in order to help the agency carry the weight of farm support until a new Agricultural Adjustment program could be passed. Before the 1936 amendment, the SCS continued on much in the same way as the SES had under the department of the interior, providing research demonstrations across the nation to show farmers the strategies and benefits of conservation farming, along with the Conservation Options Program, which provided technical assistance to farmers who wanted to apply the agronomic techniques displayed in the demonstrations. In 1936, with the amended legislation, the SCS established the Agricultural Conservation Program (ACP), essentially the first land retirement program, offering payments to farmers for shifting cultivated land from 'soil depleting' crops, to 'soil enriching' ones. However, the job of limiting overproduction proved too big for the SCS alone and it failed to orchestrate production limits to the same degree as the Agricultural Adjustment Administration had. Severe drought in 1936 obscured the fact that conservation programs from the 1936 bill were less effective than the AAA had been – planting was significantly up in 1936.[79]

It took two years of finding their footing and being preoccupied with picking up the slack left behind by the repealed AAA before the SCS could begin implementing the kind of compressive approach that Bennett had always talked of. In February 1937, a model state soil conservation district law was drafted by the SCS, which would allow local farmers to organize their own soil conservation districts. It was from these districts that conservation practices could transition from demonstrations to actual practice on private farms. President FDR wrote to every governor with the recommended legislation.[80] In 1937, 22 states passed a soil conservation law that enabled the creation of local districts, and over time, all 50 states would create similar laws.[81] This policy, therefore, depended heavily on community involvement and the local initiative of farmers to implement

[79] Rasmussen et al., "A Short History of Agricultural Adjustment, 1933-75," 4-5.
[80] Roosevelt, F.D., *Letter from President to Governors,* (White House, Washington, DC February 1937).
[81] Huong N. Tran and Liu Chuang, "State Conservation and District Laws Developments and Variations" *Natural Resources Conservation Service Delaware*, United States Department of Agriculture, Working Paper No. 3, (July 1996), Accessed March 24th, 2016, http://www.nrcs.usda.gov/wps/portal/nrcs/detail/de/home/?cid=nrcs143_014208

conservation practices. However, community involvement and localized oversight proved more difficult in practice than in theory, and Worster claims that many soil conservation districts fell apart due to lack of local initiative.[82] However, the problem of soil conservation districts failing to coerce farmers into practicing conservation agriculture isn't so much that the soil conservation districts dissolved – there are over 3000 soil conservation districts in operation today[83] – the complications arise because these soil conservation districts rely on voluntary conservation compliance. Local oversight might help considerably in convincing farmers to implement conservation practice, but these districts still lack the authority to coerce farmers into complying if they choose not to do so.[84] Nonetheless, Worster pins the failure of the Soil Conservation Districts as the result of farmers' ideological opposition to government intervention in agriculture, or at least they were opposed when it diminished their profits.[85]

When the Soil Conservation and Domestic Allotment Act of 1936 was passed, about 20,000 government workers were sent to the southern plains in a desperate attempt to tame the blowing dunes, the SCS began waging war against the dirt and the dust. Operation Dust Bowl aimed to plant a vegetative cover and slow the drifting dunes through the use of contour plowing.[86] Also, Roosevelt signed Executive Order 7028, creating the Resettlement Administration, in order to buy back the most marginal lands sold under the Homestead Acts – a profound reversal of American frontier policy over the last near-century.[87] By 1940, federal agricultural support had cost $1.4 billion and was the largest item of the federal budget. [88]

A prominent New Dealer, Lewis Cecil Gray, whom Worster praises as an insightful conservationist thinker, saw the problem of American land use as the result of capitalism, broadly defined as personal economic freedom and unlimited

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[82] Worster, *Dust Bowl,* 190-192.
[83] "Bennett, Hugh Hammond," *American National Biography*, Volume 2, 582.
[84] Cox et al, *Losing Ground*, 11.
[85] Egan, *The Worst Hard Time*, 263.
[86] Egan, *The Worst Hard Time,* 263.
[87] Egan, *The Worst Hard Time*, 229.
[88] Worster*, Dust Bowl*, 154-55.

acquisitiveness. Germany, France, England and Denmark had each come to similar conclusions and consequently established strict controls over private property in agriculture. Gray hoped to organize a similar reform of the American agricultural system, to find some 'intermediate ground' between unregulated capitalism and state owned socialism.[89] This implied the conservative use of privately owned land through government regulation.

Worster frames Gray's policies in three stages. First, conserving what remained of the public domain – the end of homesteading. The Taylor Grazing Act of 1934 set aside 80 million acres of grassland toward this end. Second were the sub-marginal land purchases. Formally the 'Land Utilization Project', the federal government aimed in 1934 to buy back 74 million acres of unprofitable and ecologically damaged land. At its conclusion in 1947, only 11.3 million acres had been bought. Third, conservation needed to apply on privately owned land – the most important and most difficult step. The goal was to entice farmers into voluntarily acting within society's long-term interests, but it was also necessary to establish coercion against uncooperative farmers. In this original attempt for conservation compliance, uncooperative farmers were to be coerced by their peers through community involvement in Soil Conservation Committee. Gray was philosophically committed to achieving conservation compliance with small-scale community land oversight - decentralized county planning committees. Committees were to be established at both the state and county levels. By the end of the 30s two-thirds of the nation's counties had such committees. But after Secretary of Agriculture Henry Wallace left the position in 1941, the county committees quickly dissolved. Worster blames their dissolution on the Farm Bureau (an affiliation of farmers), land-grant extensions agents, and others with commercial interests in farming more land, with fewer regulations. With the loss of the grassroots soil conservation committees went the most important mechanism for establishing

[89] Worster, *Dust Bowl*, 189.

Gray's vision of some 'intermediate ground,' which could reconcile private enterprise and soil conserving agriculture.[90]

The Future of the Great Plains (1936) provides a valuable summary of the New Deal conservation thinking (and how theory was subverted by political limitations in practice). The report was authored by a committee of eight persons, representing four different agencies, each with a different view on the matter – Worster claims its principal author was Lewis Gray.[91] The report stated, radically, that land destruction was the result of our cultural attitudes – namely the "that man conquers nature," "that natural resources are inexhaustible," "that habitual practices are best," that what is good for the individual is good for everybody", "that an owner may do with his property as he likes," "that expanding markets will continue indefinitely", and "that free competition coordinates industry and agriculture".[92] By challenging the justifications and feasibility of private enterprise in agriculture, this section of the report seems to suggest that far-reaching changes within the agricultural economy were required, yet somehow, the conclusions of the report fell far short. Instead, the report blamed land degradation of the plains as the result of farmers applying humid agricultural practices onto an arid land.[93] Such a conclusion implied the possibility of an agronomic/technical solution, not the necessary cultural revisions. The solutions proposed included lager farm units, the purchase of sub-marginal lands, cooperative grazing associations, soil conservation districts, farm loans conditioned on approved farming practices, country zoning to protect highly erodible lands, consolidation of governments into more effective units, tax relief during drought, and a permanent dust bowl agency to implement all of this.[94] The application of these policies helped mitigate soil loss and land degradation to a degree, but against the pressure of expansionary commercial agriculture, US agricultural policy fell far short of an adequate solution. The 30s proved a mere

[90] Worster, *Dust Bowl,* 190-192.
[91] Worster, *Dust Bowl*, 195.
[92] United States, *The Future of the Great Plains: Report of the Great Plains Committee*, (Washington, D.C.: Government Printing Office, 1936), 63-65.
[93] Worster, *Dust Bowl*, 193.
[94] United States, *Future of the Great Plains*, 71-121.

momentary lapse in our growth culture; soon the memories and lessons of the black blizzards faded and the southern plains rejoined the nation's expansionary race ahead.[95]

Lessons Learned

There are many various links in the causal chain of the dust bowl, but Worster provides a persuasive argument that 'capitalist' values are a common element for each contributing cause of the dust bowl.

Blaming the dust bowl on a freakishly extended drought implicitly pardons farmers and others with interests in commercial agriculture, because it implies the event occurred by no human fault. Worster makes clear that although drought was a necessary cause, it was not a sufficient one. Droughts have come and gone through the southern plains for millennia without such a disaster. Tree ring evidence in Nebraska has shown the semi-regularity of extended droughts, including one lasting 26 years in the 16th century.[96] The destruction of the native sod, in favor of cultivated land combined with drought and high winds (common occurrences on the southern plains) physically created the dust bowl [97] – not drought alone.

The economic and political forces that contributed to the destruction of native sod in an area ill-suited for agriculture were the advent of industrial technology, Jeffersonian public policy (Homestead Acts), and capitalistic growth culture. Worster discounts the independent roles of both industrial technology and the Homestead Acts by arguing that each contributed to the dust bowl only because they occurred within a capitalistic growth culture.

The film, "The Plow That Broke the Plains" (1936), made by Pare Lorentz for the Farm Security Administration, blamed the dust bowl on the advent of industrial machinery, yet paradoxically concluded that the same technology could be utilized responsibly, post-New Deal. And so Worster argues, the more fundamental cause of

[95] Worster, *Dust Bowl*, 197.
[96] Worster, Dust Bowl, 75
[97] Worster, *Dust Bowl*, 42.

the dust bowl was the kind of farming practiced with this machinery, or even more fundamentally, the cultural values determining those farming practices. He writes, "The attitude of capitalism – industrial and pre-industrial – toward the earth was imperial and commercial; none of its ruling values taught environmental humility, reverence, or restraint. This was the cultural impetus that drove Americans into the grassland and determined the way they would use it."[98] Worster argues that the advent of the tractor and industrial farm machinery in the early 20th century were never pure technological advances in practice, but were only ever technological advances in the hands of a commercialized society. Technological advancement in itself could never have led to the dust bowl. Instead, *industrial capitalism* – mechanized process combined with investment, for a profit, led to the dust bowl. [99]

Although the Homestead Acts and the related Jeffersonian ideals of an expansionary agriculturally based democracy were necessary causes for the creation of the dust bowl, Worster blames the capitalist ethos as more fundamental. One might argue that Jeffersonian ideals are responsible for the dust bowl in the same way as the capitalist ethos; they were both underlying cultural values. And just as the capitalist ethos is problematic in it's drive for growth and disregard for ecological limits, Jeffersonian ideals would evolve over the 19th and 20th centuries into a cultural attitude of expansionary optimism, occasionally spouting pure lunacy, assuming that rain would follow the plow and that there exist no deserts, only lands not yet tamed by man.[100] It was this misplaced confidence in westward settlement that resulted in a severe imbalance between the farmer and the ecology of the plains. The Homestead Acts (of 1862 and the enlarged version in 1909 that made available the southern plains) were entirely Jeffersonian and without this land policy, the surge of settlement and destruction of the native sod between 1910 and 1930 would not have occurred nearly so rapidly.[101] In this sense, the Homestead

[98] Worster, *Dust Bowl,* 97.
[99] Ibid.
[100] Worster, *Dust Bowl*, 81-82.
[101] Worster, *Dust Bowl*, 87.

Acts were the greatest political force that contributed to the dust bowl. However, Worster diminishes the blame on Jeffersonian ideals, stating,

> Both [Jefferson's expansionary democracy and capitalism] were expressions of the same self-minded, individualistic dynamism that ignored complex ecological realities. But the capitalist ethos was by far the more important, for it replaced man's attachments to the earth, which Jefferson still cherished, with an all out dedication to cash, it replaced a rural economy aimed at sufficiency with one driving toward unlimited wealth.[102]

Had Jeffersonian ideals of an agricultural democracy been present in a society without the capitalist ethos, the speculative commercial growth in agriculture that led to the dust bowl would never have occurred.

Droughts had occurred many times on the southern plains without ecological catastrophe; it was only once settlers exchanged the native sod for cultivated acreage that the dust bowl became possible. Native sod was quickly exchanged for cash crops because the commercial agriculture of America in the early 20th century possessed the advent of industrial agricultural technology and the still growing legacy of Jeffersonian land policy. Thus, Worster comes to the conclusion that the fundamental cause of the dust bowl was commercial agriculture. Commercial agriculture is a manifestation of capitalistic culture, driven primarily by a desire for extracting greater wealth from the soil. The dust bowl was not a freak environmental disaster that unexpectedly and unavoidably wrought disaster upon the Great Plains, but was instead the predictable result of an American capitalist culture upon the land, which promoted ecologically destructive farming practices.[103]

To be clear, blaming cultural values greatly diminishes the blame on individual farmers within that culture. If the problem was the individualistic expansionary growth culture, then the US agricultural market was simply an

[102] Worster, *Dust Bowl*, 97.
[103] Worster, *Dust Bowl*, 4.

expression of this culture, and farmers, the individual producers, were merely performing the functions of the market. Individual farmers were responding to the market, which was trending towards larger and more efficient farming, while overproduction pushed farmers into expanding the farm in order to stay financially solvent. Short run market forces dominated the decision making of farmers. There was certainly an element of greed and shortsightedness, but it wasn't as if urbanites were any more constrained in their commercialism during this era. Worster sees the simultaneous events of the dust bowl and the Wall Street collapse as products of a common cause: "a common economic culture, in factories and on farms, based on unregulated private capital seeking its own unlimited increase."[104] Individual farmers became little more than cogs in the wheel of US and international markets.

Worster's *Dust Bowl* is an explicit argument that the capitalistic values of American culture caused the dust bowl. In contrast, Timothy Egan's book, *The Worst Hard Time: The Untold Story of Those Who Survived the Great American Dust Bowl* is less of an argument for what really caused the dust bowl (though he takes up that question as well), but more of a defense of those who lived through the dust bowl. Revealing the personal accounts of various farmers and rural communities, Egan makes it clear how "settlers lacked both the knowledge and the incentive necessary" to avoid the mistakes which led to the dust bowl. Egan identified the Homestead Acts, technological changes and speculative agricultural investments, as the institutional forces, which led to the dust bowl. More land was continuously plowed up into the 1930s, first *incentivized* by high grain prices from increased wartime demand during WWI, then by increased production capacity from mechanized farm equipment. As oversupply ensued and prices dropped, individuals were *incentivized* to produce more in order to cover their operating costs and pay off mortgages on new machinery. In 1929, farmers needed, on average, three times the biggest allotted homestead in order to simply cover operating costs.[105] When the market became oversaturated, it was economical for farmers to leave fields uncultivated,

[104] Worster, *Dust Bowl*, 44.
[105] Egan, *The Worst Hard Time,* 82.

bare and susceptible to wind erosion. In these ways, individual farmers were reactionaries to larger institutional forces, not the primary causes of the dust bowl.[106]

Worster provides a compelling theory for why the dust bowl happened, but on the topic of alternatives or solutions, his direction is vague and a bit muddled. To do so, as a historian, would be more than is expected of him, yet simultaneously, it feels unfair to argue against commercial agriculture without providing some suggested alternative. Of course he suggests a revision of cultural values, but exactly what that looks like is left very vague – some 'intermediate ground' between unregulated capitalism and socialist state-owned agriculture. Although he quotes Karl Marx's, *Capital* in the epigraph of his introduction - "All progress in capitalistic agriculture is a progress in the art, not only of robbing the laborer, but of robbing the soil" - Worster is not a Marxist himself. In the afterword of the 2004 edition of *Dust Bowl* he writes, "I never intended… to offer a 'Marxist' interpretation of Great Plains history, for after all, Marx missed quite a few things and turned out to be a bad prophet."[107]

Worster distances himself from the philosophy of Karl Marx primarily because he appears unwilling to entirely abandon the system of private property in agriculture. I think this is why he evokes Lewis Gray, the New Dealer who hoped to salvage privately owned commercial agriculture through careful government oversight. Unlike any other person in his historical account, Worster frames Gray in a very positive light, as an especially forward thinker in his time. But Worster also suggests that Gray's intermediate ground between capitalism and socialism became too moderate to be wholly effective; it failed to establish any real control over the industry in terms of stemming its commercial drive for growth. This was proven when commercial interests from within overcame the decentralized, county soil conservation committees. Worster recognizes the influence and ability of private

[106] Egan, *The Worst Hard Time, 268-269*
[107] Andrew C Isenberg, edit. *The Oxford Handbook of Environmental History*, Oxford: Oxford University Press, 2014.

capitalistic competition to derail obstacles in the way of financial growth. By pointing out the shortcoming's of Gray's policy's, Worster implies that in order for this 'intermediate ground' to be successful, it must be more aggressively anti-free-market than what the New Deal established. In my opinion, Worster is necessarily vague on alternatives and solutions, because from his stance - that capitalist values must go – the logical solution is the dissolution of private capital in agriculture, a step that he is not willing to take.

There are important lessons that can be drawn from the dust bowl years and agricultural policy in the 1930s; lessons that can be applied toward practical policy solutions in the 21st century. One such lesson is that farmers will often prove defensive and resistant to policy reform. There were two kinds of defensiveness from farming during the dust bowl: defensiveness for the sake of the whole industry and status quo, and defensiveness for the sake of personal fault and responsibility.

During the dust bowl farmers became defensive about modern agriculture in general and its common practices. As evidence mounted that their agricultural practices were not in harmony with the environment, many farmers clung to the belief that their way of farming was unproblematic. The farmers of the southern plains were optimists: optimistic that dry land farming would be successful; optimistic for one's own land and a faith that its produce would send them up the social ladder; optimistic that the land existed only for their cultivation, that there would be no consequence for destroying the natural ecology; optimistic that tomorrow would always bring greater riches. The black blizzards seriously challenged such optimism and contradicted the plainsmen's thinking; nature would not yield unlimited riches so easily. How did farmers respond to such a challenge? Worster says, "Changes in attitudes did occur, to be sure, but the most incredible fact of the dirty thirties was the tenacity of bourgeois optimism and its imperviousness to all warnings."[108] The black blizzards suggested that the southern plains were no place for farming. People are never so eager to accept that their way of life is flawed. Worster generalizes the progression of local attitudes as: never

[108] Worster, *Dust Bowl*, 28.

anticipating a serious drought during settlement, underestimating the seriousness of the drought once it started (keeping faith in a better tomorrow), denying its seriousness and defending the value of their home region, asking for limited help, but then demanding federal aid quickly when and where they want it without strings attached, supporting only optimistic politicians and ever denying the need for radical reform, and grudgingly accepting the aid that is given while bitterly awaiting the day when the plains are 'normal' and prosperous again.[109] Farmers in the 1930s never wanted reform, only 'relief'. Worster frames it as a matter of pride. 'Relief' implied they had done no wrong but were simply overcome by some natural disaster. Worster writes, "Intense pride in themselves and their achievements, which is the natural emotion of a frontier community, nonetheless required that the asking be severely constrained: there was to be no confession of failure; work was infinitely preferable to the dole; relief was to be only a temporary arrangement."[110]

The dust bowl also illustrated a personal defensiveness in response to blame. If the defensiveness of farmers for their industry in general was ever overcome, there was also a personal defensiveness against any blame for the dust bowl or for the fracture between agriculture and ecology. Not just for farmers, but also for every individual immediately responsible for some questionable industry practice, there will always be this kind of personal defensiveness. If Egan's argument is accepted, the personal defensiveness of farmers during the 1930s was legitimate. Farmers were primarily reactionaries, sailing in the direction of the economic winds, performing their function as commercially competitive units. In this sense, none the individuals were fundamentally responsible. But 'bailing out' the whole industry because the individuals appear innocent becomes practically complicated, because of the long run consequences. Providing relief and implementing policies that salvaged US agriculture in the 1930s was like a patch-job on broken or fundamentally flawed system. Private enterprise was still far from internalizing the externalities of its practices and respecting ecological limits. Also, it seems unfair to

[109] Ibid.
[110] Worster, *Dust Bowl,* 43.

always pawn off the responsibility of farmers to greater institutional incentives – maybe farmers who were still plowing virgin lands in 1930s weren't really so guilty because they were desperately trying to avoid bankruptcy, but what about the land grant agents and farmers who were antagonistic towards Dr. Gray's localized soil conservation committees in the 1940s? Where does personal accountability come into play? For the practicality of policy makers, often it does not.

Both kinds of defensiveness (for the status quo of farming, and for personal responsibility) are unsurprising. Whether its farmers in the 1930s, or today, people tend to not like to be told how to farm by the government. This contradicts their political ideals of American economic liberty. Bennett, Gray, and the other New Deal conservationists aimed to construct a conservation oversight system that would be amenable with these ideals of American economic liberty through the use of voluntary soil conservation districts. The idea was that coercing farmers into implementing conservation on private land wasn't an appropriate role for the federal government, and that locally run committees would be better suited for conservation oversight. Even on the local scale, voluntary conservation compliance failed to include every private farm in the way that Bennett's ideal comprehensive conservation program would, or in the way that Dr. Gray's intermediate ground hoped to do. The dust bowl illustrates how people generally resist when the government, or their peers, tells them precisely how to farm. For this reason, tax incentives should be a more practical policy than conservation compliance through unpopular, subjective, and corruptible localized oversight. With a soil erosion tax, farmers are free to be defensive and continue their way of farming if they wish, but will pay higher taxes accordingly.

Another important lesson to be learned from the dust bowl is that farmers, like everyone, follow the path of economic incentives. Indeed, there are exceptions, where farmers choose to implement costly conservation practices for the sake of good stewardship. But such approbation should not be expected. Whether this is an eternal fact, or limited to our capitalistic culture is irrelevant for the purpose of this thesis. The revision of our cultural values, to suddenly remove profit-seeking

behavior from agriculture, is a highly impractical political solution, despite whether or not it is ideal.

The problem of how to incentivize conservation has been around since the SCS began demonstrations in the 1930s. For these demonstrations, the SCS would buy or rent out eroding land from farmers, then bring in the experts who would implement all of the available conservation measures for reducing erosion: contour cultivation, strip cropping, terracing, stopping gullies, etc. The SCS then advertised around the area – come see and learn how to make a conservation plan for your own farm. The demonstration projects certainly helped promote awareness and exposure of conservation farming, but they did little for the actual implementation of these practices on private farms. Individual farmers were busy with their own farm, and not eager to take on additional conservation projects that required expensive heavy machinery and technical expertise that most farmers lacked.[111] This is the fundamental challenge of conservation policy: how to apply conservation onto privately owned land. Clearly, demonstrations alone were not enough, and so the policies of the SCS quickly evolved into incentivizing land retirement and the Agricultural Conservation Program (ACP) was created. Then, the SCS implemented the grassroots democratic system of soil conservation districts in order to promote local involvement and support. This system has proved effective at increasing farmers' involvement in conservation, to a degree, but it relies on voluntary involvement and there is still no means for coercing farmers that choose, often for financial reasons, not to practice the most advanced conservation agriculture.

The simple fact is that farmers and agribusiness are profit-seeking producers in the market. If the political impracticality of legislation that totally defies or constrains the economic interests of farmers has not already become apparent from examining the dust bowl, a brief examination of modern farm policy since then in Part B of this essay, will reinforce the fact that policies enacted by US Congress almost always are within the financial interests of farmers. US farm policy has

[111] Douglas Helms, "The Preparation of the Standard State Soil Conservation Districts Law: An Interview with Philip Glick," USDA SCS, Economics and Social Sciences Division, (1990), 13.

historically been a policy of providing economic security, and also global advantage to US farmers. Existing conservation policies certainly utilize incentives, but they do so in a piecemeal way and are often underfunded. A soil erosion tax could prove a more effective and streamlined policy for incentivizing conservation practices.

The history of the dust bowl illustrates the reality and even law-like nature of economic competition. The conservation policies of the 1930s fell short of conditioning agriculture in equilibrium with the ecology primarily because of economic competition. Karl Marx didn't believe that a revolution of the proletariat was possible on a local level, because wherever such a revolution happened, it would be at an economic disadvantage to whatever neighboring nation squeezed the maximum productivity out of its land and labor. That is why he rallied for the workers of the *world* unite, because he could think of no defense against more industrial and productive societies. Economic competition is the modern mode of nature's law. Be fit or die; be price competitive or go bankrupt. Economies of scale are a reality, and there are propensities for agricultural units of industrial efficiency. The drive for commercial competition tends to ignore obstacles to short-run profit, such as ecological limits and long run externalities. The tenacity of private competition to always grow in wealth is difficult to stem. And when the nation drives ever onward in economic growth, how can the farmer not be expected to do the same? To paraphrase George Steinbeck from the *Grapes of Wrath*, 'When the monster stops growing it dies. It can't stay one size.'

Worster reinforces this idea of economic competition as the modern law of nature and the pioneers of industry dragging everyone else along behind them. He does so especially when he highlights another wind erosion disaster that occurred in the late 50s and early 60s in the USSR. Food production had been falling behind demand and so Nikita Khrushchev, the Soviet Premier, ordered the collectivist farms to plow 40 million hectares of semi arid grasslands. Droughts soon lead to wind erosion, damaging 17 million acres. His decision led to widespread criticism for his disregard of the local ecology. In his defense he wrote, "Put Comrade Barayev [the critic] into conditions of capitalistic competition and his farm, with its present system of plantings, probably would not survive. Could he ever compete with a large

capitalist farm if he keeps 32 percent of his plowed land in cleaned fallow?"[112] There is a propensity for agricultural practices that are most immediately productive, regardless of long-run sustainability. If markets become oversupplied from too much production, prices will drop and farm units that produce relatively less – perhaps because they behave responsibly by alternating cultivation with clean fallows instead of using chemical fertilizers, consequently reaping smaller profits – are the first to go bankrupt on the crash course to market equilibrium. The tendency of the market to reward price competitiveness and ignore ecological externalities is why the authors of, *A History of World Agriculture*, concerned with the ecological trajectory of global agriculture and land degradation, call for the end of the "international agricultural price war."[113] Arguably, agriculture is a unique industry and we cannot afford to be swayed by the whims of price competition when it is the livelihood of farmers and the soil resources of all consumers at stake.

Ultimately, the dust bowl illustrates the paradigm between private enterprise in agriculture and ecological limits. Individual farmers in the market react to short run market forces in ways that often ignore long run ecological externalities such as soil erosion. An appropriate policy response to the dilemma of how to address conservation practices on privately owned land is that of Lewis Gray; aiming to establish some intermediate ground between unregulated capitalism and state owned socialism. State owned socialism might be undesirable for some ideological reasons, but it is appealing because the central authority could then easily regulate land use without worrying about violating the ownership rights of farmers and landowners. Unregulated capitalism is appealing in the sense that it the path of least political resistance; farmers in the US generally prefer to go unregulated. Gray sought to establish an intermediate ground between the two by establishing conservation compliance through localized community oversight. This method for coercion proved ineffective in practice, as there was never enough local political support and the committees eventually dissolved. Worster suggests that

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[112] Worster, *Dust Bowl,* 7

[113] Marcel Mazoyer and Laurence Roudart, *A History of World Agriculture: From the Neolithic Age to the Current Crisis,* (New York: Monthly Review Press, 2006).

Gray's intermediate ground failed because it was too moderate, too close to unregulated capitalism, but really, it failed because it was not a pragmatic policy approach, it depended upon local grassroots involvement, something there was no political momentum for. It isn't that we need an intermediate ground that is more liberal, or more conservative – we need a conservation policy that accepts the political climate and implements a policy that does not require active grassroots political involvement. A soil erosion tax would be successful where voluntary conservation compliance has failed, because its implementation does not rely on the enthusiastic involvement of farmers.

Part B

Agricultural Policy Reform: The Argument for a Soil Erosion Tax

Practicing agriculture has always been an ecological challenge. The first section of Part B will examine a brief account of the failed agricultures of expired civilizations, and then examine the 'permanence' of modern agriculture. To be sure, the practice of agriculture often leads to land degradation generally. Soil is a complex resource and its degradation often comes in the form of soil organic matter (SOM) loss, increased salinity, acidification, nutrient depletion, and the decline of microbial activity. However, for the practicality of this essay, the 'permanence' of agriculture is weighed in terms of soil erosion. How much soil volume is retained under the practice of agriculture? Following the archeological account of failed agricultures, the rest of Section One examines our current understanding of soil formation rates and soil erosion rates – the improved understanding of each is fundamental to accurately gauging the sustainability of ongoing farming practices. Section One concludes by pointing out farming practices that improve soil erosion and soil formation rates. The greater implementation of these conservation practices must be the end-goal of any government conservation policy.

Before moving on to the policy suggestions of Section Three, Section Two lays out a brief history of US farm policy. The history of modern US farm policy

reinforces some of the lessons from the dust bowl, and also illustrates the purpose, as well as the necessity and complexity of US agricultural policy. Understanding the failed attempts of conservation policies in the past and the general role that farm policy plays is critical in order to justify any agricultural policy for the present and future.

Section Three of Part B then lays out the prescribed policy solutions towards reconciling the fracture between private enterprise farming and ecological limits. A soil erosion tax is a practical means for incentivizing the greater implementation of conservation practices in order to improve soil erosion and formation rates to that of a permanent agriculture. Section Two shows that the traditional approach of conservation policy has been a mostly ineffective paradigm and warrants a new approach. Therefore, I argue that conservation policy ought to employ a Pigouvian Tax strategy in order to internalize the externalities of soil erosion. Section Three examines the practicality and ramifications of such a soil erosion tax.

Section 1: A Permanent Agriculture

1.1 US Farming in an Archeological Context: Another Attempt at a Permanent Agriculture

Agriculture has always been a precarious endeavor. The dangers of accelerated soil erosion due to agriculture have been recognized since at least the time of Plato and Aristotle.[114] Many more recent studies suggest a strong association between soil erosion and the decline of civilizations.[115] In 1938 and 1939, Walter Clay Lowdermilk, Assistant Director of the USDA Soil Conservation Service and colleague of 'Big' Hugh Bennett, surveyed the lands of England, Holland, France, Italy, North Africa, and the Near East, in the interests of learning from the history of

[114] David R. Montgomery, *Dirt: The Erosion of Civilizations*, University of California Press (2007), 51.
[115] **See**: T. Beach, N. Dunning, S. Luzzadder-Beach, D.E. Cook, J. Lohse, "Impacts of the Ancient Maya on Soils and Soil Erosion in the Central Maya Lowlands," *Catena* 65 (2006), 166-178. **Or** Tjeerd H. van Andel, Eberhard Zangger, Anne Demitrack, "Land Use and Soil Erosion in Prehistoric and Historical Greece," *Journal of Field Archeology* Vol. 17 (1990), 379-396.

others and establishing a permanent agriculture in our relatively young nation.[116] Lowdermilk's account of the history of agriculture, soil erosion and the decline of civilizations, specifically in the Near East (today this is Israel, Syria and Lebanon) are especially haunting, and his broad analysis of agriculture extremely insightful.

Lowdermilk saw the world with the eyes of an agricultural archeologist reading the stories of ancient civilizations written on the land. He believed that the partnership between farmers and the land is the rock foundation for every civilization. Efficient agriculture was the birth of human civilization, for once food is produced without demanding all available labor, individuals begin to specialize in various crafts, and exchange the goods they produce for food instead. And as food production becomes more labor efficient, the division of labor continues to develop into that of a complex civilization. [117] In accredit of modern civilization and its rock-foundation, modern agriculture is indeed extremely labor efficient. In 2006, a common industrialized American farm operates at an average of 480 acres/worker/year.[118]

Lowdermilk noted that throughout human civilization, failures in establishing a permanent agriculture have been more frequent than successes.[119] Archeologists believe that the birth of human civilization happened approximately 7000 years ago in the fertile plains of Mesopotamia and the Valley of the Nile where irrigation and tilling allowed for more efficient agriculture. On Mesopotamia, Lowdermilk writes,

> For at least 11 empires have risen and fallen in this tragic land in 7,000 years. It is a story of a precarious agriculture practiced by people who lived and grew up under the threat of raids and invasions from the denizens of grasslands and the desert, and of the failure of their irrigation canals because of silt.[120]

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[116] W.C. Lowdermilk, *Conquest of the Land Through Seven Thousand Years*, U.S. Department of Agriculture, Washington D.C. (Issued August 1953, reviewed and reprinted August 1994).
[117] Lowdermilk, *Conquest of the Land Through Seven Thousand Years,* 2.
[118] Mazoyer and Roudart, *A History of World Agriculture, 17.*
[119] Lowdermilk, *Conquest of the Land Through Seven Thousand Years*, 2.
[120] Lowdermilk, *Conquest of the Land Through Seven Thousand Years*, 4.

Muddy irrigation canals would slow their flow over time due to the build up of sediment. As these irrigation canals expanded into vast systems, it required an ever-greater labor force to keep the canals from choking up with silt. The ruling empires kept slaves for the task of digging out the canals, such as the biblical Israelites: "By the rivers of Babylon we sat and wept when we remembered Zion." (Psalm 137:1). Unlike other failed agricultures around the world, the decline of Mesopotamia was not due to soil loss from erosion, but instead the fragile irrigation system proved their demise when wars or other disruptions took place. Lowdermilk posited that, "Mesopotamia is capable of supporting as great a population as it ever did and greater when modern engineering makes use of reinforced concrete construction for irrigation works and powered machinery to keep canal systems open."[121] Similarly, Lowdermilk suggested that farming in the Valley of the Nile has remained suitable for about 6000 years because soil erosion has been essentially a null issue – the annual flooding of the river spreads thin layers of silt from the uplands over the valley depositing new fertile soil.

Lowdermilk contrasts the relatively successful agricultures of the Nile and Mesopotamian river valleys (ancient farmland that still contains fertile soil) with the more mountainous lands of Israel, Syria and Lebanon. His survey of the land of Sinai, where Moses and his Israelites supposedly wandered with their herds of grazing animals for 40 years, found the epitome of desolation by accelerated soil erosion. Brown hillsides had been severely eroded into deep ephemeral gullies, often down to rock.

Throughout Israel, Lowdermilk found that the land of milk and honey had been degraded over the centuries. The red soil of the area has washed away in many places down to bedrock. Agriculture is still practiced in the valleys where the soil has washed into, but with every hard rain, more soil flows away through great ephemeral gullies. In the sloping lands around Jerusalem, agriculture remained practiced in the areas where large stonewalls formed terraces to prevent erosion.

[121] Lowdermilk, *Conquest of the Land Through Seven Thousand Years*, 5.

However, even where these careful practices have been implemented, the damage of thousands of years of grazing and cultivation is clear.[122]

In Syria and Jordan, Lowdermilk found even greater desolation and evidence that the agriculture of an ancient civilization had worn upon the land until the soil was utterly exhausted, marking the expiration and desertification of their once bountiful land. He writes,

> Still farther to the north in Syria, we came upon a region where erosion had done its worst in an area of more than a million acres of rolling limestone country between Hama, Aleppo, and Antioch. French archaeologists, Father Mattern, and others found in this man-made desert more than 100 dead cities.[123]

The scattered ruins of these small cities suggest that this land was once fertile, until overgrazing or excessive tilling resulted in extreme soil erosion, decimating the civilization of these hill-peoples.

Lowdermilk also examined similar stories of success and failure in North Africa and Europe, and then looked towards the application of learned lessons in the US. Essentially, Lowdermilk found that where there are slopes, erosion eventually compromises the ability to practice agriculture. In 1953, he warned of the path on which we were (and still are) trending. He said, because most of our land is somewhat sloped, approximately 300 million acres of our 400 some-million acres of US farmland were eroding faster than soil was being formed. He admitted that we have not yet found a solution to soil erosion but that the application of certain soil conservation practices, like leaving a layer crop residue to cover the soil, can improve our rates of soil erosion. In the words of Lowdermilk, "Here clearly is our objective for a permanent agriculture, namely, to safeguard the physical body of the soil resource and to keep down erosion wastage under cultivation as nearly as

[122] Lowdermilk, *Conquest of the Land Through Seven Thousand Years*, 7-8.
[123] W.C. Lowdermilk, *Conquest of the Land Through Seven Thousand Years,* 7.

possible to this geologic norm of erosion under natural vegetation."[124] The policy recommendations of this essay maintain this same objective.

1.2 A Tolerable Rate of Soil Loss

More than half a century since Lowdermilk's report, soil erosion rates have improved, but agriculture in the US remains far from 'permanent'. One can simplify the issue with the following mathematical expression:[125]

$$T_c = S/(E - F)$$

Where: T_c = critical time, S = initial soil thickness, E = soil erosion rate, F = soil formation rate

A permanent agriculture would operate with an erosion rate equivalent to the formation rate – we can only afford to lose soil at the rate it is renewed. Establishing a permanent agriculture then requires data on both the erosion rates under cultivation, and the rate of soil formation in order to balance our E-value against our F-value. The problem is that there is an extreme dearth of data necessary for estimating each value and for determining a tolerable rate of soil loss.

1.3 Soil Formation Rates

The contemporary literature is extremely muddled in its references when it comes to soil formation. Leonard C. Johnson comically points that most authors today cite David Pimentel et al. "Land Degradation: Effects on Food and Energy Resources" (1976) on the rate of soil formation, but Pimentel et al. in fact cited David Hudson (1971)[126] (Pimentel and Hudson were fellow professors at Cornell),

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[124] Ibid, 26.
[125] David R. Montgomery, "Soil Erosion and Agricultural Sustainability," *Proceedings of the National Academy of Sciences of the United States of America vol. 104 no. 33* (2007), 13271, Accessed February 7, 2016, doi: 10.1073/pnas.0611508104.
[126] Norman Hudson, *Soil Conservation* (Ithaca, NY: Cornell University Press, 1971).

who in turn referenced 'Big' Hugh Bennett's magnum opus, *Soil Conservation.* [127] Bennett's values were admittedly speculations. Pimentel et al. also cited others who, Johnson argues were of little significance to Pimentel's conclusion that soil is formed under natural conditions at a rate of 1 inch every 300 to 1000 years.[128] Hudson then made the references entirely circular in 1981 when the republished edition of Hudson's work cited Pimentel et al. (1976), no longer Bennett (1939) as the source for his soil formation estimates. Pimentel became the go-to expert on soil formation estimates for some and has consequently been discredited by others as an alarmist and for purporting to know what no one knows. [129]

Despite a lack of data, the USDA estimated the rate of soil formation in the 1950s, following the concerns of farmers, the SCS and men like Lowdermilk and Bennett. The established soil loss tolerance levels became known as 'T-values'. T-values supposedly represent the rate of soil formation and therefore the tolerable rate of soil loss for a permanent and sustainable agriculture. Generally, soil conservation programs establish T values at 5 – 12 tons/hectares/year - equivalent to .4 to 1 mm/year of erosion (assuming a soil bulk density of 1.2g/cm^3).[130] T-values are assigned site specifically and are dependent on the soil depth.[131] If these T-values are supposed to stand for the rate of soil erosion that is equivalent to soil formation, the claim is that soil forms 1 inch every 25.4 to 63.7 years. The accuracy of these T-values, as well as the economic and political motivations behind their establishment, has been highly contested.[132]

David Montgomery of the University of Washington finds in his 2007 study that in fact, T-values are roughly ten times greater than the rate of soil

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[127] H.H. Bennett, *Soil Conservation*, (New York: McGraw-Hill, 1939).
[128] David Pimentel, et al., "Land Degradation: Effects on Food and Energy Resources," *Science* Vol. 194 (Oct. 1976), 149-155.
[129] Leonard C. Johnson, "How Rapidly Does Soil Formation Occur and Who Knows?" *Journal of Soil and Water Conservation* Vol. 62.3 (May-June 2007), 44A.
[130] D.L. Schertz, "The Basis for Soil Loss Tolerances," *The Journal of Soil and Water Conservation*, Vol. 38 (1983), 11.
[131] Cox et al., *Losing Ground*, 23.
[132] D. Keeney and R. Cruse, "The Connection Between Soil Erosion and Sustainable Agriculture," in *Advances in Soil and Water Conservation* ed. By F.J. Pierce (Chelsea, MI: Ann Arbor Press, 1998), 185-194.

production.[133] Montgomery admits the contentions of soil scientists on this topic have so far remained compromised by a lack of data and so he compiled 201 various different studies over recent years (excluding most sediment yield studies, which he finds an inaccurate method for estimating soil erosion) and attempts to empirically ground some general claims about soil erosion and formation. Montgomery's data supports the claims that geological erosion rates and the soil formation rates are indeed roughly equal on non-cultivated land, except in very steep terrain where the geological erosion rate is higher. Therefore, most terrain can sustain a certain layer of topsoil overtime. His results found that gentle slopes ("cratons") have geological erosion rates between .0001 to .01 mm/year (3.94×10^{-6} to .000394 inches/year), moderate slopes ("soil-mantled terrain") have geological erosion rates between .001 and 1 mm/year (3.94×10^{-5} to .0394 inches/year), and that steep slopes ("alpine") have geological erosion rates between .1 and >10 mm/year (.00394 to >.394 inches/year).

However, classifying soil formation rates in respect to terrain, slope, and geological erosion rates alone ignores many of the fundamental aspects of soil formation. The University of Minnesota Extension website lists the following as the five soil-forming factors: 1) parent material, that is the original geologic material from which the soil is formed; 2) climate; 3) the slope and terrain; 4) The organisms that live on or in the soil; 5) The duration during which the other four elements have interacted.[134] And so soil formation rates not only contingent upon the slope and terrain, but also (perhaps more fundamentally) contingent upon the parent material, climate, and living organisms involved. For the decision making of farmers already operating on some given land, the geologic parent material and climate are relatively unchangeable[135], and so arguably the most important factor of farmers

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[133] Montgomery, "Soil Erosion and Agricultural Sustainability," 13271.
[134] J.L Anderson et. al., "Soils and Landscapes of Minnesota," *University of Minnesota Extension Website*, Accessed March 9th, 2016, http://www.extension.umn.edu/agriculture/tillage/soils-and-landscapes-of-minnesota/.
[135] Climate can change and is changing at rates that are rapid relative to the geologic time scales of soil formation, which is problematic. Nonetheless, climate is not a practical factor to focus on in order to improve soil formation rates.

and policy makers to adjust and improve soil formation rates is factor four, the organisms that live on or in the soil.

The fourth soil-forming factor refers to the microscopic ecosystem of microorganisms and the plant material that grows from the soil, as well as the insects, worms, and burrowing animals that live in that ecosystem. In a forest, the soil formation rate depends on the decomposition of the forest litter. In a cultivated field, the soil formation rate depends on the decomposition of crop litter. The soil formation rate of any given field is dependent on the crop residue management practices, however crop residue like corn-stover has economic value as an animal forage source[136] or as a biofuel feedstock[137]. So every corn farmer must decide how much corn-stover to keep on the field as a crop litter in order to renew soil biomass and organic matter, and how much to harvest for forage and feedstock. Richard Hess and Doug Karlen et al. take up the feedstock question, concerned about the loss of SOM but recognizing the reality of market forces, which incentivize farmers into selling their corn-stover to ethanol producers. They conclude that sustainable corn-stover removal rates, that is, the amount of crop litter necessary to maintain a healthy SOM and prevent soil erosion, are usually below 40% of total corn-stover.[138] But regardless of market forces, it's important to recognize the role that crop residue plays by preserving SOM and contributing to general soil health. Conservation farming must not only consider how to lower the rates of soil erosion, but also how to increase the rates of soil formation.

1.4 Soil Erosion Rates

[136] V. C Kennedy et al., "Supplementation of corn dried distillers grains plus solubles to gestating beef cows fed low-quality forage: I. Altered intake behavior, body condition, and reproduction," *Journal of Animal Science* Vol. 94 No. 1 (2016), 10.2527/jas.2015-9615, http://dx.doi.org/10.2527/jas.2015-9615.

[137] Lin Luo et al., "An energy analysis of ethanol from cellulosic feedstock–Corn stover," *Renewable and Sustainable Energy Reviews*, Volume 13, Issue 8, (October 2009), 2003-2011, http://dx.doi.org/10.1016/j.rser.2009.01.016.

[138] Wally W. Wilhelm et al., "Balancing limiting factors and economic drivers for sustainable Midwestern US agricultural residue feedstock supplies," *Industrial Biotechnology* Vol. 6 No. 5, October 2010, http://online.liebertpub.com/doi/pdf/10.1089/ind.2010.6.271

The USDA has made progress over the past several decades in estimating the rates of soil erosion on agricultural land. Although previous attempts had been made in the early 20th century to express the association between land topography and soil erosion (by water), it wasn't until the 1965 that the USDA developed the Universal Soil Loss Equation (USLE).[139] This equation was revised by Wischmeir and Smith again in 1978, and significantly revised in 1997, creating the Revised Universal Soil Loss Equation (RUSLE). Although the 1997 revision improved estimates, there were shortcomings to the methodology that limited its applicability. USLE and RUSLE equations did very poorly in the short run, because they did not consider soil depositions. A new kind of soil erosion estimate was developed by Flanagan and Nearing of the USDA throughout the 1980s, and finally in 1995, the Water Erosion Prediction Project was documented and validated.[140] WEPP improved upon previous models because of its attention to detail - it includes factors for plant growth, residue management and decomposition rates, water balance (snow, snowmelt, soil saturation), weather generation, tillage, rill and interrill soil detachment, sediment transport and deposition and sediment particle size distribution.[141] RUSLE has recently been revised again so that the most recent evolution of this model is RUSLE 2.[142]

The Iowa Daily Erosion Project (IDEP) is an ongoing collaboration of scientists at Iowa State University, USDA's National Soil Erosion Research Lab, USDA's National Library for Agriculture and the Environment, and the University of Iowa. For the last decade, the IDEP has been working to overcome the challenges on the forefront soil erosion estimates. The IDEP that aims to improve soil erosion estimates across the state of Iowa by focusing on the role of localized heavy

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[139] W.H. Wischmeir, and D.D. Smith, "Predicting Soil Erosion from Croplands East of the Rocky Mountains," *USDA Agricultural Handbook* No. 282 (1965).
[140] D.C. Flanagan and M.A. Nearing, "Water Erosion Prediction Project: Hill slope profile and watershed model documentation." National Soil Erosion Research Laboratory (NSERL) Report No. 10. (USDA – Agricultural Research Service: 1995).
[141] John M. Laflen and Dennis C. Flanagan, "The Development of US Soil Erosion Prediction and Modeling," *International Soil and Water Conservation Research* Vol. 1 Issue 2 (2013). 1-11
[142] The RUSLE equation is as follows:
(predicted loss in tons/acre) = (rainfall erosivity factor) x (soil erodibility factor) x (topography factor) x (cover factor) x (erosion control practices factor)

rainstorms that dramatically affect erosion. Other soil erosion models estimate water erosion by using rainfall averages over the long run, but soil erosion doesn't occur on average; erosion by water occurs when and where it rains. Previous estimates for large areas fail to account so precisely for localized and highly weather variable nature of soil erosion.[143] Richard Cruse and the other scientists at the IDEP argue that soil erosion models like RUSLE and RUSLE2 that use long run precipitation averages significantly underestimate soil erosion because of the extreme volumes of soil lost in heavy storms.[144] And the work of the IDEP will only become more relevant in the future as weather patterns intensify with climate change.[145]

Iowa Daily Erosion Project uses the WEPP model, drawing data from 1997 USDA NRI report for field measurements, and from the Hydraulic Rainfall Analysis Project (HRAP) which uses advanced weather radar technology across the state of Iowa, for precipitation data every 15 minutes in 4 square mile increments. NRI report provides various data points within every township (36 mi^2) but does not specify precisely where each data point is within each township. The IDEP then creates a distribution of possible erosion rates within each township, running calculations with every combination of NRI field specifications against every precipitation measurement in each township. The minimum values of these distributions represent the erosion estimates if the least amount of rainfall in the township occurred on the most well protected and least erodible land, while the maximum values represent the worse case scenario, the greatest amount of rainfall on the most erodible land. Both the minimum and maximum values of the IDEP distributions likely occurred somewhere in that township on that day.[146]

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[143] Craig Cox, Andrew Hug, Nils Bruzelius, *Losing Ground*, Environmental Working Group (Washington: 2011), 11.
[144] J.L. Ballew and E.E. Fischer, "Floods of May 17-20, 1999, in the Volga and Wapsipinicon River Basin, North-East Iowa," *US Geological Survey* Open File Report 00-237 (1999).
[145] Cynthia Rosenzweig et al., "Climate Change and Extreme Weather Events; Implications for Food Production, Plant Diseases, and Pests," *Global Change and Human Health* Vol. 2 Issue 2 (2001), 90-104, 10.1023/A:1015086831467, http://link.springer.com/article/10.1023%2FA%3A1015086831467?LI=true.
[146] R. Cruse et al., "Daily Estimates of Rainfall, Water Runoff, and Soil Erosion in Iowa," *Journal of Soil and Water Conservation* Vol. 61 No. 4 (2006), 192-193

The results of the IDEP are alarming. Erosion is often worst in the spring before planted crops can take root and when the ground is already saturated with snowmelt. A three day storm from May 5-7th 2010, resulted in IDEP soil loss estimates with the most vulnerable land in *every* township eroding at rates greater than the annual T-value (12.35 tons/hectares/year). The most vulnerable land in 10 of Iowa's townships was estimated to have eroded at the rate of 100 tons/hectare/day. It's possible that these values represent only the single worst field of the township. However, it's also possible that these values represent many similar fields. Regardless, these results illustrate the catastrophic effects that a single storm can have on vulnerable land.

Richard Cruse of Iowa State University contends that soil erosion modeling is limited by two major factors: the lack of field measurements (soil type, topography, crop management, conservation practices), and the use of long-run averages for precipitation data.[147] Although the IDEP does much to overcome the challenges of precipitation data and the weather dependent and localized nature of soil erosion, it still faces the problem of a lack of site-specific field data. Soil scientists constructing erosion models over vast areas don't have nearly enough field measurement data. Surely databases within the USDA exist, such as the 1997 NRI report used by the IDEP, but such resources prove far more useful in garnering data on the soil type which is generally more consistent across a township, than on the site specific topography, and annual farming and conservation practices.[148]

Besides the lack of field data, another significant barrier to soil erosion models is the failure to account for gullies. All of the major existing soil erosion models estimate sheet and rill erosion, cannot yet account for the formation of daily and ephemeral gullies, channels that form as it rains. In their review of the history and evolution of soil erosion models, Laflen and Flanagan (the lead developer of WEPP), suggests that the next major break through in soil erosion models needs to be an account of these ephemeral gullies.[149] A National Resource Conservation

[147] R. Cruse et al., "Daily Estimates of Rainfall, Water Runoff, and Soil Erosion in Iowa," 192.
[148] Cox et al., *Losing Ground*, 11.
[149] Laflen and Flanagan, "The Development of US Soil Erosion Prediction and Modeling," 11.

Service study in 1997 estimated that erosion from ephemeral gullies ranged 3.01 tons/hectare/year (in Michigan) to 31.62 tons/hectare/year (in Virginia), concluding that if erosion from gullies were included, USLE soil loss estimates would be doubled.[150] Another study in 2008 reported that ephemeral gullies cause a loss of 5.51 to 12.13 tons/hectare/year that remains unaccounted for in our soil erosion models.[151] Farmers are well aware of gullies on their land and many routinely smooth them over or fill them in with additional soil. But this practice only supplies more soil to be washed away in the same way as before. In fact, soil erosion from these the gullies actually worsen over time as they are repeatedly eroded and smoothed over.[152] What is needed is not smoothing the gullies over so that the area can continue to be planted, but instead to plant the area that forms ephemeral gullies into a grass waterway. The NRCS defines grass waterways as, "constructed graded channels that are seeded to grass or other suitable vegetation. The vegetation slows the water and the grassed waterway conveys the water to a stable outlet at a non-erosive velocity."[153] The complication here is that grass waterways make farming more technical and tedious, and come with the opportunity costs of forgone crops. There is ongoing research and development into improving soil erosion models in order to account for gullies, such the study published by in 2014 by Vieira et al.,[154] and the 2016 study by Wells and Cruse et al.,[155] but it will likely be some time before ephemeral gullies are included into mainstream soil erosion models.

In his meta-analysis on soil formation rates and soil erosion rates, Montgomery finds that conventional agricultural erosion rates have a median of

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[150] Cox et al., *Losing Ground*, 14.
[151] L.M. Gordon et al., "Modeling Long-term Soil Losses on Agricultural Fields Due to Ephemeral Gully erosion," *Journal of the Soil and Water Conversation* Vol. 64 No. 4 (2008), 181.
[152] Gordon et al. "Modeling Long-term Soil Losses…," 175.
[153] USDA NRCS Des Moines Iowa, *Grassed Waterway: Iowa Fact Sheet,* accessed April 3, 2016, http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_007306.pdf.
[154] Dalmo A.N. Vieira, Seth M. Dabney and Daniel C. Yoder, "Distributed Soil Loss Estimation System Including Ephemeral Gully Development and Tillage Erosion," *Sediment Dynamics from the Summit to the Sea* (Proceedings of a symposium in New Orleans, December 2014).
[155] Robert R, Wells et al., "A Measurement Method for Rill and Ephemeral Gully Erosion Assessments," *Soil Science Society of America Journal* Vol. 80 no. 1 (2016), 10.2136/sssaj2015.09.0320, http://dx.doi.org/10.2136/sssaj2015.09.0320.

roughly 18 tons/hectares/year and a mean of roughly 47 tons/hectares/year (assuming a soil bulk density of 1.2 g/cm^3). That mean value tends to mirror his values for the geological erosion rates of alpine terrain, not that of the 'cratons' or the 'soil-mantled' terrain on which agriculture is actually practiced. However, due to the tremendous range of environments used in the various studies he draws from, the most reliable data in terms of assessing agriculture's impact on erosion comes from studies which use the same (or comparable) land and observe its erosion under native vegetation and 'conventional' (with tilling) agriculture. From these specific studies, Montgomery finds median and mean values of 18 and 124-fold increase in erosion due to (mostly) conventional agriculture.[156]

1.5 Ways for Farmers to Reduce Soil Erosion Rates

The goal of agricultural conservation policy should be to ensure that farming practices are ecologically sustainable. Practically, this means ensuring that the present market forces make farmers weigh and consider the ecological costs of farming. The fact that farmers discount the long run ecological costs of farming is nothing unique to agriculture; there is tendency for both farmers and other individuals and firms in every industry to discount costs in the distant future. Further, the unsustainability of modern soil erosion rates in agriculture isn't particularly unique in the ancient and ongoing history of exhausted agricultures.

Focusing a conservation policy around a soil erosion tax is advantageous because it directly confronts the issue. Soil erosion is negatively associated with a wide array of conservation practices. There are numerous conservation practices that farmers might implement, but many do not implement every available one due to economic and technical considerations. A soil erosion tax would incentivize all necessary conservation practices in the interest of avoiding higher tax cost.

One category of conservation farming practices is the planting of conservation buffers. Conservation buffers are areas of land in constant vegetation that works to filter runoff and prevent erosion. These vegetative buffers, usually

[156] Montgomery, "Soil Erosion and Agricultural Sustainability," 13269-13270.

some planted grass or alfalfa (which is technically not a grass, but is in the Fabaceae family) stop and slow the movement of sediment downhill and filter out chemicals from fertilizers and pesticides before draining into watersheds. Contour strips are strips of grass or cover crops planted across the middle of slopped fields, slowing sheet erosion as the soil moves downhill.[157] Grass waterways are planted grass strips in the lower crevasses of fields where ephemeral gullies would typically form. Filter strips are grassed margins along the edge cultivated fields and watersheds, and riparian buffers are similar to filter strips but utilize forest cover and trees in addition to grass or cover crops. Conservation buffers have the potential to prevent more than 50% of the loss of nutrients and pesticides, more than 60% of the loss of certain fertilizer pathogens, and up to 75% of sediment loss.[158]

[157] http://www.mda.state.mn.us/protecting/conservation/practices/~/media/Images/protecting/practices/contourbuffer.ashx?w=300&h=353&as=1

[158] "Buffer Strips: Common Sense Conservation," USDA NRCS website, Accessed March 10th, 2016. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/home/?cid=nrcs143_023568

Contour Strips

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Other Conservation Buffers

Cover crops are planted grasses, legumes, and forbs for the purpose of seasonal cover to reduce erosion by wind and water, increasing SOM, recycling and redistributing soil nutrients, weed suppression, and reducing soil compaction.[160] Fall cover crops are an especially important conservation practice. Without fall cover crops, the soil lays bare during in the late fall after harvest and early spring before planting, meaning that the soil is especially susceptible to erosion. More than 50% of annual soil erosion in many temperate areas occurs when frozen soils are

[159] Both images taken from Minnesota Department of Agriculture Website.
Right: http://www.mda.state.mn.us/protecting/conservation/practices/bufferforested.aspx
Left: http://www.mda.state.mn.us/protecting/conservation/practices/contourbuffer.aspx
[160] "Cover Crop," *NRCS Conservation Practice Standard* (2010), 1, Accessed April 6th, 2016, http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_025656.pdf

thawing.[161] It is critical to use cover crops to prevent erosion losses in during this thawing period. The use of fall cover crops and cover crops planted in strips in conjunction with the cash crop throughout the rest of the growing season also helps aeration of the soil, lowering soil compaction and allowing for greater moisture absorption during wet periods, and better moisture retention during dry periods. But perhaps the greatest benefit of using cover crops is their preservation of nitrates. Cover crops pull up nitrates from the soil and store them, preventing the common problem of nitrate leaching that occurs when nitrogen fertilizers wash away and/or leach through the soil, eventually ending up in waterways. Cover crops can store excess nitrogen until they die and begin to mineralize. The decomposing biomass provides the cash crop with additional Nitrogen throughout the growing season.[162]

Conservation practices are implemented to their current extent because there are significant economic advantages that accompany ecological stewardship. Over the decades, the use of conservation practices has significantly improved erosion rates [See figure: Soil Erosion Rates from '82-'07]. However conservation practices are not always implemented and maintained as often as they should. It requires a significant amount of design, engineering, and labor to implement perfect contour strips and grass waterways so that every necessary area of a field is grassed. Also, planting areas of grass instead of crops in the middle of a cultivated field is an opportunity cost. The government program Environmental Quality Incentives Program (EQIP) provides financial incentivizes for the planting of such conservation buffers in order to reduce the costs.[163] But funding for EQIP and other similar programs is generally insufficient.[164] Further explanation on EQIP and current conservation policies are provided in section two.

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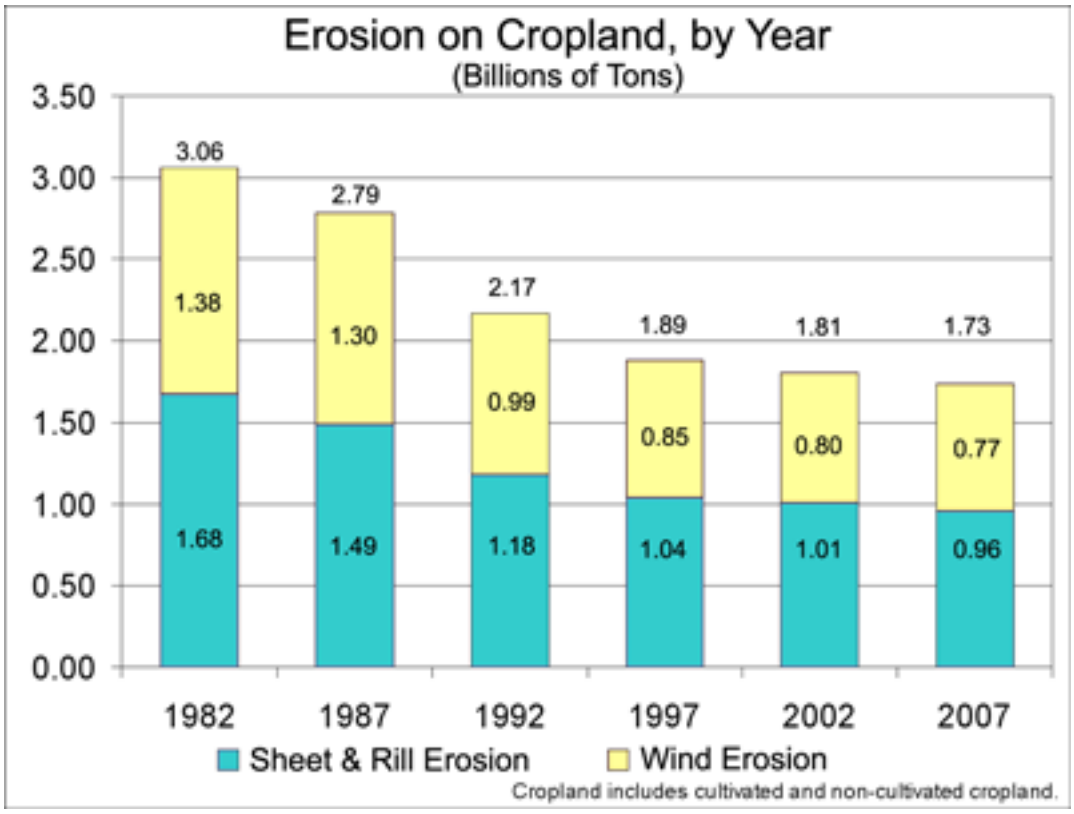
[161] Froese, Jane C.; Cruse, Richard M.; Ghaffarzadeh, Mohammadreza, "Erosion Mechanics of Soils with an Impermeable Subsurface Layer," Soil Science Society of America Journal Vol. 63 No. 6, 1999, 10.2136/sssaj1999.6361836x, http://dx.doi.org/10.2136/sssaj1999.6361836x

[162] Jim Cross, "Cover Crops Reduce Compaction, Erosion, and Nitrate Leaching," *Globe Gazette*, Jan 27, 2016, accessed March 13th, http://globegazette.com/cover-crops-reduce-compaction-erosion-and-nitrate-leeching/article_66c3aa68-6350-5f7b-a8a4-abe81b30c94c.html

[163] "Buffer Strips: Common Sense Conservation," USDA NRCS website, Accessed March 10th, 2016.

[164] "Environmental Quality Incentives Program" *National Sustainable Agriculture Coalition Website,* Accessed March 13, 2016,

Soil Erosion Rates from '82-'07[165]



The significantly improved erosion rates under no-till farming is a silver lining in the results of Montgomery's meta-analysis of soil erosion and formation rates. No-till involves leaving the soil structure intact (not tilling it) and letting the crop residue that remains after harvest lay on the surface rather than incorporating it. No-till has become increasingly popular over the past decades due primarily to the increased yields and productivity that results from healthier soil.[166] No-till was relatively new on the scene in the 1970s, but in 2000, 16% of US cropland was no-

http://sustainableagriculture.net/publications/grassrootsguide/conservation-environment/environmental-quality-incentives-program/

[165] Taken from NRCS article "Soil Erosion on Cropland in 2007," on their website: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/nra/nri/?cid=stelprdb1041887

[166] A. Stuart Grandy et al., "Long-Term Trends in Nitrous Oxide Emissions, Soil Nitrogen, and Crop Yields of Till and No-Till Cropping Systems," *Journal of Environmental Quality* Vol. 35 no. 4 (2006), Accessed April 6th, 2016, http://dx.doi.org/10.2134/jeq2005.0166

till.[167] Globally No-till has grown from about 45 million hectares in 1999, then 72 million ha in 2003, and 111 million ha in 2009.[168] There is no singular or precise definition for no-till farming, because many farmers who claim to practice 'no-till' in fact practice rotational tillage, perhaps tilling once every four years, once every other year, or even once a year at the end of the growing season. The soil should remain permanently layered with crop residues from previous cash crops or cover crops, but the amount of residue that is kept as litter also varies greatly across no-till farms. Crop rotation is also supposed to be a fundamental element of no-till farming but the degree to which no-till farmers rotate cover crops and which crops are rotated also varies greatly. In order to practice no-till, specialized equipment is necessary for penetrating the crop litter during seeding, as well as extra pesticides for weed and pest management (weeds are normally killed by tilling). Under all these requirements (tilling less than annually, utilizing a permanent residue layer, and regularly rotating cash crops with cover crops) no-till farming is considered the epitome of the widely used concept of 'Conservation Agriculture'.[169] Although the US has always been the leading country for adopting no-till (approximately 25% of US land under cultivation is no-till, self defined), of the 25.3 million hectares of no-till cultivated land in the US in 2004, only about 10 to 12 percent is permanently under this system and less than half of land under 'no-till' would qualify under the stricter definition of Conservation Agriculture. The reasons for this are practical and economical; with the help of US farm policy and the subsidy farm support system, it is more profitable to practice monoculture year after year on the same field than to practice careful crop rotations. Also, it is less technically complicated and laborious to farm with conventional practices and tillage.[170]

Montgomery's meta-analysis finds overwhelmingly that no-till, which is often practiced in tandem with other conservation practices, is positively associated with

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[167] Rattan Lal et al., "Managing Soil Carbon," *Science* Vol. 304 no. 5669 (April 2004), 393.
[168] Derpsch, Rolf et al. "Current status of adoption of no-till farming in the world and some of its main benefits," International Journal of Agricultural and Biological Engineering, Vol 3, No 1, March, 2010, doi: 10.3965/j.issn.1934-6344.2010.01.0-0, https://ijabe.org/index.php/ijabe/article/view/223, 1.
[169] Derpsch et al. "Current status of adoption of no-till," 2.
[170] Derpsch et al. "Current status of adoption of no-till," 8.

lower rates of soil erosion. This is primarily because the surface layer of crop litter acts as a mulch increasing water retention and reducing runoff and erosion.[171] From the 47 studies that Montgomery analyzed that included land being cultivated by 'conservation agriculture', no-till farming resulted in .082 and .084 mm/year median and mean values of soil erosion (compared to the 1.537 and 3.939 mm/year median and mean values of soil erosion raters under conventional agriculture).[172] One of the first trials of no-till in the 1970s reported a 75% reduction in soil erosion from Indiana cornfields.[173] A 1986 study showed that no-till farming reduced soil erosion by >90% over conventional tobacco cultivation.[174] A 1993 study in Kentucky amazingly found that no-till methods decreased soil erosion 98%[175] Studies continue to show the yield increases and productivity benefits that accompany no-till. One recently published study compared fields under no-till and cover crops, to land cultivated with traditional tilling practices, and found that conservation agriculture improved yields 15% due to preserved microbial communities that better cycled carbon, nitrogen, and phosphorus – critical nutrients in soil.[176]

Montgomery's results showed that no-till farming lowered soil erosion rates to roughly that of the geological erosion rate, suggesting that under no-till, soil erosion is nearly a null issue. Although no-till and conservation agriculture can significantly improve our soil erosion and soil formation rates, two problems remain: coercing all farmers into implementing conservation agriculture, and the fact that unaccounted for ephemeral gulley erosion remains severe, even on fields with carefully implemented no-till. The studies that Montgomery compiled used

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[171] Montgomery, "Soil Erosion and Agricultural Sustainability," 13270.
[172] Montgomery, "Soil Erosion and Agricultural Sustainability," 13270.
[173] C. B. Johnson and W. C. Modenhauer "Effect of Chisel Versus Moldboard Plowing on Soil Erosion by Water," *Soil Science Society of America Journal* Vol. 43 (1978), 177-179.
[174] Sandra D. Wood and Arch D. Worsham, "Reducing Soil Erosion in Tobacco Fields with No-tillage Transplanting," *Journal of Soil and Water Conservation* Vol. 41 No. 3 (May/June 1986), 193-196.
[175] A.K. Seta et al. "Reducing Soil Erosion and Agricultural Chemical Losses with Conservation Tillage," *Journal of Environmental Quality* Vol. 22 (1993), 661-665.
[176] Lilian Wanjiru Mbuthia et al., "Long term tillage, cover crop, and fertilization effects on microbial community structure, activity: Implications for soil quality," *Soil Biology and Biochemistry*, Volume 89, October 2015, Pages 24-34, doi: 10.1016/j.soilbio.2015.06.016. http://www.sciencedirect.com/science/article/pii/S0038071715002217.

traditional soil erosion models that systematically underestimate the real amount of erosion because they do not account for ephemeral gullies and the volatile nature of soil erosion during storms. Improving soil erosion models to account for ephemeral gullies and sever weather patterns is the ongoing work of Richard Cruse and other researchers Iowa State.[177] Even if every hectare of cultivated land were managed with no-till, we would not have yet solved the problem of soil erosion entirely. Perhaps more importantly, policy makers have remained unsuccessful in fostering market conditions that incentivize the widespread adoption of conservation practices. Even though no-till and conservation agricultural is not a cure-all for soil erosion and degradation, the implementation of these practices must be widespread and nearly universal across US farms. A soil erosion tax would quickly incentive the widespread adoption of these already existing conservation practices.

In summary, agriculture is the very foundation of civilization and its practice has always been somewhat precarious. If modern civilization is to continue to flourish over the decades and centuries to come, it's absolutely essential that we operate with sustainable rates of soil erosion and formation. In order to achieve this goal, we must improve soil erosion models so that conservation practices are driven by a more precise understanding of the economic costs that result from farming practices, as well as the costs associated with the absence of conservation practices. One central question to conservation agriculture, what is the economic cost in lost yield due to soil erosion, remains almost completely ambiguous. This question is exactly what Rick Cruse aims to answer in his ongoing research grant from the Leopold Center. Gaining a better understanding of the exact economic costs at hand with soil erosion provides policy makers even more justification for the imposition of Pigouvian tax strategy in order to internalize the externalities of soil erosion, which will in turn incentivize farmers into implementing the many specific agronomic practices that improve the sustainability of soil erosion/formation. Indeed many of these conservation techniques are currently practiced, but they

[177] Cox et al., *Losing Ground*, 14.

remain sparsely adopted. The goal of agricultural policy should be to ensure that the practices proven to improve soil conservation are universally adopted.

Section 2: Modern US Farm Policy

2.1 Brief History of the Farm Bill

Just as lessons were learned from the dust bowl that justify the implementation of a soil erosion tax, the history of US farm policy since the dust bowl reinforces the need to break from the mold of failed conservation policies. Also, a brief examination of the progression of agricultural policy and successive farm bill illustrates the purpose, necessity, and complexity of the expensive and expansive US agricultural policy system as a whole. In order to prescribe policy solutions for the present and future, it's fundamental to first understand the past.

Modern American agricultural policy began in the 1930s as an attempt to address a crisis of overproduction. The Agricultural Adjustment Administration managed to mostly salvage an oversaturated industry and was committed to the well-being of each individual farmer in the face of market forces that would have led to the bankruptcy of many. In the decades that followed agricultural policy evolved through various farm bill legislations. Though the specific policies have changed significantly over the decades, each farm bill has continued to provide a price floor and income support for farmer, and to find new and creative ways for increasing the demand for agricultural goods. Instead of the bankruptcy that seemed imminent due to market forces, most farmers left agriculture by their own will over the last eight decades of farm policy. There were roughly six million farms in 1930, while today there are around 2 million, a number that has remained relatively constant since 1990.[178] Although soil conservation has played a role throughout modern US agricultural policy, its role has always been secondary to more urgent economic concerns. The following is a brief history of the farm bill since the 1930s. The security of farm income and the stimulation of demand have always been the

[178] Dimitri et al., "The 20th Century Transformation of U.S. Agriculture and Farm Policy," *Economic Information Bulletin Number 3 of the Economic Research Service* (2005), 5

primary goals of US agricultural policy – immediate economic security first, long run ecological considerations second.

Franklin Delano Roosevelt and his administration entered Washington in 1933 with more political capital than any new president in US history. Congress and the executive branch were both prepared to try anything in order to combat the Great Depression. One such ad hoc policy was the Agricultural Adjustment Act (AAA) – the beginning of a long tradition of farm bills - signed into law on May 12, 1933. As mentioned before in the discussion of the dust bowl, American agriculture was in a crisis of overproduction, a massive supply glut. The price of agricultural commodities had fallen too low to keep individual farmers above the costs of operating the farm. The AAA aimed to revitalize the revenue of farmers to what it had been in the Golden Age of American Agriculture (1909-1914). It established the baseline (parity) of optimal farm-household purchasing power[179], using the average costs of production and farm revenue during that period of farm prosperity. Policy makers of the 1930s aimed to supplement farmer's income in order to restore their purchasing power to parity. The AAA authorized the USDA to offer direct payments to farmers in exchange for participation in acreage control programs for 'basic crops'. This way, they could pump revenue to farmers while also decreasing the amount each farmer planted. The law established taxes on food processors, and used that tax revenue to fund the direct payments and acreage control programs, as well as other policies of the AAA.

Although the AAA could limit acreage in the future, it needed to address the issue of oversupply for the crops already planted in 1933. Non-recourse loans, provided by the Commodity Credit Corporation (CCC) were initiated as temporary emergency measures, until the production control policies fixed the market in the long run. These loans effectively set price floors for given commodities, as the government became a guaranteed buyer at that rate. The first cotton loan level in 1933 was set at 69 percent parity, corn at 60 percent parity[180], meaning that the

[179] Purchasing power being defined as the ability for farmers' average revenue to adequately cover the average costs of operation.
[180] Rasmussen, et al., "A Short History of Agricultural Adjustment, 1933-75," 4.

price at which the government would buy corn would be the estimated price for providing farmers with 60 percent of the full purchasing power of the average farmer between 1909 – 1914.

As mentioned in Part A, Section 3, in 1936 the Supreme Court case *Butler v. United States* ruled the Agricultural Adjustment Act of 1993 unconstitutional. The direct payments by the federal government to individual farmers for production control provisions - funded by the tax on food processors - was ruled an overextension of the federal government's power versus that of individual states. The reason for the ruling was the use of the specific tax on food processors. Despite being unconstitutional; the AAA had been successful in pumping revenue into the rural economy; farm income in 1935 had risen 50 percent since 1932, largely because of the AAA.[181]

Needing an alternative method for coordinating the limit of agricultural production, in 1936 congress passed the Soil Conservation and Domestic Allotment Act and established Hugh Hammond Bennett's Soil Conservation Service. The Soil Conservation Service (SCS) was established as a permanent agency. The SCS's primary policy tool was the Agricultural Conservation Program (ACP), which was the original land retirement program and would serve as a precursor for similar land-retirement programs, as well as other conservation programs to come. The ACP could restrict the still imminent over-production by paying farmers for shifting acreage from 'soil depleting crops', such as cotton or corn, to 'soil enriching crops', such as alfalfa, peanuts, etc. That year, the incentives for soil conservation alone proved inadequate for widespread crop reduction. A drought in '36 kept prices high, and obscured the failure of the Soil Conservation and Domestic Allotment Act to incentivize farmers into planting less and conserving soil resources. However, commodity surpluses and falling prices the following year in 1937 made it clear that the ACP, alone, was ineffective for the reduction of agricultural production.[182] From the beginning, soil conservation policies were about making the long run

[181] Rasmussen et al., "A Short History of Agricultural Adjustment, 1933-75," 5.
[182] Rasmussen et al., "A Short History of Agricultural Adjustment, 1933-75," 5.

sustainable behavior economical for farmers, but just like the conservation policies that would follow, it failed to draw enough excitement and political support from farm communities.

The Agricultural Adjustment Act of 1938 aimed to reestablish the control lost by the USDA with the ruling of *Butler v. United States*. Explicitly defending its congressional authority to govern matters of interstate commerce, the AAA of 1938 drew its funds from the general tax pool. The AAA of 1938 was essentially the same as the AAA of 1933, only slightly more assertive, *mandating* (versus providing the option for) the USDA to provide non-recourse loan price supports for wheat, corn, and cotton, and at the option of the Secretary of Agriculture for many other crops. Marketing quotas were established (pending a referendum by all of the farmers of that commodity on whether to participate as a whole) for corn, cotton, rice, wheat, and tobacco. Farmers who remained under their allocated marketing quotas received tax exemptions, while those who exceeded their marketing quotas received no tax exemptions. The need for these market quotas was illustrated in 1939, when tobacco growers voted against the quota in their referendum; the resulting overproduction was disastrous to the industry and the marketing quota was voted back into effect the next year. The AAA established the rates of loans for specific commodities usually between 50 and 75 percent of parity, but at the Secretary of Agriculture's discretion. The 1938 AAA also established the first government crop insurance program[183] and established country soil conservation districts.[184]

WWII provided an enormous economic stimulus for the American economy, mostly through profits from defense contracts. In 1941, congress aimed to provide the benefits of the military industrial complex to farmers. CCC loan rates were raised to 85 percent parity until 1946 for all normally supported 'basic' commodities and also 'non-basic' farm commodities that the Secretary of Agriculture saw fit to support so as to increase wartime production. In 1942, new amendments and legislation continued to raise CCC loan rates up to 90 percent

[183] Rasmussen et al., "A Short History of Agricultural Adjustment, 1933-75," 6.
[184] Zachary Cain and Stephen Lovejoy, "History and Outlook for Farm Bill Conservation Programs," *Choices: The Magazine of Food, Farm, and Resource Issues* (4th Quarter, 2004)

parity for basic and non-basic commodities. In 1944 and 1945 the CCC purchased cotton at 100 percent parity.[185] The use of incredibly high farm subsidies throughout WWII was touted as a way of increasing the income of family farms but it was also a way for the military to secure food for troops. With very high non-recourse loan rates, more farmers forfeited their grains and kept their loan rates. This kept the government storage bins full and soldiers fed.

Until WWII, stockpiles in government granaries continued to rise along with concern about the excess storage. However, the excess stock proved valuable with the onset of World War II. Rather than the criticism of excess storage that was common in the thirties and early forties, post-war convention held that the government granaries should always be stocked to meet wartime levels. WWII let America forget that farmers still produced more than what was demanded due to the price floor. The AAA of 1933 and the following agricultural policies worked in the short run to keep farms financial afloat, but did not fix the underlying and long run factor of too many farmers needing to produce too much in order to cover the costs of operation.

Phasing out farm-support spending has been ever-present challenge of policy makers since the beginning of modern farm support – a challenge that has never been overcome entirely. Wartime price supports were set to expire at the end of 1948 and would've reverted to the 50 – 75 percent range mandated by the 1938 AAA. Afraid of what abruptly lowering the price floor would do to farmers who depended on price supports, Congress hoped to ease the transition away from such high price floors. The Agricultural Act of 1948 maintained mandatory CCC loan rates for a variety of crops at 90 percent parity for the year of 1949. Another legislation the following year updated the loan rates so that basic crops received 90 percent parity payments in 1950, between 90 and 80 percent in 1951, then levels varying from 75 to 90 percent in 1952 and onward. However, the breakout of the Korean War prevented this transition to lower supports from occurring. The Secretary of Agriculture used the national security clause to maintain payments at 90 percent

[185] Rasmussen et al., "A Short History of Agricultural Adjustment, 1933-75," 8-9.

parity for every basic commodity except peanuts. Acreage allotment programs were also ignored in 1951 and 1952 for wheat, corn, cotton, and rice. Following the end of the Korean War in 1953, debate ensued whether to keep prices fixed high, or flexible over a range of parity rates. The Agricultural Act of 1954 established a flexible scale of price supports at 75 to 90 percent parity following 1955 indefinitely for all basic crops (except tobacco which was mandated at 90 percent parity). [186]

Without the outlet for surplus stores provided by feeding troops in WWII and then the Korean War, farm policy needed a new way to dispose of surpluses gained from the utilization of the price floor. In 1954 Congress also passed the Agricultural Trade and Assistance Act (commonly referred to as Public Law 480 or P.L. 480) that established the Food For Peace program. Under the pretense of humanitarian aid, P.L. 480 allowed 'friendly' countries to purchase US farm commodities with local currency. The clause for only 'friendly' nations was discourage poor countries from associating with communism and the Soviet Bloc, and the use of nation's local currency allowed them to save on foreign exchange reserves making the purchase dramatically cheaper. The prices provided by the US government were much cheaper than what local producers could offer, as well as other agricultural producing and exporting nations (Canada, Australia, Argentina and New Zealand). Like any trade dumping, the Food for Peace program was to the advantage of the US agricultural industry, and to the advantage of consumers in the nations that the goods were imported, but to the disadvantage of any domestic farmer or other international agricultural producer also supplying within that market. Since the 1950s, despite externalities to local farmers, the Food for Peace and food aid programs that evolved from it has been critical tools for increase of US supplied markets and the removal of surplus commodities.[187]

For the last two decades, following the failure of the 1936 Soil and Conservation act to adequately limit production, agricultural policies had focused on price supports rather than production limits. Farmers were happy to receive a boost

[186] Rasmussen et al., "A Short History of Agricultural Adjustment, 1933-75," 10.
[187] "Public Law 480: "Better than a bomber"" Middle East Report (MER) 145 – The Struggle for Food, Volume 17 (1987).

of income support in order to escape the Great Depression and the increased wartime demand in the 1940s and 50s made high price floors feasible. However, the Agricultural Act of 1956 represented a movement back towards focusing on limiting acreage with the establishment of the Soil Bank. The Soil Bank program provided paid contracts to farmers who agreed to plant less than the allotment for crops with acreage allotments already established (wheat, cotton, corn, tobacco, peanuts and rice) and also provided paid contracts for farmers who simply put land to conservation reserve for a designated period of up to ten years. For the first time since 1936, federal farm policy spurred a significant movement towards soil and resource conservation. In fact, the conservation reserves were occasionally so popular that it caused severe complications in some rural communities where farmers put all of their land into conservation.[188] A local farm economy with all of the land in conservation is poor business for mechanics, truck drivers, seasonal harvest workers, and other agricultural service sectors.

Farm policy continued to evolve in the 60's in order to keep up with the improving efficiency of agricultural production. The trends in farm policy were toward more conservation, in order to limit production, and finding new outlets for surplus stores. The Feed Grain Act of 1961 reestablished CCC loan rates at not less than 65 percent parity (the effective rate became 74 percent) and incentivized acreage conservation by providing price support for corn and grain producers only after retiring at least 20 percent of the land used for these crops during the previous two years. The Agricultural Act of 1961 and following legislation of the '60s continued to incentivize increased acreage conservation. The increased conservation was an economic strategy more than an ecological consideration; increasing yields and growing government granary stocks called for action against overproduction. The growing government stocks began to be used for social welfare, first with the use of a pilot food stamp program under Kennedy, and then it's full implantation under Johnson. Throughout the decade, government reserves from the utilization of the CCC loan rate (price floor) were increasingly spent

[188] Rasmussen et al., "A Short History of Agricultural Adjustment, 1933-75," 13.

towards resource allotment to school lunch programs and international distribution of American produce abundance. Also, exports under P.L. 480 increased 40 % under the Kennedy Administration. [189]

When the US withdrew from the Breton Woods Agreement (a system for exchange rate management established by the UN following WWII) over 1971 and 1973, because of running a persistent gold exchange deficit, the US dollar declined in foreign exchange value. When the US dollar declined in value, US agricultural commodities became more competitive in international markets. Exports boomed and commodity prices continued to rise. This, along with general inflation, the OPEC oil embargo, and the popular belief of declining natural resources, resulted the doubling of farmland prices between 1972 and 1979. The high land prices lead to the most intense period of rural investment (farm machinery, buildings and rural housing) since the Golden Age of Agriculture before WWI.[190]

With a dollar favoring US exports and a massive purchase of US wheat by the Russian Government. The USDA asked farmers to plant fencerow to fencerow in order to answer the call of markets. Farmers eagerly removed land from the conservation programs that had been established by the Soil Bank since the '50s. The 1970s showed how difficult it can be to maintain conservation retirement programs over the long run, especially once they are no longer economical in the short run.[191]

Although the devaluation of the dollar increased US exports for a short while, the dollar soon appreciated and exports shrank. Prices for farm commodities dropped and by the mid 80's land prices had dropped 30 to 50 percent. Soon deficiency payments and nonrecourse loans were heavily utilized and the government took entitlement to hundreds of millions of bushels of grain.[192]

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[189] Rasmussen et al., "A Short History of Agricultural Adjustment, 1933-75," 14.
[190] Edward Lotterman, "Farm Bills and Farmers: The effects of subsidies over time," *Federal Reserve Bank of Minneapolis: The Region*, (December 1996).
[191] O.C. Doering, "An overview of conservation and agricultural policy: Questions from the past and observations about the present," *Agriculture and Conservation Policies, A Workshop in Honor of Norman A. Berg* (1997).
[192] Lotterman, "Farm Bills and Farmers: The effects of subsidies over time."

Due to growing discontent with the costs of agricultural policy, and also concern over the ecological imbalance of the US agricultural market, there was significant political momentum for policy reform in the 1980s. In 1985, State Representative Richard Gephardt of Missouri, and Senator Tom Harkin of Iowa, drafted a farm bill that would have set a strict supply control system. Farmers would have been allotted quotas for production and sales. Any amount over the quota would be illegal for sale. This would've streamlined an increasingly complex farm support and production allotment system and greatly reduced costs to the treasury, but also would have increased food prices for consumers. It was never voted in largely because of skepticism about the practicality of a strict supply control system for commodities with such vast quantities and range of international markets.[193]

The 1885 farm bill that did become implemented represented a desperate attempt to regain lost export markets. The downturn in exports was blamed on too high of loan rates that created all around high prices for US agricultural commodities. Congress hoped that by reducing price supports and providing export subsidies, they could reclaim international markets. Policy makers failed to recognize that the trend towards lost exports was partially the result of independently rising agriculturally exporting nations who were now benefiting from the technological improvements on acreage efficiency that US farming had been reaping for half a century. US farmers were simply not as price competitive against international competition and the export subsidies required to make their commodities price competitive were immense. The price of farm commodities in the US that was necessary to assure that farmers covered their running costs was simply higher than what was required to sustain farmers revenue and cover input costs required in poorer countries with weaker currency.[194]

The 1985 farm bill was also the first to have a separate title in the bill for conservation; it represented a significant shift towards conservation, rather than

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[193] Lotterman, "Farm Bills and Farmers: The effects of subsidies over time,"
[194] Daryll E Ray, and Harwood Schaffer, "'Freedom to Farm' Bill Changed History," Agweek (February10, 2014). http://www.agweek.com/columns/3791938-freedom-farm-bill-changed-history

just acreage allotments and supply control. New programs were added such as the Conservation Reserve Program (CRP), which incentivized the retirement of farmland on contracts, just like the Soil Bank did in the 1950s, and the ACP of the 1930s. But most significantly, the 1985 farm bill set up a Conservation Compliance program in order to coerce farmers into using conservation practices and lowering their rates of soil erosion. Conservation compliance meant that farmers on 'highly erodible land' were required to develop and implement a 'farm conservation plan' by 1995. The failure to comply would result in the extreme penalty of lost eligibility for all farm program benefits (price-support programs, CCC loans, government crop insurance, and even CRP payments). The initial enforcement of conservation compliance caused political uproar in rural communities where the soil conservation service were declaimed, 'soil cops'. However, due to the vagueness of the law that mandating the establishment of some 'conservation plan', it was never clear exactly where to draw the line against non-compliant farmers, especially when the penalty was so high for farmers.[195] From its creation in 1985 to its effective removal in 1996, the conservation compliance program was unpopular and rarely enforced.

Farm policy remained relatively the same throughout the late 80's and early 90's (other than the Soil Conservation Service being renamed the National Resources Conservation Service, in 1994)[196] until the Federal Agricultural Improvement and Reform Act of 1996 (FAIR) under the Clinton Administration. The 1996 farm bill, euphemized the Freedom to Farm Act, was the result of a fiscally conservative Congress that aimed to wean farmers off of government price supports. This was acceptable for the agribusinesses lobby only if the new legislation removed restrictive conservation programs, like the conservation compliance program from 1985. Farm policy was seen as a retardant to the growth of the agricultural sector (as if that wasn't the point – the reason farm policy was always seen necessary was to keep an industry that systemically produced too much

[195] T.L. Napier, ed., *Implementing the Conservation Title of the Food Security Act of 1985,* Soil and Water Conservation Society (1990).
[196] Cain, "History and Outlook for Farm Bill Conservation Programs."

financially afloat). Congress was eager to cut budget costs, and the Clinton Administration hoped to foster a new era of US agriculture that was more kosher to the demands of the WTO (newly established in 1995) and global trade policy. Also, policy makers were optimistic that the projections for rising demands in China would make unregulated agricultural exports feasible.[197]

The 1996 farm bill was a seven-year program for dismantling the long-standing price support system for farm commodities. The transition towards no government price supports was to be eased by a series of direct cash payments, related to farmers previous years of production. These cash payments would slowly decrease over the seven-year span. Direct payments were 'decoupled', meaning the crops concerned, their prices and levels of production would be irrelevant. Their implementation has (in theory) no distortion of farmer's decisions on which commodities to produce. A corn subsidy, for example, is coupled because it incentivizes farmers to grow corn. An automatic direct payment, given regardless of prices or production decisions, is decoupled because farmers producing behavior remains unaffected. Decoupled farm support is the only agricultural protectionism fully endorsed by the WTO. The 1996 Farm bill also eliminated annual acreage control programs and most public stocks that were associated with CCC loans. The USDA would no longer place limits on farmer's production – thus the 'Freedom to Farm Act'. Also, failure to meet Conservation Compliance would no longer result in any penalty. [198]

Farmers and policy makers were optimistic that the necessary changes toward equilibrium could occur painlessly through the action of the farmers alone. If prices dropped, individual farmers would understand that they should plant less of that crop and perhaps more of some other crop with higher demand. The free-market would supposedly balance itself and at the liberation of taxpayer budget. However things did not go as planned. 1995 had been a shortfall in corn production so things went on as normal. Levels rose in 1996 and by 1998, a good crop year (but

[197] Ray, and Schaffer, "'Freedom to Farm' Bill Changed History."
[198] Carl Zulauf, and David Orden. 2014. *The US Agricultural Act Of 2014: Overview And Analysis*, International Food Policy Research Institute (2014) 1.

not a record year) made for a glut and prices fell. Corn farmers were running operations in the red. The government, that had only two years ago proclaimed the farm bill to end all farm bills, sprang into action for emergency relief. Huge emergency payments and loan deficiency payments were provided over the next four years. The 1996 farm bill had failed. Farmers proved too unorganized to painlessly transition towards market equilibrium. As soon as the 'natural' process of eliminating suppliers in an oversaturated market began, the government reassumed the role as the crutch for a systemically unsustainable agricultural industry. [199]

The 2002 farm bill was not a complete relapse to old policies. Congressmen Ron Kind of Wisconsin and a coalition of representatives (many of them from farm states) sponsored an amendment to the proposed bill that would have shifted billions of dollars from the commodity specific programs to conservation programs. The amendment failed by a slim margin and the 2002 farm bill became another installment of classical US farm support. The Secretary of Agriculture, Ann Veneman was not a supporter of the final 2002 bill. She was openly critical of traditional farm support programs and hopped to transition support towards conservation rather than subsidies. Conservation would address the issue of overproduction, lower commodity prices and utilized government support. Although there were also significant efforts by congresspersons to address the systemic issues of overproduction, reform proved futile and subsidies reigned over the bill. 17 billion dollars was allotted to conservation programs, while the commodity subsidy programs were expected to cost 190 billion over the next 10 years.[200]

The 2002 farm bill was in many was a relapse into the traditional price and income support policies. The support shown for the Kind amendment, however, provided optimism to those looking for reform, and various interest groups began to set their eyes on the incoming farm bill, which would eventually be passed in 2008. Although the 1996 Freedom to Farm Act was largely a failure, fiscal conservatives still wanted nothing to with farm subsidies, which they saw as the paradigm of

[199] Ray and Schaffer, "'Freedom to Farm' Bill Changed History."
[200] Morgan, "The Farm Bill and Beyond," 15.

wasteful big government. Environmentalists wanted greater emphasis on conservation, protection of watersheds and regulation of environmentally destructive farm practices. Anti-hunger activists wanted greater focus on the food stamps and foreign aid programs. Global justice activists wanted the removal of 'trade distorting subsidies' that maintained surplus domestic production and the subsequent fall of global prices, benefiting wealthy US farmers at the expense of poor farmers in developing nations. Urban and corporate America wanted a globally friendly direction for US agricultural policy that could move negotiations forward at the Doha round of global trade talks and pave the way for profitable global trade agreements, opening access to new markets. By 2005, a hodgepodge of 35 different organizations, from the politically far right to the far left, loosely affiliated by a commitment to agricultural policy reform, called themselves the Alliance for Sensible Agricultural Policy (ASAP).[201] Although the various organizations of the ASAP disagreed on exactly how US farm policy should change, their mutual goals were threefold: "to pare back government payments seen as duplicative, wasteful, and tilted toward the wealthiest farmers; to phase out subsidies seen as propping up rich farmers at the expense of unsubsidized farmers in developing countries; and to use the savings either to reduce the federal deficit or to boost financing for nutrition, rural development, conservation, and renewable energy."[202]

Commodity programs were targeted as the main culprit of globally trade distorting and domestically wasteful farm support. Because the commodity programs support the price of commodity, quantity matters, and very large farmers sometimes reap in very large amounts of government payments. The inclusion of large farmers into the public safety net made more sense when agricultural policy implemented acreage control programs that those receiving price and income supports had to comply with. This was done in order to scale back production and raise prices. An acreage control program would have been senseless without including the largest farmers. But such programs ended with the 1996 farm bill, and

[201] Morgan, "The Farm Bill and Beyond," 7.
[202] Morgan, "The Farm Bill and Beyond," 4.

so the exclusion of the largest and wealthiest farmers from government support was now a real possibility.[203]

Another major goal of the reform movement was also to end the duplicity of safety nets and provide a single payer system of government farm support. Currently, the farm bill provided two safety nets: one, a vast network of public support programs, the other, a semiprivate subsidized crop insurance safety net. In 2006, the American Farmland Trust (AFT) endorsed the ideas of Carl Zulauf, professor of agriculture at Ohio State University. Zulauf argued that the most glaring flaw in farm policy was the dual safety net, and that its merger would save taxpayer's money and provide a real safety net.[204] The Iowa Corn Growers Association made a similar endorsement towards a single payer system, and provided the blue prints – through the work of Iowa State University economist, Bruce Babcock – for the Average Crop Revenue (ACR) plan. The ACR would become government provided revenue insurance. If chosen, farmers would forfeit any entitlement to countercyclical payments and a portion of direct payments but would secure their end of the year revenue, which would be calculated by how much and what each individual planted. [205]

The political pressure for agricultural reform was higher than ever before, but the 2006 congressional election would change the landscape in Washington unexpectedly. The Democratic Party won a sweeping victory over both houses of Congress in 2006. In the Senate, the Democrats won six new seats, and in the House, 31 new seats, and without a single incumbent loosing their district. Nancy Pelosi became the first-ever female Speaker of the House. Nineteen of the party's victories came from rural states that had voted for Bush. The Democratic Party Leadership had a new agenda for agricultural policy in order to consolidate their new hold. They placed eight freshman House Representatives on the Agricultural Committee, putting them in a position to take credit for a 2008 farm bill that brought big

[203] Morgan, "Farm Bill and Beyond," 13.
[204] Ibid. never mind that Title I wasn't really a true safety net because it rewarded farmers during good years with direct payments and can be insufficient during bad years when crops are lost.
[205] Morgan, "Farm Bill and Beyond," 26.

dividends to the rural community. In an interview with Dan Morgan, House Majority Leader Steny Hoyer of Maryland explained the predicament, "It is a real challenge, because we want to make some changes [in farm policy] but we don't want to put our members at risk." Politicians don't win elections by being fiscally responsible on a national level, they win elections by serving the interests of their constituents, and that's exactly what these new 'Agricrats' did.[206]

After a long and embittered political process (multiple failed drafts and amendments through the House, significant revisions in the Senate, a veto by president Bush, and the final override in the House, made possible by rampant pork barreling) the $307 billion 2008 farm bill was passed. For better or worse, significant reform didn't happen – the bill largely resembled the 2002 farm bill, except that it had added on an additional $10 to $20 billion in order to appease a much wider span of interest groups that at one point had stood for reform.[207] The ACR program was implemented, under the name Average Crop Revenue Election (ACRE) but in a watered-down version. Lobbing efforts by the crop insurance proved effective and the ACR as originally envisioned was tweaked so as not to encroach on the private sector. The Corn Growers Association Ron Litterer claimed this tweak robbed the ACR of providing any meaningful reform.[208]

President Bush's veto message provides an adequate critique of the 2008 farm bill: "At a time of high food prices and record farm income, this bill lacks program reform and fiscal discipline. It continues subsidies for the wealthy and increases farm bill spending by more than $20 billion, while using budget gimmicks to hide much of the increase. It is inconsistent with our objectives in international trade negotiations." The president also said it was "irresponsible to increase government subsidy rates for 15 crops, subsidize additional crops, and provide payments that further distort markets." The Bush administration also criticized the implementation of ACRE, which created yet another farm bureaucracy and provided

[206] Morgan, "Farm Bill and Beyond," 20.
[207] Zulauf, and Orden, *The US Agricultural Act Of 2014,* 1.
[208] Morgan, "Farm Bill and Beyond," 44.

a new and 'uncapped' revenue guarantee.[209] The 2008 farm bill was another blow to those pushing away from government support.

The 2014 farm bill became dangerously closed to not being passed, but after an emotional plea and some careful political maneuvering by Rep. Frank Lucas, chairman of the agricultural committee, a farm bill was finally agreed upon by Congress and signed by President Obama in Feb 2014. [210] The most significant change in the 2014 Agricultural Act was the elimination of 40.85 billion dollars in direct payments (this removed nearly all direct payments, except for certain direct payments to cotton growers which were phased out over the next two years).[211] In place of the direct payments, there's increased protection against declining revenue through the ACRE program and other insurance programs. The projected 10-year costs are around one trillion dollars,[212] but relative to continued expenditure of programs from the 2008 bill, it saved 16.5 billion over the 10-year period.[213] Instead of addressing low prices with targets fixed by Congress, the 2014 farm bill focuses on programs that address revenue loss. Subsidized crop insurance is now a foundation of the US farm safety net, along with Title I, standard farm commodity programs. [214]

Title II, the conservation title, changed in some significant ways. Twelve programs were repealed and their roles consolidated into others programs so that there are now four main approaches to conservation policy in the farm bill: 1) land retirement (Conservation Reserve Program [CRP]), 2) enhanced conservation practices on agricultural land (Environmental Quality Incentives Program [EQIP] and Conservation Stewardship Program [CSP]), 3) Government purchase of easements for preserving natural resources and ecosystems on private land (Agricultural Conservation Easement Program), 4) fostering local partnerships to address site specific environmental issues (the Regional Conservation Partnership

[209] Morgan, "Farm Bill and Beyond," 51.
[210] "Passing The Agricultural Act Of 2014 | Congressman Frank Lucas," 2015Accessed August 31 2015. Lucas.house.gov
[211] Zulauf, and Orden, *The US Agricultural Act Of 2014: Overview And Analysis*, 14.
[212] Zulauf, and Orden, *The US Agricultural Act Of 2014: Overview And Analysis*, 1.
[213] Zulauf, and Orden, *The US Agricultural Act Of 2014: Overview And Analysis*, 18.
[214] Zulauf, and Orden, *The US Agricultural Act Of 2014: Overview And Analysis*, 9.

Program [RCPP]). Funding was cut from the CRP by $ 3 billion and from the CSP by $2 billion. Funding remained steady for EQIP, however it has been asked to pick up the slack from and perform the roles of several repealed programs. EQIP is meant to make conservation practices economically worthwhile for farmers, but there simply isn't enough funding to cover everyone and acceptance into the program is highly competitive.[215] CRP payments remain the most heavily funded, and in order to qualify for subsidized crop insurance and revenue insurance, farmers cannot plow any land with native sod.[216] The consolidation of the roles of various repealed programs into the Regional Conservation Partnership Program could prove over time to be a significant shift in conservation policy approach, using government money to fund various local sustainability enterprises so that regional conservation practices are implemented at their own discretion.[217]

2.2 Farm Bill History in Review

Although US farm policy has always been primarily about the economic prosperity of American farmers, conservation has remained a constant aspect of farm policy since the 1930s, largely because of the environmental concern spurred by the dust bowl. And throughout this long and rich history, conservation has always fallen short of achieving anything resembling a permanent and ecologically sustainable agriculture. This short summary recounts the role of conservation over the last 83 years of US agricultural policy.

Political momentum for conservation was initially triggered by the dust bowl and paved the way for Big Hugh Bennett's 1936 Soil Conservation and Domestic Allotment Act. From the beginning, the goal of agricultural conservation policy has been to better represent long run economic costs associated with ecological damage in the present decision making of farmers. The ACP helped make progress toward

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[215] "Environmental Quality Incentives Program" *National Sustainable Agriculture Coalition Website,* Accessed March 13, 2016,
[216] Zulauf, and Orden, *The US Agricultural Act Of 2014: Overview And Analysis*, 35. Native sod is so rare that the sodbuster program doesn't apply on a lot of land that isn't currently under cultivation.
[217] Zulauf, and Orden, *The US Agricultural Act Of 2014: Overview And Analysis*, 33.

this goal by providing cash incentives for alternating cash crops with soil-enriching crops. Ecologically responsible farming became more economical for farmers. But it's critical to recognize that the only reason that land retirement and the ACP was politically achievable at the time, is because it was in the short run interests of the agricultural economy during the 1930s.

However, soil conservation alone failed to entice farmers in the same way that the AAA had. The soil conservation districts established in 1938 were largely ignored during WWII and the Korean War because farmers preferred to do their job – grow crops and make money – instead of policing their neighbors.

Following the high price floors of the 1940s and early 50s, the USDA and congressional policy makers found it difficult to lower the price support system; the equilibrium cost of farming (land, seeds, machinery, etc.) had adjusted to account for the new equilibrium farm income that included government supports, and now farmers could not remain profitable without the supports. Farm policy began to look like an endless system of ratcheting up farmers' incomes, bit by bit, every year in order to continuously protect farmers from the risk of bankruptcy. And along with the escalating costs of the 1950s and '60s, the quantity of government owned grains were amassing as well. During these two decades, land retirement and soil conservation were economical for farmers in order to limit aggregate supply and raise prices – it was for this reason alone that soil conservation found political momentum and the Soil Bank program was established in 1956.

Since the 1960s, agricultural policy has managed to partially avoid constantly escalationing the costs of farm support by implementing policies that increased the demand for agricultural commodities. The Food for Peace program, and school nutrition programs of the 1960s were examples of such policies for increasing demand. Demand then skyrocketed during the recession of the '70s, when the US export market was strong, and it again proved difficult to maintain soil conservation and land retirement programs against opposing economic forces. However, the strength of the US dollar recovered and in the 80s, US exports would have shrank, except that the 1985 Food Security Act made sure to protect our export markets.

Again, conservation was implemented in the 1980s because farmers felt the need to restrict aggregate production amidst falling prices.

The 1985 farm bill took an assertive step in the direction of conservation with the use of the conservation compliance program, which mandated that farmers create a 'conservation plan' on highly erodible land. Like the failure of Dr. Gray's plan from the 1930s for conservation compliance - a more strict system of localized oversight than the soil conservation districts that we have today – the 1985 plan was a federal legislation that never engendered enough local support to carry it through into its successful implementation. For the most part, farmers hated being told by the government how to do their job. And it must have extremely awkward for the local SCS/NRCS agents to suddenly begin policing farmers, their peers and fellow community members, at the threat of totally losing their farm support package. Although conservation compliance technically remains on the books, the 1996 farm bill removed its penalty of ineligibility for the rest of farm support payments.

Various conservation programs remain on the books today, but funding is currently inadequate for the widespread application of programs, such as in the case of EQIP. There remain important ecological challenges for agricultural policy to address. What follows in this essay is normative argument for the implementation of a soil erosion tax in order to address the fundamental ecological challenge of agriculture.

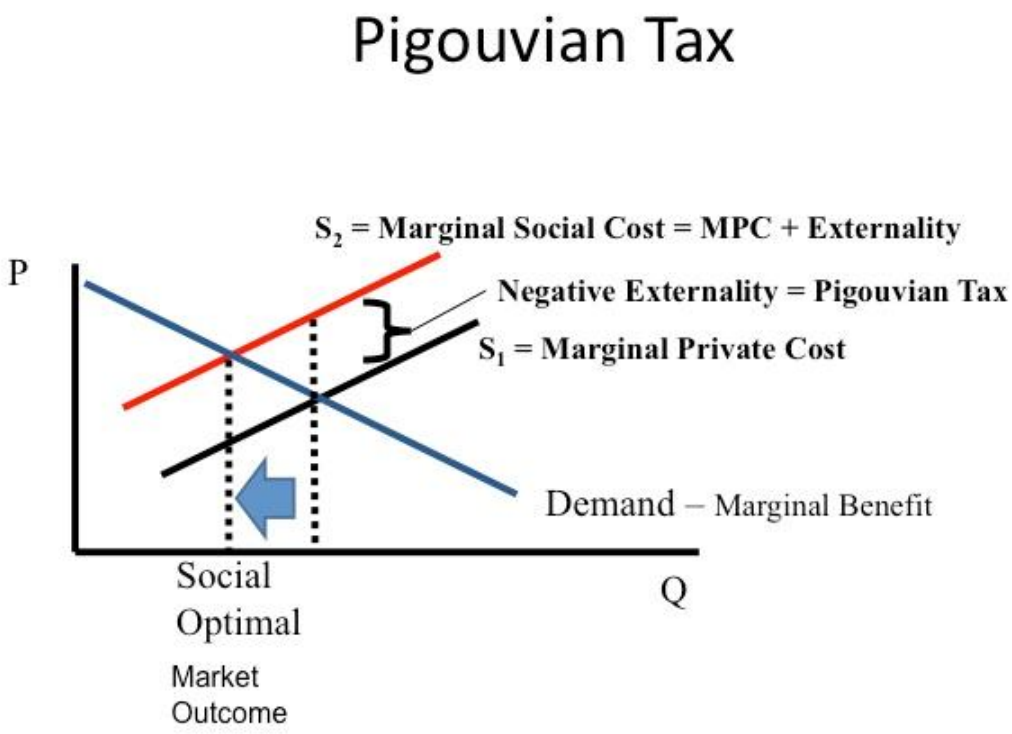
Section 3: A Soil Erosion Tax: Traditional Approach for New Solutions

3.1 Pigouvian Taxes and Soil Erosion

British economist Arthur C. Pigou (1877-1959) was a pioneer in the field of welfare economics. He is most famous for his development of the already existing but primitive concept of externalities. Externalities are costs imposed or benefits conferred on others that are not taken into account by the individual who is acting.

Pigou argued that negative externalities (pollution for example), if significant enough, warrant government intervention in the form of a tax that discourages that specific practice. The tax value is supposed to represent the social cost. Likewise, Pigou argued for government subsidies for activities with positive externalities (education for example). Taxes and subsidies for those purposes are called Pigouvian taxes and subsidies.[218]

A Standard Pigouvian Tax[219]



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[218] "Arthur Cecil Pigou" *Library of Economics and Liberty: The Concise Encyclopedia of Economics,* website accessed March 13th, 2016, http://www.econlib.org/library/Enc/bios/Pigou.html

[219] Image taken from the BYU Idaho Economics department website: https://courses.byui.edu/econ_150/econ_150_old_site/lesson_11.htm

If this diagram were a soil erosion Pigouvian tax, the commodity will be land – quantity of land on the horizontal axis and its price on the vertical axis.

In Pigouvian economic theory, the government must find the 'efficient level' for a per unit tax. For example, the efficient level of an alcohol tax would make it so that the costs of individuals buying alcohol are equal to the normal private costs of buying alcohol, plus the social cost of alcohol consumption, which might include the probable damage of drunk driving or noise pollution. The socially optimal market outcome is the result of the new market equilibrium that results after the social costs, or externalities of this practice are imposed with a tax. The Pigouvian tax is set so that the marginal return of the practice includes the marginal social costs[220] in other words, the return of producing or consuming one additional unit of some commodity is equal to the private cost plus the social costs that result. In the case of soil erosion, the unit should be an acre of cultivated land and the efficient level would represent the long run economic costs of soil erosion due to nutrient and organic matter loss, yield and productivity drops, sedimentation and pollution, and the reduction of our society's food supply. A soil erosion tax would essentially be a land use tax.

The recommendation of a soil erosion tax is nothing particularly novel or radical; it's a traditional approach of welfare economic theory. There are multiple ways to go about Pigouvian taxes (taxing consumer or producers). I recommend a per unit tax on producers. In practice, this would be a per acreage tax, and therefore essentially a land use tax. Due to the vast amount of information required for a Pigouvian tax approach applied to agriculture, critics hold that such a policy is infeasible.[221] However, perfect accuracy is not necessary for an effective Pigouvian tax; by lowballing the estimated social cost, policy makers can justify a soil erosion tax as being the least amount that we can afford to pay for soil erosion. Another criticism of a Pigouvian tax on negative soil externalities of agriculture is that soil erosion and land degradation tend to increase with poverty; therefore taxes should

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[220] E. Kula, *Economics of Natural Resources, the Environment and Policies*, (Chapman and Hall: London, 1992).

[221] Edna T. Loehman and Timothy O. Randhir, "Alleviating soil erosion/pollution stock externalities: alternative roles for government," *Ecological Economics* Vol. 30 (1999), 30. http://search.proquest.com/docview/56856209?accountid=14070.

not be imposed on farmers, because the increased tax costs could lead to poverty.[222] However, this problem is less significant in the US and could be addressed by maintaining the already existing farm support system, especially the provision of countercyclical payments such as subsidized crop insurance and revenue insurance. What follows in Section 3 of this thesis is an argument for the use of such a Pigouvian tax strategy applied to soil erosion and an examination of some of the details and ramifications of its practical application.

3.2 Estimating the Social Cost of Soil Erosion

If Pigouvian taxes are a straightforward solution for agricultural conservation policy, why is such a policy not already in place? A part of the answer to this question is that the agribusiness lobby has great influence over the farm bill and agribusinesses generally do not want to be taxed (later I will argue for why farmers and agribusinesses should support a soil erosion tax). But another reason that agricultural policy does not already utilize a Pigouvian tax for the negative externalities of farming (like soil erosion) is that the issue is incredibly complex and any estimated value for the efficient level of a soil erosion tax would be inaccurate, because of the complexity in determining the social cost of soil erosion. The value of a Pigouvian tax is supposed to represent the social cost of some industry practice [see figure 5]. The biggest part of the social cost of soil erosion is the lost productivity over time. Determining the appropriate social cost of soil erosion is a matter of calculating the long run cost of lost yield due to soil erosion, not an easy undertaking.

Calculating the efficient level for a per unit tax on soil erosion is technically problematic because is there are seemingly innumerable assumptions required. Soil erosion and decreased yields are a nearly inevitable result of cultivation, but to varying degrees depending on the soil type, the crop planted, the agronomic techniques used, the topography, the climate, the weather that year, and many,

[222] Ibid.

many other factors. And then there's the problem of how to account for the future of seed technology, because the new seeds farmers use are constantly improving yields. And although it might be easy to concede defeat in the face of such complex problem, effective policy action can still be achieved by calculating a value that will be inevitably inaccurate, but effectively accurate on the correct side of error. What is needed is a model for calculating the cost of lost yields and productive acreage due to soil erosion with assumptions that conservatively estimates the value of each factor, always estimating on the side of error for 'low-balling' the estimated social cost.

The writers of *The Economist* take up this issue in their defense of carbon tax strategies:

> One objection frequently heard is that Pigouvian taxes require omniscience from their designers: in order to set the tax at the right level, we need to know, down to the last few dollars, exactly what the economic impact of climate change will be—obviously, an impossible task. This is a problem, but it's not necessarily a fatal one. OK, if we set the tax too low, there'll still be some residual inefficiencies left that a higher tax would have eliminated. But it's nevertheless better than not having a tax at all. This objection, it seems to me, essentially amounts to arguing that since perfection is unattainable, we should abandon the whole idea rather than merely settling for improving upon the status quo.[223]

Likewise for a soil erosion tax, it's seemingly impossible to calculate the exact economic impact of soil erosion. As the writers for *The Economist* point out, this is problematic, but not fatally so. It can be overcome by lowballing the appropriate value of the soil erosion tax. Even an inaccurate soil erosion tax would be effective at incentivizing alternative practices and thereby improving soil erosion rates. Economists, scientists, and policy makers would be wise to underestimate the social efficiency in every aspect of the calculation, seeking the path of least political

[223] "Some More Thoughts On A Carbon Tax," *The Economist*, June 18, 2016, Accessed March 25 2016. http://www.economist.com/blogs/freeexchange/2010/06/taxing_carbon

resistance. In defense of the tax, it would be an underestimation and therefore the minimum cost that we can afford to impose. Even a fraction of the real economic cost of soil erosion, if imposed onto farmers in the form of a tax, should be enough to incentivize farmers into implementing conservation practices on their own terms.

In order to determine the appropriate tax value, one must apply an erosion model, such as the models discussed in Part B, Section 1.5, like WEPP, or RUSLE 2, in order to estimate the volume of soil lost on each given plot of land. Then the tax values should estimate the lost productivity due the estimated amount of soil erosion. As mentioned in my discussion of these models, there are limitations to currently used soil erosion models (such as ephemeral gulley erosion). A Pigouvian tax approach would benefit from the further development of soil erosion models, the economic models estimating the costs of erosion, and research into the socially efficient tax level, in order to improve the accuracy of the estimated social cost. Research and development into these models should constitute a greater portion of farm bill spending.

I'm making the argument that a soil erosion tax is a good policy, justified by a historical approach, but I am not myself offering any model or dollar amount estimate of what this tax should look like in practice. I will leave that to real Economists. There is a host of literature that focuses on economic models concerning soil erosion. Such models are highly technical and a detailed discussion is beyond the scope of this essay; however their development and progress. In 1983, Kenneth McConnell published an economic model of soil erosion and conservation.[224] One 1996 study published in the academic journal *Ecological Economics* modeled the on-sight and off-sight costs[225] of soil erosion with the primary on-sight cost being lost productivity. The authors then applied the estimated costs into a general market equilibrium model that they used to

[224] Kenneth E. McConnell, "An Economic Model of Soil Conservation," American Journal of Economics, Vol. 65, (Feb, 1983), 83-89.

[225] On site costs are costs to the farmer or landowner, while off site costs are costs that result from the farming practice elsewhere than that field, for example pollution into watersheds is a major offsite cost.

determine the larger social cost of soil erosion.[226] Another study by Edna Loehman and Timothy Randhir was published in same journal in 1999 that explores various modeling strategies and policy solutions.[227] Another study published by the Brazilian Soil Science Society (*Sociedade Brasileir de Ciência do Solo)* compiles various estimates on the on-site and off-site costs of soil erosion into a single meta-analysis for estimating the total economic costs of soil erosion.[228] The authors of each essay admit that their models are rough estimations of a complex issue but that's the nature of the problem at hand. Policy makers should take a cue from these researchers and use the best tools available in order to address the externalities of soil erosion head on.

3.3 Parallels Between Agricultural Policy and Climate Change Policy: Present and Future Value

Both agricultural conservation policy and climate change policy aim to address the tendency of free market behavior to discount the present value of externalities that lie in the distant future. Just as the costs of greenhouse gas emissions are felt in the distant future once greenhouse gas pollution has built up over time and become severe enough to cause significant damage, the greatest costs of soil erosion lie in the distant future, once soil erosion has become severe enough over time that the productive capacity of American agriculture is greatly diminished. Private enterprise and sustainable agriculture are in discord because the short run demands of the market dictate the behavior of farmers, and the ecological costs of farming are discounted over time into the present market. Focusing on the analogy between climate change policy and agricultural policy, this section examines the role that discounting plays in our behavior and estimation of future ecological costs.

The underlying fracture between private enterprise and sustainable agriculture is a conflict between present and future value. The microeconomic

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[226] Knut H. Alfsen, "The Cost of Soil Erosion in Nicaragua," *Ecological Economics* 16, no. 2 (02, 1996): 129-145, http://search.proquest.com/docview/56693367?accountid=14070.
[227] Loehman and Randhir, "Alleviating Soil Erosion/Pollution Stock Externalities, 29-46,
[228] Tiago Santos Telles, et al., "The costs of soil erosion," *Revista Brasileira de Ciência do Solo*, *35*(2), (2011), 287-298, https://dx.doi.org/10.1590/S0100-06832011000200001

behavior of individuals in the market is that we prefer money in the present, more than we prefer money in the future. Would you rather have $100 today, or $100 a year from now? Economic theory (and common sense) says that people prefer $100 today, rather than a year from now, because the $100 received immediately could be invested or placed in a savings account and would grow over time. The interesting question is, how much more do we value things in the present than the future? Would you rather have $100 today or $101 a year from now? A rational person (which none of us really are) would take $100 today because they could invest it and watch it grow to be greater than $101 a year later. This assumption, that $100 today is worth more than $100 a year from now is called the 'Time Value of Money' principle. If the prevailing interest rate is 4%, then a rational person would only prefer sums greater than $104 a year from now, instead of $100 today. The amount that any value is discounted annually is called the discount rate. If the prevailing interest rate is high, then the observable discount rate[229] is high and the present value of future money decreases, because we expect even greater returns in the future.

This same principle (Time Value of Money) holds for costs just as it does for returns. Now the question is, would you rather pay $100 today, or $104 a year from now? What would you pay now, to avoid costs later? The answer still depends on the prevailing interest rate, that is the discount rate in this context, but the present value of money always decreases as the event (cost or return) moves further into the future. Soil erosion has to do with discount rates in that the cost of soil erosion is a cost felt in the distant future once the topsoil has been so severely eroded that yields plummet and farmers face the cost of lost productivity. Assuming a farmer does in fact weigh this distant cost when making decisions in the present, the present value of the future cost of lost productivity from soil erosion, is discounted over time and the resulting present value of this lost productivity becomes inadequately small for inspiring any change of market behavior in the present.

[229] the discount rate that we observe real people behaving with in the market, as opposed to a discount rate set in a present value calculation that is theoretical and might take other factors into consideration than the average person does in practice

There is a parallel between agricultural conservation policy and climate change policy; both aim to 'internalize the externalities' of industry practices. For climate change policy, the goal is to make firms accountable for the greenhouse gas emissions that result from their industry practices, incentivizing alternative practices that are more ecologically friendly. Likewise, the goal of agricultural conservation policy is to make farmers accountable for their ecological footprint and to incentivize ecologically friendly farming practices. Within climate change debates, economists generally advocate the use of a carbon tax in order to achieve improve general welfare. This is a traditional Pigouvian tax strategy of applying the social cost of industry practices into the decision making of firms. As I mentioned above, the widely respected magazine, *The Economist*, has long advocated for a carbon tax.[230]

The discount rates set in climate change models are a key factor in determining carbon taxes and other policy implemented costs on industry meant to reflect the future costs of ecological damage. As previously illustrated, discounting is a procedure for computing the present value of financial flows in the future.[231] From one side of the debate, there is the argument that using any discount rate in our climate-policy models, especially discount rates that reflect the real return of capital and the prevailing interest rates, puts future generations at an inherent disadvantage by lessening the present weight of future events. Discounting is already a part of our behavior and our current behavior is exactly the problem; our short-run market forces are failing to feel the weight of distant economic costs until it is too late to do anything about it. However, from the other side of the debate there is the argument that given the nature of capital returns, discounting is an objective and necessary aspect of the present value of future events.

The debate between Cambridge economist Nicolas Stern and William Nordhaus of Yale is an archetype for disagreement over discount rates: 'the alarmist' vs. 'the delayer'. Generally, the disagreement is over how much to impose

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230 "Some More Thoughts On A Carbon Tax," *The Economist*.
231 Cedric Philibert, *Discounting The Future*, International Society for Ecological Economics (2003), 2, http://isecoeco.org/pdf/philibert.pdf

the future cost into the present through the use of climate policy, but the heart of the debate lies in Nordhaus's disagreement with the near-zero time discount rate used by Stern's climate change model in his famed *Stern Review*. Nicolas Stern, former World Bank chief economist published the *Stern Review: The Economics of Climate Change* in 2006, a research publication sponsored by the UK government that argued for urgent policy action in order to prevent the future damage of climate change.[232] Stern's results were more dramatic than most reviews that came before his because the discount rates used in his economic models were set extremely low. Discounting involves two related concepts: the discount rate of goods and the 'time discount rate'. The discount rate of goods (also called the real return on capital or the real interest rate) is a positive economic concept[233] that is, in principle, the observable discount rate in the market, which is known to range from about 5 to 26 percent per year.[234] The 'time discount rate' (also known as the pure rate of social time preference) is a normative value that represents the relative weight of the economic welfare of various households and generations over time. This refers to the discount of future welfare, not future goods or capital returns. A zero time discount rate means that all generations are treated symmetrically with present generations. Stern applied a 0.1 percent time discount rate, and combined this 0.1 time discount rate with a variety of discount rates of goods for the various different goods that are relevant to climate change and the associated real return of capital for these goods, and came up with a 1.4 full discount rate, which was in turn applied to his economic climate change models.[235] In defense of the low time discount rate, Stern argues that basic human ethics calls for the recognition of intergenerational

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[232] Nicholas Stern, *Stern Review: The Economics of Climate Change,* Accessed February 23, 2016, http://mudancasclimaticas.cptec.inpe.br/~rmclima/pdfs/destaques/sternreview_report_complete.pdf

[233] Positive economics is the branch of economics that is supposed to be concerned with objective analysis, and determining the facts and cause-effect relationships between economic phenomena; as opposed to normative economics that involves value judgments.

[234] Arrow, et al. "Intertemporal Equity, Discounting, and Economic Efficiency," *Climate Change 1995: Economic and Social Dimensions of Climate Change*, ed. Bruce et al. Cambridge: Cambridge University Press for the IPCC, 1996. 125–144.

[235] William Nordhaus, "Nordhaus: A Review of the Stern Review," *Journal of Economic Literature* Vol. XLV (September 2007), 686-702.

common humanity and historical responsibility. The *Stern Review* concludes that without climate-policy action, climate change will be the greatest market failure in human history and is estimated to cost 5 percent of the global GDP every year indefinitely and could range up to a loss of 20 percent of the global GDP annually.[236]

However, William Nordhaus is skeptical of the conclusions of the *Stern Review* because of the assumptions made about discounting. Firstly, Nordhaus argues that the ethical stance from which Stern draws his discount rate isn't quite so universal as his *Review* might have one believe. He claims that the *Review's* near zero discount rate is based on utilitarian reasoning and brings with it all of the complications of that viewpoint, most infamously that the ends always justify the means. Supposedly, there are many alternative ethical stances which justify discounting; a Rawlsian ethics, where societies should maximize the wellbeing of the poorest generation, which we assume is us, and so consumption should be at maximum now; or a precautionary ethics where societies minimize consumption while maintaining the path closest to risking overconsumption. Nordhaus argues there are a multitude of various different time preference rates that are each justifiable.[237] I however find his arguments unconvincing. He fails to clearly provide any justification for putting future generations at an extreme disadvantage in our decision making process.

Nordhaus accuses Stern of playing into political pressures of the UK government and giving them an unambiguous answer that urgent and sharp reductions in greenhouse gas emissions were necessary in order to prevent widespread market collapse. President Harry Truman famously complained that economists always told him this on the one hand, and that on the other hand. He wanted a one-handed economist. *The Stern Review* was essentially a one-handed report with an argument for urgent policy action in mind. However, economics is rarely so simple, especially not an intertemporal economic model over centuries with, not only known unknowns, but innumerable unknown unknowns. According

[236] Stern, *Stern Review: The Economics of Climate Change.*
[237] Nordhaus "A Review of the Stern Review," 692-693.

to Nordhaus, the question has always been, to what degree, how fast and how much, to impose a carbon tax, and the use of a near-zero percent time discount rate is not by any means a silver-bullet to answering this fundamental question of climate change policy.[238]

Although Nordhaus doubts the economic models and assumptions used by Stern, he commends the *Review* for pointing out climate change policies that can align economic priorities with environmental dangers. Nordhaus agrees with Stern that the cost of carbon emissions must be raised in order to incentivize individuals and firms into more environmentally friendly practices, and to stimulate research and development into low-carbon technologies. It's a simple economic insight that the social costs of the distant future must be reflected onto the everyday decision-making of billions of individuals and firms in the present.[239]

The debate over climate change policy provides a useful parallel with agricultural policy. Just as the debate between Nordhaus and Stern over climate change policy isn't about whether or not to impose a carbon tax, because the need for a carbon tax in general is widely accepted amongst economists, the question becomes, what is the appropriate amount for a carbon tax? Likewise, if we accept that a Pigouvian tax strategy applied to the externalities of agriculture would be a good policy, then the next question becomes, how high should a soil erosion tax be? Discounting is major factor in determining the efficient level for any Pigouvian tax.

Discounting is an undeniable fact of economic behavior. Rational economic agents behave in a way so that money is more valuable today then tomorrow. When a homeowner takes out a mortgage of $150,000 to buy a $200,000 home, it's worthwhile even though over the course of paying off the mortgage, it will be more expensive than the original $150,000. At a 6 percent interest rate over 30 years, that mortgage would cost $323,759. This isn't unfair, because the extra $173,759 from accumulated interest represents the opportunity cost of capital growth over that period of time. The homeowner who took out this mortgage made this decision

[238] Nordhaus, "A Review of the Stern Rview," 701.
[239] Nordhaus, "A Review of the Stern Review," 689.

based on the rationale that having an additional $150,000 in the present was worth paying an additional $173,759 later. In this way, discounting is fair and fundamental to economic theory, because investments and capital are productive over time. [240] Yet, one can argue, it remains fundamentally problematic that rational decision-makers discount the value of ecological damages in the distant future. Our systematic disregard for ecological limits might justifying Stern's use of a very low discount rate in order to correct present markets.

At first, it seems imperative that a near-zero percent discount rate is used in order to fairly account for the real damages of the future due to soil erosion. It seems shortsighted to argue for discount rates of 5 percent in climate change models (or presumably in soil erosion tax models), like Jerry Taylor, a writer for the conservative think tank *Cato Institute* does. In Taylor's defense, 5 percent is roughly the *observable discount rate*, the real return of capital, representative of the prevailing interest rates, and thus accurate of how we really behave in the market.[241] But a 5 percent discount rate means that the weight of distant events like climate change are not felt until it's far too late. From the viewpoint of positive economists like Nordhaus and Taylor, it is simply an economic fact that the present value of ecological catastrophes is discounted over time. Their evidence is the observable economic behavior. But this is exactly the problem! Current economic behavior is failing to adequately value future natural resources and ecological disasters. The parameters of the market are pushing farmers and agribusiness into remaining financially solvent and price competitive in the present, but failing to adjust for long-run consequences. It is not the job government economic policy to be practice only factual positive economics, without value judgments. Government policy is one place where normative economic value judgments are essential. Positive economists like Nordhaus and Taylor might argue that the observed discount rate suggests that we value possessing the financial means to address

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[240] William Nordhaus, *Climate Casino: Risk, Uncertainty, and Economics for a Warming World,* (New Haven, Connecticut: Yale University Press, 2013), accessed March 1, 2016, http://site.ebrary.com.ezproxy.csbsju.edu/lib/csbsju/reader.action?docID=10793689

[241] Jerry Taylor, "Nordhaus vs. Stern," *Cato at Liberty,* November 28, 2006, http://www.cato.org/blog/nordhaus-vs-stern.

incoming disasters more than forgoing growth in the name of avoiding those disasters. But this is still only a description of what we have already done, not what we should do.

I'm definitely more sympathetic with Stern than Nordhaus. Discounting is a fact of normal economic behavior, which has led us down a disastrous path where we fail to value the long run costs of our actions, like ecological costs. Nonetheless, Nordhaus and other critics of Stern bring forward legitimate objections, the most persuasive of which that we need to account for alternative investments and opportunity costs. Nordhaus writes:

> A portfolio of efficient investments would definitely include ones to slow global warming. But it also includes investments in other priority areas—health systems at home, cures for tropical diseases, education around the world, and basic research on all kinds of new technologies. Investments to slow global warming should compete with other investments, and the discount rate is the measuring rod for comparing competing investments.[242]

According to the critics of Stern, a soil erosion tax should be one of many investments towards greater social welfare. This investment would be like an insurance policy against the probable long run costs that would result from continuing the current trends of soil erosion. In order for agricultural policy makers to implement a soil erosion tax, they must make assumptions about discount rates used in their models for estimating the appropriate tax value. Discounting is key to determining how much to invest in a soil erosion tax insurance policy and any such soil erosion tax will require economic models very similar to those of Stern and Nordhaus.

Although Stern and Nordhaus disagree on the degree of climate policy action that should be taken, they both see the utility of an emissions tax for incentivizing better industry practices. Likewise, a soil erosion tax would have great usefulness, even if its social efficiency value were underestimated. I think that discounting, despite being a rational aspect of economic behavior, is exactly the problem of

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[242] Nordhaus, *Climate Casino*, 193-194.

commercial values and ecological sustainability, but in the interest of crafting a pragmatic agricultural policy that follows the path of least political resistance, the discount rates used in a soil erosion tax should be set conservatively. The use of a soil erosion tax would provide a path for maximizing profits over the long run. It would essentially be an insurance policy against the risks of soil erosion. In order to avoid the damages of soil erosion that are probable in the distant future, we should invest small amounts annually by paying additional costs for the farming practices that are estimated to lead to greater erosion. We must redefine markets so that our present behavior does not compromise agriculture in the coming centuries.

3.4 Learning from history

The Environmental Working Group (EWG) is a non-profit organization dedicated to empowering people to live healthier lives in a healthier environment. Their strategy for accomplishing this goal is by researching complex issues on toxins, food, agriculture, children's health, energy, and water, and simplifying the problems for consumer awareness. EWG is also a significant lobbying force in Washington for environmental reform. EWG enters the conversation about agricultural with the bias that strict environmental regulation is necessary for correcting the tendencies of unregulated commercial behavior. [243]

The Environmental Working Group's Publication, *Losing Ground*, presents a good summary of the issue of at hand, acknowledging the prevalence of unsustainable soil erosion and the systematic flaws of lowering erosion rates; their summary includes items discussed in Part B Section 1 of this essay such as inaccurate T-values, and soil erosion models that consistently underestimate the

[243] Mission statement and general information on the Environmental Working Group taken from the EWG website, accessed March 25, 2016. http://www.ewg.org/

real amount of erosion that is occurring. However, the recommended policy solutions of the authors are politically unpragmatic. They call on congress to reopen and revise the conservation compliance policies of the 1985 farm bill that were removed by the 1996 farm bill and to require the following in order to remain eligible for the rest of farm support:

- Reduce soil erosion to below T-values
- Treat and prevent the formation of ephemeral gullies on *all agricultural land*, not just highly erodible land
- Plant a vegetative buffer of at least 35 feet between row crops and watersheds
- Exclude farmers who do not comply with these conservation measures from participating in crop and revenue insurance programs.
- Exclude farmers who convert native prairie grass into row crops. [244]

EWG believes that conservation compliance will be an adequate solution to the unsustainable loss of soil resources, despite their acknowledgment that is has failed in the past. But what evidence is there to think conservation compliance will finally be successful this time? There are reasons why conservation compliance has been inadequate in the past - most importantly, the lack of support from farmers for strict localized oversight - and there is little reason to think things have changed.

Erosion is a cost of farming. Farmers' behavior will not adjust until markets represent that cost. To their accredit, the recommendations of EWG would adjust markets so that what is economical for American farmers is improved conservation practices. Also, the suggestions of EWG are slightly revised from the conservation compliance policy of the 1985 Food Security Act. The '85 farm bill mandated that farmers establish a 'conservation plan' and was problematically vague. Here, the EWG suggests that conservation compliance should be defined by operating with soil erosion rates under assigned T-values.

[244] Cox et al., *Losing Ground*, 31-32.

However there are complications with the EWG's suggestions. What T-values will they use? Even if one could find an accurate T-value for every plot of land, it would be unrealistic to expect that the USDA could set a benchmark for total soil erosion sustainability at some specified time after the legislation. Despite the use of the best available conservation practices, soil erosion often remains greater than what is actually tolerable. Demanding that farmers practice with erosion rates that mirror soil formation rates sets up farmers for an impossible task and it would be unreasonable to expect NRCS agents to cut all of the farmers from the income support they depend on if they do not 'comply'. If policy makers were to use T-values as the measurement for conservation compliance, T-values would instead need to lower than true soil erosion tolerance, like the currently existing T-levels. But then farmers would be at risk of losing their government farm support based upon an arbitrary standard. EWG might respond that the Pigouvian tax strategy that I recommend of low-balling the social cost of soil erosion also results in an arbitrary standard, and this is true. But the difference is that in the case of a soil erosion tax farmers are not forced to comply at the threat of bankruptcy to the arbitrary standards that we set for practicality's sake.

Another complication to conservation compliance is the idea of putting farmers under the threat of bankruptcy. US farm policy always has, and for the practical purposes of a pragmatic policy maker, always will exist for the interests of American farmers. It is impractical of the EWP and other environmentalists to pit themselves against the interests of farmers and agribusinesses in order to establish conservation – these groups essentially write the farm bill. But beyond pragmatism, this severe penalty of violating conservation compliance would unreasonably leave farmers at the mercy of weather and climate. It would make the case that one year, despite the best attempts at implementing conservation practices, one farmer's erosion rates might be estimated to be above T-values, disqualifying them for farm support, while another farmer who implements less conservation practices is lucky with the weather and suffers no consequences. Then there is the problem that once farmers are below the benchmark of these arbitrary and unrealistically high T-values, there is no further incentive for conservation practices.

One could avoid the problems inherent in using T-values by creating conservation compliance standards of implementing specific farming practices, decided at the local level by NRCS agencies. This suddenly empowered NRCS could mandate that all farmers eligible for government support must practice no-till farming (whether that be no-till year-round, every year, or some tilling allowed) and plant filter strips along the edge of their fields, riparian buffers where streams run, contour strips and vegetative barriers across slopes in the middle of fields, and grass waterways in the places where ephemeral gullies form. This approach would be preferable to that of enforcing the T-value benchmark, because it is easy to measure and hold farmers accountable for implementing specific practices. However it is difficult to see how the local NRCS agents could determine standards fairly in each situation without some objective measurement.

More importantly there is an issue of enforcement, which we have seen has been a problem in earlier programs. In order to ensure that conservation compliance is strictly enforced, there would need to be a strict overrule of the local NRCS agents over the farmers and their conservation practices. Few farmers or NRCS agents want a system of 'soil cops'. Even if such a tight oversight and authoritative bureaucracy is desirable, it's unreasonable to think it would ever be sustained by the involvement of local farmers after it is put into place by federal legislation. The failure of strict oversight on private land through the use of soil conservation committees was a lamentation of Lewis Cecil Gray, Worster's hero of the New Deal Agricultural reform, long before the failure of conservation compliance since the 1985 farm bill. And now the EWG suggests we try the same approach again. History warrants a new approach. We need to learn from the failed attempts of the past and implement an appropriate and more effective agricultural conservation policy.

3.5 Farmers and Agribusiness Should Support a Soil Erosion Tax

The idea of placing a soil erosion tax onto farmers would probably be met with immediate hostility by the farmer and agribusiness lobby. However, I believe

that such a knee jerk reaction against a soil erosion tax is mistaken and that if farmers and agribusiness consider its benefits and the alternatives, a soil erosion tax is the best way for farmers to practice sustainably while remaining financially solvent.

The fact that US farm policy always has been and still is a tool almost exclusively for the economic interests of farmers should not discredit the practicality of conservation policy. It is entirely within long-run profit seeking behavior to conserve soil. If we do not conserve our nation's soil there will eventually be no more economic opportunity in agriculture (never mind the fact that we would starve first, or that skyrocketing prices of food would never actually allow us to erode or deplete all of our topsoil). Even within a purely commercialized view of the world, soil conservation remains an urgent priority.

Farmers and agribusiness have not yet established sustainable soil conservation by their own accord because of significant obstacles. Firstly, there is no individual, or group of farmers in control of agriculture markets; the US agricultural market is instead more like a magnificent beast which is pulled in this and that direction by the demands and competitive advantages of the global economy, then meagerly called in another direction by political forces like the farm bill and the NRCS. Even the most massive agribusinesses do not have the power to suddenly decide to practice completely sustainable agriculture (whatever that would entail) and implement the necessary and expensive conservations measures. Any agribusiness acting alone would likely suffer by mandating even simple conservation practices such as alternating crops with cultivated fallows. Too many farmers would decide to affiliate with a different agribusiness that does not impose restrictions. It is incredibly difficult for a single farmer or agribusiness firm to behave with long run ecological considerations because there is a competitive advantage for suppliers who produce more efficiently in the short run.

But remaining price competitive isn't the only obstacle; the demands of consumers hold great sway over the behavior of farmers. Consider the poor conversion efficiency of grain to beef. Instead of grazing (grass-fed) cattle, almost all beef in the US is now 'corn-fed'. Because it takes approximately 6-8 pounds of grain

to produce 1 pound of beef in the US (worse elsewhere)[245] beef demand is exponentially grows into higher demand for corn. High demand means better prices and so farmers are incentivized to farm more corn and pumping more revenue onto their farms. Nonetheless, corn fed beef is a blatantly inefficient use of food and soil resources. Even if they wanted, neither the individual corn farmers, the Iowa Corn Growers Association, cattle growers nor beef processors could change the market in order to streamline production to consumption efficiency and eliminate corn fed beef in order to release some of the strain on our soil. If they tried, some other link in the supply chain would take their place. Economies have sticking power, and now that markets are used to farmers growing millions of acres of corn, and food producers are used to processing millions of acres of corn, and consumers are used to eating the livestock produced off of feed from millions of acres of corn, things are unlikely to change.

Another obstacle to the marriage of private enterprise and sustainable agriculture, mentioned several times now, is the fact that not all costs are represented in the decision making of farmers today; the far distant effects of our actions remain unfelt to us. And so, the solution proposed is to reframe the short run market forces with the long run economic costs of soil erosion in mind. Rather than spending billions every year on the farm bill as it stands - a confused patchwork safety net that breathes life into a broken system - the US government should instead spend billions of dollars collecting data to perfect the USDA and NRCS soil erosion models. An advanced soil erosion model could be used to calculate the long run cost of every immediate farming practice, impose that given cost onto the farmer in the form of a tax and watch the short run market forces defend long run soil sustainability. The imposition of a per unit tax on land would raise the cost of practicing agriculture to varying degrees[246], depending on the predicted soil erosion provided by our imaginary advanced model. Farmers would then seek to minimize

[245] United Nation's Secretary-General's High-level Panel on Global Sustainability (2012), *Resilient People, Resilient Planet: A Future Worth Choosing*. New York: United Nations, 30.
[246] This price inflation would start with increased price of land, but also ripple through to increased price of agricultural commodities, food, and also seed and machinery technology.

soil erosion on their land in order to avoid larger taxes. In practice, this would entail cooperation between soil erosion estimates on every cultivated field in tandem with an annual IRS audit. In this way, agricultural policy could achieve the goals of conservation compliance – adjust market conditions so that conservation practices are economical for farmers – while avoiding the subjective discretion of localized oversight which has historically proven to be the downfall for conservation policies.

It's important to recognize that the prevalence of soil erosion is not the result of any particularly malicious intent of farmers towards the environment. The inability of individuals to change the market as a whole, the nature of price competition, the demands of consumers, and the ambiguity of soil erosion and other agricultural externalities are all significant obstacles towards reconciling private enterprise with sustainable agriculture. A soil erosion tax is the most feasible way of overcoming these obstacles because it holds every farmer accountable to the same standard, while also respecting the autonomy of farmers to implement conservation practices as they see fit. This policy would increase the costs of farming, but over time the price of agricultural commodities would rise to account for the tax costs and farmers would be not disastrously affected. If the transition to the new market equilibrium puts too much strain onto farmers, they could still be protected under the traditional farm support system. Furthermore, gaining tax revenue is not the purpose of a soil erosion tax, or any Pigouvian tax, but it certainly would be an added benefit for what has historically been a costly US farm policy.

US farm policy already has some methods for representing the long run ecological costs of practicing agriculture into the present. But unfortunately, the existing policies fall far short of fostering sustainable agriculture. And so reconfiguring these market conditions to better represent the future costs of present action would not be anything new in principle, though more assertive policy action may be the necessary change for achieving our economic and environmental goals. Assertive conservation policy has typically been opposed by the farmer and agribusiness lobby, but if these interest groups carefully consider the opportunity provided by a soil erosion tax - taking a significant step in the direction of soil

sustainability while remaining on the same playing field of every other US farmer, staying financially solvent in the process – they should favor the tax.

3.6 Externalities

This section will not go into great detail or length into the externalities that would result from implementing a soil erosion tax, but merely to point a few that seem likely. I lack the broad knowledge necessary for a full-blown defense of a soil tax in terms of its consequences. The bulk of this essay has relied on mostly historical justifications for a soil erosion tax, but the purpose of this section is to briefly consider some of the probable externalities from imposing a soil erosion tax.

The imposition of a soil erosion tax would make US agricultural commodities less competitive on the global market. Taxes increase the price of production. A per acre tax on soil erosion would increase the price of land and the price of practicing agriculture. If the costs of farming are increased in the US, but not elsewhere, then American agricultural commodities will have a competitive disadvantage in the global market. Although this might seem like a bad thing for US farm policy to be doing to its own farmers, from a global justice perspective, this would be a significant step in the right direction. The presence of cheap agricultural commodities from outside exports can lower prices so that the revenue of farmers in developing nations falls below sufficient operating costs. Price competition has been identified as the chief culprit by global agriculture academics, like Mazoyer and Roudart, authors of *A History of World Agriculture*. They believe that in order to establish a prosperous and ecologically harmonious agriculture around the world, there cannot be price competition for agricultural commodities in the same way as other economic goods. Global justice activists Mazoyer and Roudart see the patterns of trade liberalization as problematic. The liberalization of global trade allows for the most price efficient producers to expand and dominate global markets. The problem is that farmers in developing countries are not always the most price-efficient. Rural farmers around the world have been suffering from a global

agricultural market where consumption tends to align with the lowest prices.[247] Often the lowest prices align with the exporters of surplus produce such as the United States who exported over $140 billion in agricultural commodities in 2014.[248] Although the imposition of a soil erosion tax would not end the global agricultural price war that puts the farmers of the developing world at a disadvantage and reaffirms the cycle of global poverty, a soil erosion tax would increase the price of American produced agricultural economies and would therefore promote increased prices and revenue for poor farmers around the world. There simply aren't a lot of market opportunities in developing countries. When manufacturing giants like China, Germany and the US dominate global markets, there are significant disadvantages and barriers to entry for small manufacturers. Agriculture is one industry that every nation has a very viable capacity for – that is until excessive imports from America and Europe drive prices too low for local farmers. And so the soil erosion tax externality of decreased US exports seems unproblematic in the grand scheme.

Another externality of a soil erosion tax is the potential for putting farmers below the costs of operation with the newly imposed costs of the tax. For this reason, farm policy should continue to protect farmers against downside risk, primarily through the use of crop and revenue insurance programs. The purpose of US agricultural policy to promote the welfare of American agriculture, so there is no reason to harm US farmers and agribusinesses. Agribusinesses are indeed very much concerned with finding what is sustainable, but no individual within the market has the power to totally redefine the market – they instead react to the market conditions already in place. Farmers and agribusiness understand that the current rate of soil erosion is not sustainable. But decreasing the amount of acres planted on, utilizing crop rotations and fallows to the degree of complete soil erosion sustainability, seems impossible at the moment. If some individual farmer or agribusiness committed wholeheartedly to soil sustainability as the ultimate

[247] Mazoyer and Roudart. *A History of World Agriculture,* 17.
[248] "Agricultural Trade," USDA Economic Research Service, accessed Feb 16th, 2016.

deciding factor in all of their decisions, they would need to decrease the frequency of planting on each acre in order to allow for the slow regeneration of natural topsoil. It would become incredibly difficult for this individual to remain price competitive against their neighbors who continue to practice immediately cost effective agriculture. This is why the correction of US agricultural must instead come from government policy, a greater regulating force that can ensure all individuals within that market behave with a mind for the cost of sustainability. Because there is no reason to blame or punish farmers and agribusiness, the continued protection against downside risk for farmers seems reasonable. Also the imposition of the tax should be phased in over time so that farmers and the market are able to adjust to the increased costs of farming.

Farm policy can continue to protect farmers against downside risk and total bankruptcy. However another related and more complicated externality is the disadvantage of farmers on highly erodible land, often-poorer farmers. Some might say that it's not fair to craft a tax that disadvantages those who own highly erodible land. I would counter by saying that this tax is fair in the sense that all erosion is treated as equally problematic and that we are imposing the real costs of that erosion through cold cut and unwavering environmental justice. Surely, this would not be to the advantage of farmers on highly erodible land – too bad. If erosion on some given land is so severe that the social costs of erosion when imposed onto the farmer put them at an extreme competitive disadvantage, then land shouldn't be farmed.

Also the price of food would likely increase in the US (just like gas taxes raise prices for consumers) causing problems for those who live on minimum wage. But the price of food wouldn't not rise significantly if farmers' revenue is increased to match the increased costs from the tax. I'm not really endorsing that the government increases subsidies along with the tax so that food prices remain stable, but I'm pointing out that it's an option. With this option, the soil erosion tax code would incentivize conservation practices while farmers' balance sheets would remain steady along with food prices.

3.7 Conclusions

Worster argued that capitalistic values are at the root of agriculture's problems and that a system of individuals seeking ever-greater financial returns is inherently flawed and will never foster an agricultural industry that is in harmony with ecological limits. However, it is not the luxury of government policy to suddenly and dramatically change the pathway of our economy. Instead, I have argued in Part B for a government policy that establishes the market conditions of private enterprise in a way that profit-seeking behavior is identical to ecologically sustainable behavior. One straightforward solution with this goal in mind is to impose the long run cost of soil erosion onto the present actions that lead to soil erosion – essentially a 'carbon tax' approach applied to agriculture.

Part C: Summary and Conclusions

The dust bowl is an archetype for agriculture and ecological limits. The dust bowl is relevant to this essay, firstly because it illustrates the primacy of market forces over ecological considerations in the decision making of farmers, and secondly, because the failure of the policy response to the dust bowl to universally coerce farmers into applying conservation measures on private land suggests that a more pragmatic approach is needed in the face of contemporary environmental challenges. Modern US agricultural policy was born during the dust bowl years, yet the relationship between private enterprise in agriculture and ecological limits has not fundamentally changed in the 83 years since the New Deal agricultural policy began.

The primacy of short run market considerations over ecological ones isn't to say that farmers don't care about the ecology or conservation, but that in general, farmers follow the practice that is cost effective first, then find ways to improve

ecological stewardship. Agriculture in the US began seriously infringing on the ecological limits of the Great Plains, with the onset of commercial monocropping and industrially mechanized agriculture in the early 20th century. There was an amazing growth of US agricultural production from 1900 – 1930. Shortsighted agricultural practices and speculative growth led farmers to plow up native sod on a massive scale in preference for cultivating wheat, often on semi-arid and marginalized land like the southern plains. Farmers were like cogs in the machine of the global market, claiming homesteads and increasing planting to match the rise in demand for agricultural products, with the greatest increase in demand coming from WWI. When prices eventually dropped, the market was pushing individual farmers into increasing planting in a last ditch effort to avoid bankruptcy, but instead extreme oversupply ensued along with an extended wind erosion disaster like never before seen. The decades of speculative growth leading up to the 1930s, and the dust bowl itself exemplified how the trends of commercial agriculture and the limits of our ecology can contradict one another.

Donald Worster's *Dust Bowl* was a groundbreaking work in critical environmental history and I agree with Worster's general thesis, that a system of individuals seeking ever-greater financial returns will never foster an agricultural industry that is in harmony with ecological limits. However, Worster's prescribed solution, a revision of cultural values, is not a practical policy solution. Agricultural policy, like any government policy, tends to shift the already existing system in small, but hopefully meaningful ways, little by little. Whether or not change is preferable through the slow methods of government policy (as opposed to perhaps some radical revolution and ownership change of American agriculture) is not within the scope of this essay. Instead this essay asks: how can policy makers work towards the marriage of private enterprise and sustainable agriculture?

Worster pointed out that the policy makers of 1930s aimed to accomplish this through localized grassroots community oversight. The idea was that the federal government was an inappropriate authority for mandating agricultural conservation and would never be accepted by farmers. Therefore, localized oversight, committees comprised of farmers, would be a better system for ensuring

that soil conservation was implemented on private land. Worster depicted the situation as if these local committees of strict oversight were formed and then quickly dissolved into nothing because there wasn't enough political support and involvement from farmers on the local level for policing each other and restricting their own profits in the name of ecological stewardship. But from what I have gathered, these localized committees still exist today in the same form as always – soil conservation districts. Farmers getting assistance from soil conservation districts is voluntary – the districts lack the authority to coerce farmers into implementing conservation practices against their will. The localized committees lacked the power that New Deal policy makers like Bennett and Gray hoped to establish. The dust bowl illustrated that policy makers do not lightly overcome the autonomy of farmers. Therefore a successful and pragmatic agricultural policy ought to respect the autonomy of farmers' private decision making, when possible. This means that farmers should be the ones who choose to implement conservation practices on their land, and they should do so on their own terms.

Merging the two previously mentioned lessons of the dust bowl together, that farmers are primarily concerned with short run market forces, and that a successful agricultural policy should be a pragmatic one that respects the autonomy of farmers on their own land, a soil erosion tax would be a straightforward means of incentivizing conservation practices. A soil erosion tax is a way of directly affecting the short run market forces of farmers so that farming practices that reduce erosion are more cost effective, and it would leave the farmer autonomous, implementing conservation on their own terms and free to not implement certain conservation practices if they so choose.

History is filled with examples where unaddressed soil erosion resulted in the decline of civilizations. Lowdermilk's survey of ancient agricultural lands found many examples of failed agricultures that expired with the erosion of their soil. The risk remains the same with contemporary soil erosion.

Taking a cue from Lowdermilk, one can simplify the issue of soil erosion and conservation agriculture (ignoring many of the complexities of land degradation and soil health) as seeking a permanent agriculture defined by establishing equal soil

formation and erosion rates. There have been fewer studies on soil formation rates on agricultural land relative to erosion rates. Soil scientists understand the process of soil formation, but the rates of formation under cultivation remain ambiguous. It's easier to quantify soil erosion than formation. However there is a host of literature on the effects of crop litter removal (especial corn stover) on soil health. Maintaining a layer of crop litter is an important agronomic technique for lowering erosion rates, but also for increasing soil formation rates and soil organic material (SOM). In comparison, there have been many studies on soil erosion rates and the USDA has been continuously developing and improving upon their soil erosion estimation models. Soil scientists have gained a solid understanding of how erosion rates vary on specific fields with various inputs, but there remain significant obstacles to overcome in estimating soil erosion, most prominent of which being ephemeral gulley erosion. Additionally, there has been significant progress in the implementation of soil conservation practices, such as no-till farming. But our best agronomic techniques are not yet a cure all for the problems of soil erosion, and worse, they remain far from universally adopted.

There are important and simple facts to be considered by policy makers on the status of soil erosion and formation rates, and our agronomy for improving them: 1) The stakes are high when it comes to soil erosion; maintaining the stock, health, and productivity of our soil is fundamental to the longevity of our civilization, 2) We lack adequate data, and consequently understanding, of the soil formation and erosion rates that are prevalent under cultivation, 3) there are beneficial conservation practices that are proven to work, yet these practices are not implemented across the board. These three aforementioned facts are not highly contentious. Policy makers should accept these basic facts of the matter and then decide how we should proceed.

I argue that these facts justify implementing a soil erosion tax. Taxing soil erosion would greatly increase the prevalence of currently available conservation practices across the board. We possess the means for practicing conservation agriculture on a more widespread scale than is done, but the incentives are in the wrong place. Taxing 'bads', like soil erosion, would be a simple yet effective way for

adjusting these incentives. Furthermore, it's important to strive for a complete understanding of that which is taxed, and so farm bill spending ought to allocate more funds to the USDA and NRCS for research, data collection, and erosion modeling.[249] Soil erosion models should be continuously improved upon, as well as our understanding of the costs associated with soil erosion. The fact that Rick Cruse's ongoing and cutting-edge research into the economic costs and yield declines from soil erosion is the result of a grant for only $15,768 from the Leopold Center is ridiculous and sad. Given the history of failed agriculture and expired civilizations, understanding the real economic impact of soil erosion so that the appropriate costs can be accounted for should be one of the most important and well-funded of research endeavors around, yet it seems to be on the fringes of politician's and mainstream academia's concerns.

Like the dust bowl, significant lessons can be learned from the history of US agricultural policy since WWII. Examining this time period gives one a sense of how stuck we've become in the price support system that inflates the value of agricultural commodities, and also how difficult it is to phase out farm bill spending. It also provides further justification for reforming agricultural conservation policy into a system that doesn't depend on local initiative for its success.

Since Hugh Bennett and the creation of the SCS, the goal of agricultural conservation policy has been to better represent the long run costs of ecological damage into the present decision making of farming. Land retirement programs have been a staple of conservation policy since the beginning, effectively making what was long run ecologically beneficial, cost effective in the short run for farmers. But throughout the history of conservation programs, conservation policies were almost exclusively implemented when they were to the economic advantage of farmers. Oversupply in the 1930s made land retirement programs a practical means for limiting production and thereby contributing to the general prosperity of

[249] Or even without a soil erosion tax, the further research, data collection and precise understanding of soil erosion would help farmers identify the costs of soil erosion and implement conservation agriculture to a greater degree. Although this alone would likely be insufficient, largely because of discounting behavior, and also because of the primacy of short run market demands for farmers to remain price competitive.

farmers. The USDA and federal government then took advantage of the increased demand stimulated by WWII and the Korean war and raised price floors, pumping money into and revitalizing the rural economy, but making the ACP land retirement program less of a preferential option for farmers. Once wartime demand subdued, soil conservation once again became a practical way to limit supply and thereby prevent overproduction and contribute to the prosperity of farmers, resulting in the creation of the Soil Bank in the 60s. Starting in the 60s, farm policy then shifted some of its focus away from price floors and government non-recourse loans, and aimed to supplement farmer's income by stimulating demand. This led, in part, to political momentum for the Food for Peace program, food stamps and school lunch programs, which increased the demand for agricultural commodities, and raised prices. Global demand then skyrocketed for US agricultural commodities with the onset of the recession in the 70s, because the weak dollar made for relatively more price competitive US exports. But eventually the dollar recovered and US exports shrank. Reacting to the threat of falling export demand, the 1985 farm bill protected the US export market by using controversial export subsidies and international marketing programs. In part, it was for the sake of farmers' prosperity that the '85 farm bill strengthened the role of soil conservation, because restricting aggregate production was economical in the context of falling prices. But contrary to this last point and the pre-existing paradigm of conservation policy being used as a means for strategic scarcity and farmer's prosperity, the conservation compliance of the 1985 bill was a major shift.

The conservation compliance attempt of the '85 farm bill represented a more assertive conservation policy that would no longer simply serve the short run economic interests of farmers and for the first time would force farmers to comply to conservation standards in order to be eligible for farm support. Ultimately, conservation compliance failed for some of the same reasons that the ideal localized committees of Dr. Gray failed; policing one's peers and neighbors proved much more problematic in practice than in theory. The '85 conservation compliance policy mandated that farmers establish a 'conservation plan' on 'highly erodible land,' intentionally vague so that what qualifies as a sufficient 'conservation plan was left

to the discretion of local SCS (NRCS after 1994) agencies. But when failing to comply resulted in farmers totally losing their farm support package, SCS agents were reluctant to put their neighbors under the threat of bankruptcy, especially when they had the option of not punishing farmers, since there were no specific guidelines of what compliance entailed. The 1996 farm bill was the next major legislation in agricultural policy and it removed the threat of losing eligibility for the rest of farm support from the conservation compliance measure.

Conservation policies exist today that prevent farmers from tilling native sod, provide payments for land retirement, and even some that provide the technical assistance and payment incentives for implementing conservation practices on private land, though the latter kind of programs are, in general, insufficiently funded. But these policies are fragmented in their different ends and fail to address the underlying issue of unaccounted for externalities. And because the existing conservation policies do not address the fundamental problem of unaccounted for externalities head on, current policy fails to incentivize the widespread adoption of simple conservation practices in the way that a soil erosion tax would. Even though conservation policy has remained a staple of the farm bill throughout its entire history, it has been politically achievable primarily because of its role as orchestrating scarcity for the sake of raising prices in a manner that is advantageous for farmers. US agricultural policy has always been tool for securing the economic prosperity of farmer.

A soil erosion tax is a kind of Pigouvian tax, which is a preferred policy strategy for many economists and a relatively mainstream one. Simplified, the Pigouvian strategy is to tax social 'bads' that are not felt upon the person who acts in the way that leads to the specific cost, and to subsidies social 'goods' in the same way. Pigouvian taxes are a traditional approach of modern welfare economic theory. A common criticism against the use of a Pigouvian tax for agricultural policy is that in order to estimate the appropriate social cost, one would need omniscient

knowledge about a seemingly innumerable number of assumptions and estimations.[250]

But like the writers of the *Economist* point out[251], the fact that it is difficult and perhaps impossible to find the perfectly accurate social cost that would lead to a tax with the greatest social efficiency does not justify abandoning the project altogether. By lowballing the estimated social cost, policy makers can improve the status quo while offering a strong argument for its implementation; it's the least that we can afford to tax. Additionally, there already exists a host of research and publications on models for estimating the social costs of agricultural externalities that could be used as a starting point for policy makers, and continually improved upon through further government research.

Just as the *Economist*'s defense of a carbon tax is analogous to a defense of a soil erosion tax, the entire phenomenon of climate change is analogous to soil erosion, along with the policy approaches to each. Both policies aim to address the impending market failures that result from discounting the far distant future costs of production. The Nordhaus vs. Stern debate brings to focus the contentious role that discounting plays in the way we consider ecological costs and I find that ultimately Sterns argument for a low discount rate is far more convincing. But because elsewhere in this essay I have maintained that a successful agricultural policy needs to be pragmatic one,[252] policy makers should recognize the criticisms of Nordhaus and utilize moderate discount rates in their soil erosion tax estimation so that the policy garners more widespread political support.

The most important political support to garner for agricultural policy reform and the shift to a soil erosion tax (or other Pigouvian tax applied to agriculture) is that of farmers and the agribusiness lobby. Although it seems counterintuitive for

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[250] On a basic level for a soil erosion tax, this would entail knowing quantity of soil lost on each unit of cultivated land, and the associated economic cost. Estimating each of with accuracy is indeed problematic without omniscience. What crops will be planted in the future? How will seed technology improve yields over time.

[251] The article in the *Economist* addresses the carbon tax issue, but is analogous to other Pigouvian taxes, like a hypothetical soil erosion tax.

[252] For example the move in Part A conclusions that the economic liberty and total autonomy of farmers on their private land should be accepted as a political given and worked around rather than pushed against.

farmers and agribusinesses to support being taxed, the individuals involved in this industry should view a soil erosion tax as an opportunity to achieve their environmental goals while remaining financially solvent. It is difficult and perhaps impossible for individual farmers and food processors to make the ecological considerations they would like while also remaining price competitive. However, a soil erosion tax would keep everyone in the US on an even playing field while making ecological consideration a part of what it means to be price competitive. Also, in the face of mounting political support for radical environmental change, a soil erosion tax that preserves the autonomy and economic liberty of farmers is a relatively moderate means for achieving sustainable agriculture

Implementing a soil erosion tax would shift the economy in certain ways. Taxes increase the costs of production and would make US farmers less price competitive on the global market. From a global justice perspective, this would probably be beneficial, increasing prices for farmers in developing countries with agrarian economies. The increased costs of production might potentially be problematic for the financial solvency of farmers, but this effect could be counter balanced relatively easily by continuing to provide the government farm safety net. The simultaneous government policies of a soil erosion tax and a safety net might confuse someone to ask, why would farmers be incentivized to implement conservation practices if the are going to be protected from bankruptcy by the government, regardless of how they farm? The answer to this objection is that farmers are profit seeking on the margins; a 'rational' farmer will still seek to avoid additional costs that result from a soil erosion tax in order to maximize profits, regardless of whether or not they are protected from total bankruptcy. The increased price of production would also increase the price of food and agricultural commodities in the US. This would be problematic for low-income families in the short run, but eventually markets would adjust to a new equilibrium where the wages of workers adjusts to the inflated price of basic goods. Or perhaps the revenue from the soil erosion tax could be used to provide cheaper food to low income households.

The historical policy approaches to incentivizing conservation agriculture have been mostly unsuccessful. The strict oversight through local committees was never really established in the late 1930s. Land retirement programs have usually only played a role insofar as they contributed to the short run prosperity of farmers, being utilized during times of low prices when planned scarcity was advantageous to farmers. And the conservation compliance of the '85 farm bill was extremely unpopular amongst farmers and was politically unpragmatic. History warrants a new approach, and a soil erosion tax is the best candidate for the job.

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