Factory Farming

Economic Advantage or Ecological Disaster?

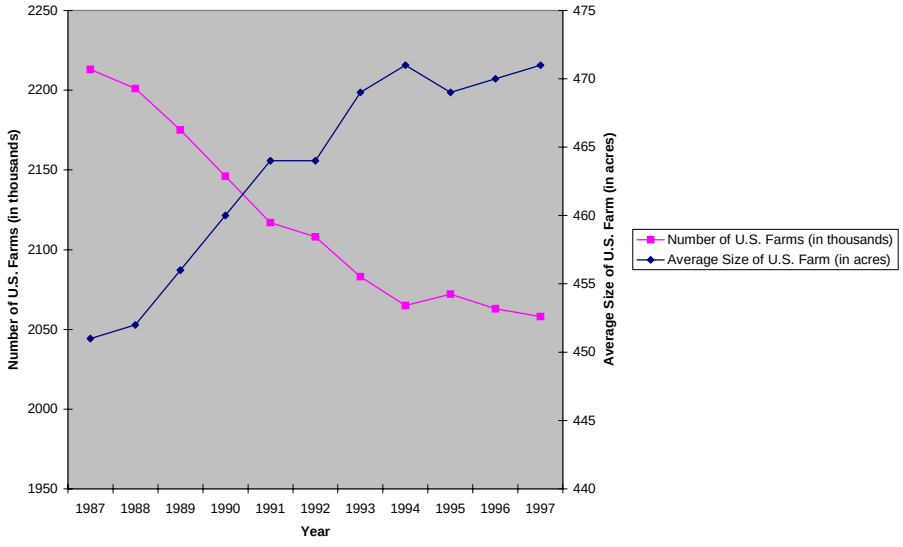
A Look at the Economic and Ecological Aspects of Industrial Swine Production in the United States

Michele Bayer
081-62-0782
Due: November 22, 1999
Presentation: November 22, 1999
Limits of the Earth
Professor Hoffert

Factory farming is the term used to describe modern systems of large-scale livestock production. (Fox 1986) Within the past twenty years, the site of the production the of United State's swine, poultry and cattle has generally moved from traditional family farms to much larger industrial livestock farms. According to Jules N. Pretty (1995), modernization of agricultural systems is a response to the need for increased food production due to a growing population and governments who are willing to support enterprises which produce more food more efficiently.

Currently, in the United States, a farm is defined as "any establishment from which $1,000 or more of agricultural products was sold or would normally be sold during the year". (United States Department of Agriculture [USDA] 1998) The United States has seen an overall decrease of 7% in the number of farms between 1987 and 1997. At the same time, the number of acres of land used for farming in the United States has been declining since 1954, when it peaked at 1.206 billion acres, and has seen a decrease of 3.1% from 1987 to 1997 when it reached 0.968 billion acres. As Figure 1 indicates, this decline in the number of farms and the number of acres of land used for farming has been met by an increase in the average size of existing farms, from 451 acres in 987 to 471 acres in 1997. (USDA 1998)

Figure 1: Change in Number of Farms and Farm Size in the U.S. from 1987-1997



While the data show that this movement to fewer, larger farms has occurred in the United States, there exists a critical debate regarding economic benefits and ecological consequences of agricultural industrialization. The environmental consequences of factory farming are not factored into the measurement of costs and profits. The industrialization of the hog industry in the United States is a perfect illustration of this dialogue between economics and ecology. Waste from America's hog factories poses an enormous environmental threat, particularly in Iowa and North Carolina, the nation's leading pork producers. Although there exists conflicting data as to the economic value of family farms in relation to factory farms, and the difference in efficiency is a matter of contention, this debate may actually be a moot point. This is because measures of efficiency do not always take into consideration economies of scale and can be manipulated to indicate desired results. In addition, from an economic standpoint, efficiency generally refers to profitability but does not necessarily take into account energy efficiency and generally does not include the costs of environmental degradation, such as water and air pollution, and the public health concerns which result. In addition, it is argued based on what is known as the Goldschmidt Hypothesis that factory farms degrade the social fabric of rural communities. (Durrenberger & Thu The Expansion of Large Scale Hog Farming…1996)

A Comparison of Characteristics: Family Farm vs. Factory Farm

In general when we think of farming, we envision the family farm characterized by red barns, tractors, and a variety of crops and grazing animals. Factory farms provide

a much less appealing landscape and are characterized by rows of long, multi-unit confinement buildings with protruding ventilation fans, metal office buildings and open air manure lagoons. (Durrenberger & Thu The Expansion of Large Scale Hog Farming…1996)

Illustration 1: Hog confinement facility with manure lagoon.
From http://checc.sph.unc.edu/rooms/education/Whole_Hog/

In "Inside the Industry from a Family Hog Farmer", Jim Braun, a hog farmer, describes his family's transition to the use of small-scale confinement in the 1970s. Confinement was incorporated to combat the spread of a disease called *Mastitus Metritus Agalactia* which causes sows to lose their milk and their young to starve. Housing hogs in stalls, as opposed to giving them free range on a traditional farm, made it possible to more easily administer injections to the sows to treat this disease. In addition, because of the controlled environment, it made it possible for the family to farrow (produce piglets) year round. (Braun 1998)

According to Durrenberger and Thu, this confinement technology is present on a small scale on many family hog farms today, but does not dramatically alter the appearance of the farm. (The Expansion of Large Scale Hog Farming…1996) Although confinement is fairly widespread and makes it easier to treat swine, the amount of waste produced is the cause of the environmental and public health concerns for humans.

Energy Use on Farms

It is important to contrast factory farms and traditional family farms with respect to energy and use of fossil fuels. In general, it takes anywhere from 7-88 kilocalories of energy to produce 1 kilocalorie of animal protein. This is an enormous amount of energy compared with the 0.73-3 kilocalories of energy it takes to produce 1 kilocalorie of plant protein. Part of this disparity can be attributed to the fact that in order to produce animal protein, it is necessary to grow forage and grains for the animals' consumption. In fact, the majority of the grains grown in America are fed to livestock. If this grain were taken out of the equation, and animals ate only grass and forage, it would only be possible to produce half as much animal protein. (Pimental 1984) Thus, the amount of energy needed to produce plant protein is included in the amount of energy it takes to produce animal protein.

In addition, the wide range in amount of energy input for animal protein production is probably attributable to the disparity in energy inputs for family farms as opposed to factory farms. Both forms of agriculture involve "ancillary" energy costs because both forms involve the manipulation of solar energy through plants to the final animal product. Energy is spent on all aspects of farming from preparing land to

advertising the final product including sowing, harvesting, caring for animals, slaughtering, processing, packing, etc. (Mason & Singer 1980) According to Mason and Singer (1980), in the United States, agriculture uses more energy than is produced in the form of food. According to John A. Young (1982), all phases of agricultural production, such as the use of heavy machinery, the manufacture of chemicals and pesticides, food processing and meat packing, use six calories of fossil fuel energy for every calorie of food energy produced. David Pimental estimates that if the whole world were fed diets of American agricultural products, the world's known petroleum resource would be exhausted in 13 years. (Mason & Singer 1980) This can be attributed to the shift in agriculture from labor intensive practices and the use of manpower on farms to more energy intensive activities where inputs of energy are needed from outside the system.

As a result of this shift, industrialized agriculture is highly dependent on the input of fossil fuels and is "the most inefficient form of food production in the history and prehistory of mankind". (Durrenberger & Thu 1998) Animal factories require the use of fossil fuels in building facilities and then maintaining the controlled environment. Ventilation systems must be installed to control odors from animal waste, and heaters and air conditioners must be used in order to maintain the desired temperature. This is incredibly important in the hog industry because pigs have difficulty maintaining body temperature. On a traditional farm, these inputs are not necessary because the animals are not confined and can use hay to warm up and damp soil to cool down. (Mason & Singer 1980) In addition, on a traditional farm, animals graze for food, and animal waste, which serves as fertilizer, is deposited directly in the field. On a factory farm all of the food the animals eat must be grown, harvested, mixed and transported to the facility.

Animal waste also creates a huge need for fossil fuel energy for activities such as pumping waste into and out of lagoons and spraying waste onto fields for fertilizer. In other words, industrialization of agriculture makes it necessary to physically move food onto and waste off of the farm.

The Economic Angle

Factory farms require more energy and are the subject of environmental controversy, yet they are still proliferating across the United States. The industrial paradigm suggests that in order for this to be the case, these large-scale livestock facilities must be productive, efficient and profitable or they would have no place in the American market. (Durrenberger & Thu 1998)

However, Durrenberger and Thu examine two important issues, which are open for interpretation. First, economies of scale refer to "situations in which a constant proportion of resource inputs results in a disproportionately higher rate of outputs or profits simply because of the size of the operation or business." (Durrenberger & Thu 1998) Larger farms can add more sows than smaller farms before production costs will increase. The second issue involves the way efficiency is conceptualized and measured in agriculture. Efficiency of production traditionally refers to "the cost and amount of inputs and related expenses compared to outputs consisting of food, commodities and profit". (Durrenberger & Thu 1998) Profits are calculated by subtracting the cost of inputs from the money received for the outputs. Efficiency is calculated by comparing one dimension of output with another dimension of input, for example cost of feed per unit of animal growth. (Durrenberger & Thu 1998)

These concepts must be considered when examining the reasons why proponents of large-scale swine production see it as beneficial. Reasons cited include:

1. Industrial swine production facilities are better managed and more efficient.
2. Industrial swine production creates jobs.
3. Pork produced through vertically integrated production better serves consumers.
4. Contract farming reduces risk because it is a joint venture between farmers and corporations.
5. The intensification of production will benefit rural communities.
6. Environmental and public health concerns are not consequences of industrial agriculture but are barrier to growth of the industry.

(Young 1982)

In 1991 the United Nations determined that pork is the largest source of animal protein in the world and accounts for 40% of the world's meat consumption. (Durrenberger & Thu 1998) I constructed figures 2 through 6 from 1997 data provided to the National Pork Producers Council by sources such as the University of Missouri and the U.S.D.A., to demonstrate the ways production of swine in the United States has increased and changed to meet that demand.

However, Figure 2 shows that the demand for pork in the United States has remained relatively constant since the 1980s and so much of the production of pork in this country is meant for export. In fact, the United States is the top pork exporting country. In 1997, the United States exported 474,000 metric tons (carcass weight) of pork. This was the peak of a progressive increase starting from a low of 39,00 metric

tons in 1986. (National Pork Producers Council [NPPC] 1999) This increase in export can be attributed to increased meat consumption in developing countries as per capita income increases.

Figure 2: U.S. Per Capita Pork Consumption (pounds)

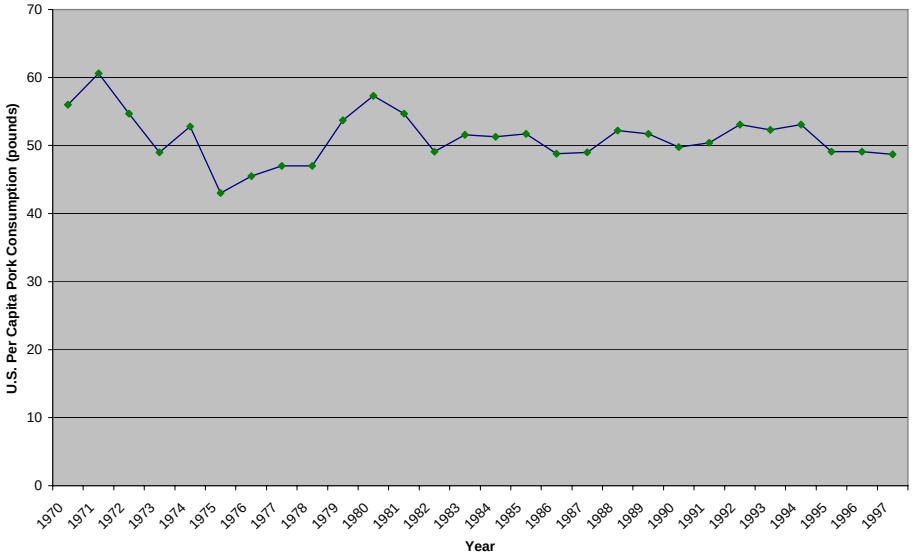
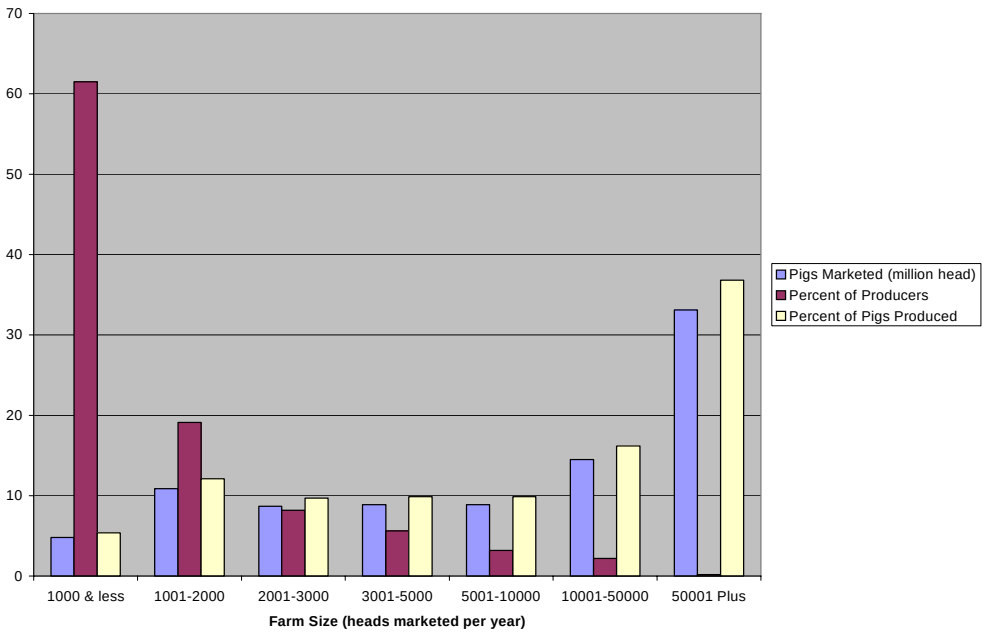


Figure 3 indicates that although farms with 1000 heads or less marketed per year represent the largest portion of producers, the largest number and percent of pigs produced come from farms that market over 50,000 heads per year. (NPPC 1999)

Figure 3: U.S. Pork Production
1997 Producer Profile



In the United States today, the largest farms produce the largest number of pigs per year. This however, is an example of the "economies of scale" phenomenon described earlier. In "Searching For 'Sound Science'", Nancy Thompson and Loren Haskins explore this concept in more depth and refute similar findings to the ones illustrated by Figure 3. The study in question, "Community and Economic Impacts of the Iowa Hog Industry", was conducted by agricultural economists at Iowa State University. The report discussed the economic impacts of industrial hog facilities. This report concluded that larger operations (3,400 sows) created the most jobs, with the highest employee income, as well as more revenue for state and local governments. However, Thompson and Haskins point out that this data is seriously flawed because it essentially compared one farm with 3400 sows to another farm with only 150 sows. A sow is a female pig that has had at least one litter. These measures that only refer to sows do not take into account piglets or male pigs and so these farms actually house more pigs than it seems. In their study, they extrapolate the original data to reflect the economic impact of twenty-three 150-sow farms (amounting to 3450 sows) with one 3400 sow operation. This revealed a very different picture. The aggregate of 150 sow farms created more jobs, with higher pay than the 3400 sow operation. Tables 1 and 2 indicate the original values found by the researchers at Iowa State and the corrected values, respectively. (Center for Rural Affairs 1998)

Table 1	Iowa State Research			
	150 sows	300 sows	1,200 sows	3,400 sows
Primary Employment (jobs created)	1.4	3	10	21
Employee Income (total)	$40,750	$87,100	$294,685	$709,097
Total Local Benefit (revenue-expenditures)	$1,096	$2,704	$10, 598	$29,544

Table 2	Corrected Version (to reflect 3400 sows each)			
	150 sows 23 farms	300 sows 11 farms	1,200 sows 3 farms	3400 sows 1 farm
Primary Employment (jobs created)	32	34	28	21
Employee Income (total)	$925,025	$984,230	$825,121	$709,097
Total Local Benefit (revenue-expenditures)	$24,879	$30,555	$29,674	$29,544

(Center for Rural Affairs 1998)

This data does not show any real benefit to large-scale swine production. It does point out that with respect to the factors compared, the same benefits can be gained from small farms. Most importantly, the information provided in Table 2 indicates that the 300 sow farm actually provides the most economic advantage in job creation, employee income, and total local benefit. The data show that the aggregate of 300 sow farms provided 34 new jobs, $984,230.00 in employee income and $30,555.00 in total local benefit. This is an illustration of the phenomenon that increasing the size of an operation can increase economic advantages, but only to a certain peak level. In this case, the benefits peaked at 300 sow farms and then began to decrease with increasing farm size. Figure 3 does not contain the same flaw as the Iowa State University study

because it represents an aggregate of small farms and this aggregate still produces far less than a very small number of the largest facilities.

The North Carolina Pork Council boasts that in 1998, 8,139 full time jobs were created for North Carolina residents as a result of hog production, an increase from 1993. Overall, the pork growing, packing and processing industries provided 43,250 full time jobs in 1998 and $1.92 billion in value added income. It is also indicated that the North Carolina Pork Council funded over $700,000.00 in research to focus on efficiency, safety and environmental responsibility. (North Carolina Pork Council 1997)

Jim Braun (1998), a North Carolina hog farmer, does not refute the claim that jobs are being created, but he does point out that they do not necessarily benefit the rural community because these jobs are being filled by underpaid, transient laborers. Braun also claims industrial swine production operations do not utilize local companies such as concrete plants, contractors or trucking companies and do not buy feed locally. This is all to the detriment of businesses in rural communities where family farmers had once made more use of these services.

Figure 4: Productivity of U.S. Pig Herds from 1970-1997

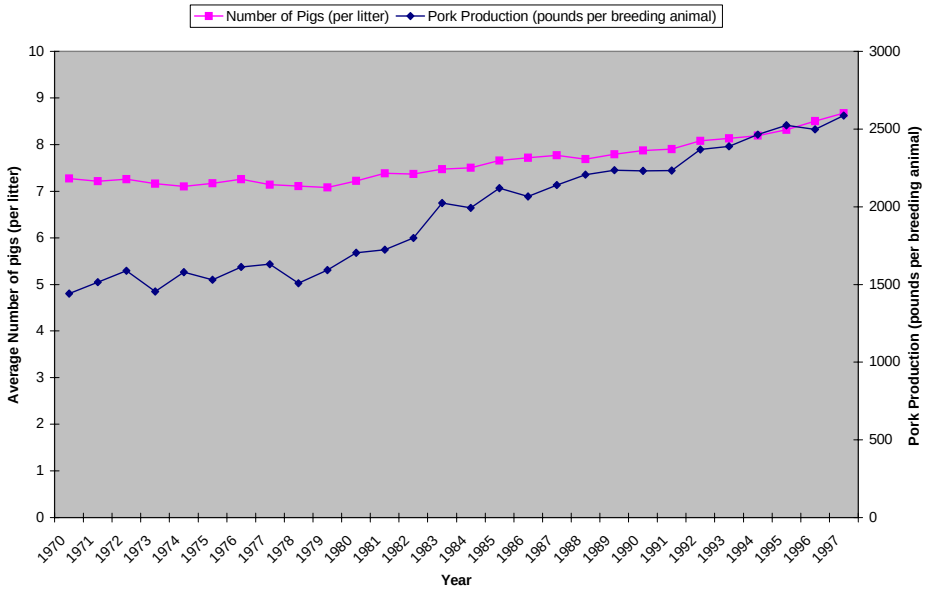


Figure 4 provides data from the National Pork Producers Council that indicates an increase in productivity in swine production from 1970 to 1997. During that time span, the number of pigs produced per litter increased from 7.27 to 8.67, and the number of pounds of pork produced per breeding animal, from offspring, has increased from 1442 to 2587. This increase in productivity has occurred during the period in United States history when the movement from family farms to factory farms can be traced. (NPPC 1999)

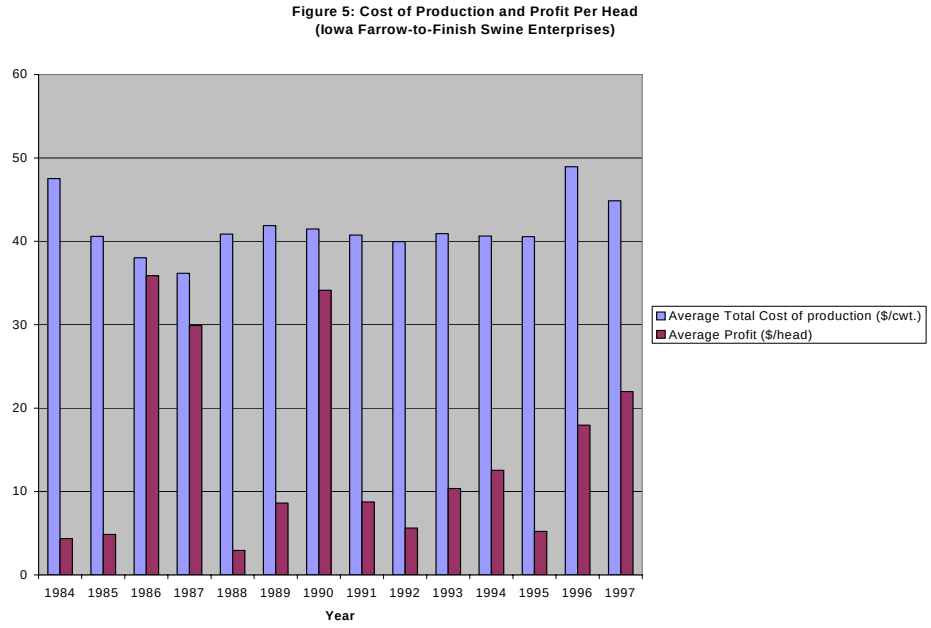
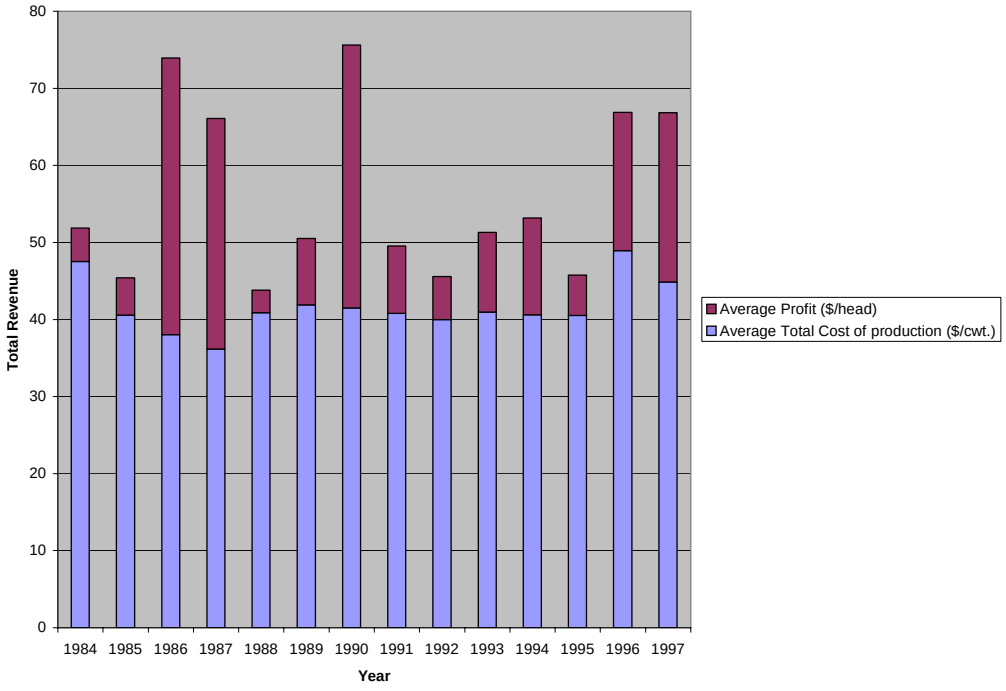


Figure 5 addresses the issue of changes in total cost of production and average profit for Iowa farrow-to-finish hog enterprises. This graph neither supports nor refutes that over this time period, when data show that small farms were disappearing and industrial facilities were appearing in their place, that farms became more profitable. The average total cost has remained relatively steady as compared to the average profit, which has varied dramatically with no distinct pattern. Although this graph is interesting in that it does not provide an increasing trend over time, it is unclear whether it is based on data solely from industrial facilities or from a combination of family and factory farms. If it

were clear that it was based on industrial facilities only, it would certainly refute claims of efficiency and profitability.

The data provided by the NPPC that was used to construct Figure 5 is problematic. Farrow-to finish operations refer to operations that raise piglets to maturity. The hogs are then sold for slaughter and production. The National Pork Producers Council provides data that indicate the costs and profits involved with pork production in these types of operations. They supply data, which implies that the cost of production exceeds the profit made by the company. One should be skeptical of this data. From an economic standpoint, total revenue for the producers equals the sum of the cost of production and the profit per head. Thus, the profits, plus the cost represents the actual amount that the pigs are sold for. The figures that are given for profit are what is made after the cost of production is subtracted. In other words, stacking the two bars on top of each other would provide a better indication of how the companies are benefiting from production.

Figure 6: Total Revenue Per Head (Iowa Farrow-to-Finish Enterprises)



A publication of Illinois Citizens for Responsible Practices called “Family Farms vs. Hog Factories” refutes claims about the efficiency of large farms over small farms, and the benefits of vertical integration. This publication cited a Kansas State University study, which concluded that family farms can compete in terms of efficiency. The study shows that among the 91 farrow-to-finish hog farms studied, the farm with the lowest cost of production had only 75 sows and produced only 150 litters per year. Also, half of the farms producing less than 200 litters per year had below average costs of production and half of the farms producing more than 200 litters had above average costs of production. (Illinois Citizens for Responsible Practices [ICRP] 1997)

Durrenberger and Thu (1998) point out that although the issue of whether family or factory farms are more efficient is fairly complicated and can be argued in favor of either, family farms are not necessarily inefficient by virtue of their size.

The ICRP publication also discusses the issue of vertical integration, which is involvement in more than one stage of production by a single company. It cites a study from the University of Nebraska, which used computer modeling to simulate the effects of vertical integration on the hog industry. The study found that if 10% of the nation’s pork production capacity is operated under contract by packers, the packers will purchase 13.3 fewer hogs from independent producers and pay 6% less than they would if they did not have control of the industry. Also, if packers control 50% of production, they will pay 26% less for hogs from independent producers. (ICRP)

Vertical integration can serve to put small farms out of business. When the same company owns both a production facility, for example, a farrow-to-finish enterprise, and also a processing facility the company can strategically destroy competition. Large

companies owning both production and processing facilities can take a loss at the stage where pigs are sold for processing. They can sell their pigs to their own processing plants for much cheaper prices than small family farms can because family farms make their profit and family's income at that stage. The result is that industrial farms put small farms out of business by taking a loss and then making up for it by selling the product at higher prices after processing. Vertical integration works to the detriment of small farmers and does not benefit consumers.

Proponents of industrial hog production also point to the benefit of contract farming as a method of reducing risk. Durrenberger and Thu point out that the process of industrialization does not refer to a process where small farms got larger. It actually involves the input of outside capital to create an entirely new system. With contracts, farmers finance the building of housing units while contractors provide animals, feed, veterinary services and management skills. This process takes the multi-skilled nature away from farming. The workers do not own the animals and make few decisions. They are paid based on the factory's output. (The Industrialization of Swine Production…1996) Another important issue that anti-factory farming groups are fighting is that farmers are responsible for waste management, not the company that contracts them. They are fighting to make corporations take responsibility because farmers do not have the resources to effectively manage the waste.

Durrenberger and Thu show that the introduction of industrial agriculture into rural communities has been shown to degrade the community socially. They cite the work of sociologist Walter Goldschmidt who studied communities in California where these agricultural changes had occurred. He found that small to moderate sized farms

more closely mirror American values in education, income, standard of living and civic organizations because independent small farmers are more community minded. Durrenberger and Thu related Goldschmidt's findings to the changes occurring in Iowa due to the industrialization of hog production. They found that in rural areas where there were fewer small to moderate size farms, economic well being declined. This was reflected in increased food stamp usage. (The Expansion of Large Scale Hog Farming in Iowa…1996) Jim Braun (1998) points out that in rural North Carolina, the quality of education is declining because of the prevalence of transient students. Families move in and out of these towns so quickly that teachers cannot effectively monitor the progress of the students.

As mentioned earlier, one of the other supposed aspects of factory farming is that environmental and public health concerns are barriers to growth, not consequences. This statement implies that strong steps are being taken to avoid the devastating environmental impacts of animal waste produced through factory farming. However, these industrial facilities continue to wreak havoc on rural communities.

The Ecological Angle

In theory, hog production should be a "no-discharge" system because fields, particularly of soybeans, hay and alfalfa can be fertilized with the waste. (Okun 1997) Theoretically, this may be so, but in actuality hog waste from industrial livestock

operations in a major source of both water and air pollution and ultimately creates threats to human health. One hog creates as much solid waste as four people, and while most small towns require treatment of human waste before it can enter the water supply, these guidelines do not exist for industrial hog facilities because the waste is applied on land. (Jackson 1998) By concentrating large numbers of hogs in one space, the land cannot carry all of the waste the animals create.

When hogs are kept in confinement facilities, they remain on slatted metal floors where feces and urine can exit into a pit underneath. In some cases waste is stored in these pits, but more commonly it is piped into an open-air lagoon where it is stored until it is spread over land. The waste in the pits is generally more concentrated while the waste in the lagoons is less concentrated but more of nuisance as plumes of foul smelling gas the size of the lagoon can form and wind can blow the plumes into nearby towns. (Jackson 1998)

Lagoon performance comes into serious question when considering factory farms as a pollution source. Careless maintenance of a lagoon can cause the walls to crack or lead to overfilling, resulting in runoff. Increased rainfall can also weaken lagoon walls and cause devastating runoff into surface waters. Lagoons can also leak to groundwater. All earthen lagoons leak until soil pores in its walls and floor seal with waste. Still, seepage occurs and can be heightened the coarser the soil is. Clay liners make soil pores smaller to minimize seepage but are subject to holes from earthworms and root plant activity. (Jackson 1998)

Durrenberger and Thu reveal that in interviews with construction workers they found that while officials argued that lagoons do not seep, the construction workers were

not surprised when they did because engineering specifications were consistently ignored to achieve greater profits. (The Industrialization of Swine Production…1996) This is a clear indication the economic consequences of ecological disasters are not factored in when management of these facilities determines prospective profits.

Manure spreading is an ancient farming practice where the waste is used to replenish soil for crops. This is an additional source of waste in groundwater. Nitrates enter the water supply either when the nitrogen content in the soil is already very high, or when the amount added exceeds the amount that can be utilized by the crops. It is very difficult and costly to determine exactly how much waste can be added to a particular field without seepage to ground water and even runoff to surface water. This is because the chemical makeup of the hog waste is heterogenous and each load would have to be tested for its nitrogen content in order to know the acceptable rate of application. In addition, hog waste generally has a ratio of 1.5 parts nitrogen for every 1 part phosphorus. When waste is applied to meet the crops' nitrogen usage, phosphorous builds up and runs off into the water. (Jackson 1998)

When hog waste seeps into drinking water supplies, it causes severe public health threats. United States Environmental Protection Agency tests show that in 17 states fecal streptococci and fecal coliform bacteria can be found in groundwater from feedlot manure. (Natural Resources Defense Council [NRDC] 1998) Several organisms that are potential causes of disease in humans can be found in lagoons and swine waste, however, it is known that 50% of bacteria and 90% of viruses may be destroyed in lagoons, but the remainder can still survive, based on factors such as temperature, pH and sunlight, predation and competition. Gastrointestinal illness is associated with consuming water

that is contaminated with waste, but often the pathogen responsible is never identified. (Jackson 1998)

Pfiesteria piscicida is an organism present in water resulting from excessive nutrients (nitrogen and phosphorous) in water supplies. This organism has been known to cause fish kills and lesions on fish. Symptoms such as skin irritation and lesions, gastrointestinal problems, short-term memory loss and other cognitive impairments are associated with human exposure through water or water vapor containing the microbe. (NRDC 1998)

Also, the presence of nitrates in the drinking supply is a particular threat to children under five years old, older people, and those with suppressed immune systems. Nitrogen in waste is converted to nitrates in soil. Nitrates have a high solubility and can move quickly into the water supply. The maximum level allowed in drinking water is 10 parts per million, while studies in North Carolina revealed that 9.4% of the wells tested had a nitrogen content greater than 10 ppm. One of the most devastating effects of nitrate ingestion is the development of methemoglobinemia in children, also called “Blue Baby Syndrome”. When nitrates are introduced into the body, they are converted to nitrites that affect the function of hemoglobin, which is to carry oxygen to the body’s cells. Nitrites convert hemoglobin into methemoglobin, which does not carry oxygen and leads to brain damage, even death in children. (Okun 1998)

Runoff from lagoons and over-fertilized fields can cause contamination of surface waters. This runoff has an adverse effect on rivers, lakes and streams and coastal oceans. The waste poses a huge threat to drinking water, fishing, recreation, esthetic enjoyment, and the biodiversity within these natural ecosystems, particularly because of the process

of eutrophication. Eutrophication is the fertilization of surface waters by nutrients that were previously scare, in this case, nitrogen and phosphorous. The most visible consequence of this process is the proliferation of algae, which can turn water green and is sometimes referred to as “pond scum”. This increase in algae can interfere with fisheries. As these plants die, those bacteria that decompose them begin to proliferate and consume more and more oxygen as they break down the plants. Fish die because of this lack of oxygen. Besides fish kills, eutrophication can lead to loss of other aquatic plants in fresh and marine water. In freshwater, “blooms” of cyanobacteria are an indicator of eutrophication and contribute to fish kills, foul odors, and poor tasting drinking water. (Carpenter et al. 1998)

Water pollution, unfortunately, is not the only threat from industrial swine facilities. Air pollution is also a major problem, particularly for those living in close proximity to one of these operations. In open-air lagoons, 70-80% of the nitrogen changes form from a liquid to a gas through the process called “ammonia volatilization”. Once the nitrogen enters the atmosphere, it enriches rainfall and thereby damages and changes natural habitats because species that require increased levels of nitrogen begin to dominate over those species that do not utilize the excess nitrogen. (Jackson 1998)

Air pollution also exists in the form of odor emanating from these industrial facilities. The odor comes from swine urine, feces and spilled feed. Anaerobic decomposition of feces results in a most objectionable odor. Compounds identified in hog manure include sulfides, disulfides, volatile organic acids, alcohols, aldehydes, amines, fixed gases, nitrogen heterocycles, mercaptans, carbonyls and esters. (Schiffman et al. 1998)

Schiffman et al. (1998) conducted a controlled study to determine if swine odor affected the moods of people living near production facilities. It was found that people could experience annoyance, depression, nausea, vomiting, headache, shallow breathing, coughing, sleep disturbances and loss of appetite due to unpleasant odors, probably from a combination of the compounds listed above.

The use of antibiotics on factory farms poses yet another threat to human health. Antibiotics are necessary because when large numbers of one species of animal, for example pigs, are confined in close quarters infections can be widely spread. (Mason & Singer 1980) The widespread use of antibiotics as feed additives, to keep the animals healthy, can result in the development of drug-resistant bacteria that could pose a serious threat to human health and could decrease the effectiveness of antibiotics for therapeutic purposes in both humans and animals. (Fox 1986) If the animals are not properly weaned off the antibiotics with sufficient time before slaughter, residues remain and enter the human food supply. (Mason & Singer 1980)

Examples of Ecological Disasters

Iowa and North Carolina are the nation's leading pork producers. An examination of problems experienced in these two states is important to understand the consequences of industrial swine production in action.

Iowa is the nation' s number one pork producer and accounts for one quarter of the total pork production. In Iowa there are 1,200 CAFOs (Confined Animal Feeding Operations) which house 1,000 animals or more. The proximity of these factories to a unique underground drainage system is a threat to surface water and groundwater

supplies. During the period from 1994 to 1998, 51 manure spills into Iowa streams, rivers, and lakes were serious enough to warrant financial penalties. An overflowing lagoon caused the biggest spill, while the worst resulted from the application of liquid manure on fields. In this spill, more than 1.1 million fish along with other aquatic species were killed. The largest spill in 1995 resulted from a broken underground pipe going into a lagoon. 1.5 million gallons of waste contaminated over 30 miles of the south fork of the Iowa River, killing fish and closing down a recreation area. In 1996, a spill occurred due to carelessness while siphoning off a lagoon. The pump was left running and 100,000 gallons of lagoon water contaminated Iowa's North Buffalo Creek. This accident killed 586,753 fish and waste flowed into a wildlife area and a lake used for recreation. The company that owned the facility was given a $33,000.00 penalty. Iowa residents also face problems of air pollution. Odors from industrial agricultural facilities are unregulated by governments unlike other industries where toxic air emissions are regulated for public health and environmental concerns. (NRDC 1998)

North Carolina residents are facing almost the exact same array of problems. 88% of the hog farms in North Carolina have at least one water quality violation. North Carolina is the nation's second largest pork producer and is home to the largest hog slaughterhouse, which produces 24,000 hogs per day. In eastern North Carolina the problems are most prominent. Excessive nutrients are present in coastal rivers and estuaries, algal blooms proliferate, massive fish kills occur and pfiesteria remains a serious problem. Gains from curbing industrial pollution from cities in the Tar-Pamlico and Neuse Rivers have been offset by agriculture. Agricultural sources (both crop and animal) make up 76% of the input of nitrogen and 56% of the input of phosphorous into

the rivers. Besides contamination of surface water, North Carolina is experiencing groundwater contamination from seepage in lagoons and leaching of contaminants through soil after manure is applied to land. A North Carolina State University study showed severe loss of nitrogen from more than 50% of the lagoons tested in the state. The study also found that even with clay liners to prevent seepage, lagoons could leak anywhere from hundreds to thousands of gallons of waste each day. Air pollution is also a problem. The E.P.A. estimated that in 1995 in eastern North Carolina, 179 million pounds of nitrogen in the form of ammonia entered the atmosphere to eventually be rained out and trigger algal blooms and fish kills. (NRDC 1998)

In September of 1999 Hurricane Floyd caused the flooding of many lagoons and the rupture of three in Duplin County, as well as the killing of more than two million turkeys, chickens and livestock in the area. Feces and urine soaked the land and the waste from the farms was so great that it is expected to continue leaching into the water supply until next spring. A Duplin County physician said no disease attributable to the disaster had developed, but he anticipated cases of severe gastroenteritis with diarrhea and vomiting. (Kilborn 1999)

Conclusions

It is logical that intensification and modernization of agriculture is a response to increased demand for certain agricultural products. When it comes to pork production in the United States, this is a very difficult explanation to swallow. Data shows that the

demand for pork in the United States has not increased over the past thirty years, yet United States citizens, particularly residents of Iowa and North Carolina are subject to the consequences of this growth to meet foreign demand.

The consequences of factory farming on rural communities are inexcusable. The environmental and public health concerns speak for themselves, in my opinion, yet industry and government are ignoring them. In America, we have the technology and knowledge to prevent these environmental catastrophes, but they still occur. Rural communities are forced by industry to deal with contaminated water and heinous odors, daily. I feel very strongly that the environmental consequences of industrial swine production have severe social and economic consequences, as well. Public health concerns and the strong odor in communities surrounding industrial swine production facilities leads to a decline in property values. This puts residents in a compromising position. They can try to sell their house for much less than it is worth, uproot their lives and move to another community or they can remain and suffer the environmental consequences living near the farm. Another problem is that the environmental effects are not only experienced locally, but are widespread when it comes to water and air pollution and affect a many communities, as well as the fishing industry.

Although I find it impossible to refute the environmental and social consequences of industrial swine production, the issue of economics is highly complicated. I find it difficult to know what is accurate. As this paper tries to show, economic calculations can be misleading. Also, because this subject is fraught with controversy, there exists a dialogue between proponents of industrial swine production and opponents such as environmental groups and each group provides different angle on issues of efficiency and

profitability. I think, however, that there is something to be learned from this analysis. Although there are economic benefits to factory farming and export to other countries, the obliteration of small farms is not justified based on claims of inefficiency by virtue of their size.

In addition, I have tried to show that while taking economic issues into consideration can be valuable, they cannot be read as the total story. Large-scale swine producers are barely held financially accountable for the damage the environmental damage they cause. From a purely environmental standpoint, however, financial accountability for damage is not enough. Prevention is the key. Environmental concerns should be barriers to and not consequences of agricultural growth, as is purported by the industry, yet evidence from Iowa and North Carolina speaks to the contrary. Growth is continually occurring and along with it comes consequences.

The question to be answered is truly one of sustainability. Perhaps in an ideal world, we could regulate sustainability so that no human activity will leave a bigger footprint than the Earth can handle. Environmentalists fight for a permanent end to these industrial systems of agriculture in favor of a return to traditional farming. This may be a more lofty goal than industry and government are willing to accommodate. Perhaps, a more immediate way to deal with the environmental problems is stricter regulation of the industry. Regulation, however, becomes complicated because it involves the issue of categorization. Industrial factories in cities are regulated for emissions of carbon dioxide and other gases and for other solid and liquid waste to with the goal to minimize environmental and public health risks. Industrial livestock facilities, however, are considered agricultural, not industrial and consequently are highly unregulated. In

addition, because big businesses have virtually unlimited resources to lobby legislators, they avoid strict regulation as industrial facilities and avoid complying with any regulations that are instituted. In the meantime, people are getting sick and natural habitats are being destroyed.

References

Braun, J. 1998. "Inside the Industry from a Family Hog Farmer". *In Pigs, Profits, and Rural Communities*, eds. E. P. Durrenberger & K.M. Thu , 39-56. Albany: State University of New York Press.

Carpenter, S., Caraco, N., Correll, D.L., Howarth, R.W., Sharpley, A.N., & Smith, V.H. 1998. Nonpoint Pollution of Surface Waters with Phosphorous and Nirtogen. *Issues in Ecology* 3.

Center for Rural Affairs. 1998. *Searching for "Sound Science"*. authors Thompson & Haskins

Durrenberger, E.P. & Thu, K.M. 1996. "The Expansion of Large Scale Hog Farming in Iowa: The Applicability of Goldschmidt's Findings Fifty Years Later". *Human Organization* 55,: 409-415.

Durrenberger, E.P. & Thu, K.M. 1996. "The Industrialization of Swine Production in the United States". *Culture & Agriculture*18:19-22.

Durrenberger, E.P. & Thu, K.M. 1998. "Introduction". *In Pigs, Profits, and Rural Communities*, eds. E. P. Durrenberger & K.M. Thu , 1-22. Albany: State University of New York Press.

Fox, Michael W. 1986. *Agricide*. New York: Schoken Books.

Illinois Citizens for Responsible Practices. 1997. *Family Farms vs. Hog Factories.* author St. John

Jackson, L.L. 1998. "Large-Scale Swine Production and Water Quality. *In Pigs, Profits, and Rural Communities*, eds. E. P. Durrenberger & K.M. Thu ,103-117. Albany: State University of New York Press.

Kilborn, P.T. 1999, October 17. "Hurricane Reveals Flaws in Farm Law as Animal Waste Threatens N. Carolina Water". *The New York Times*. 32.

Okun, M. 1997. "What's That Smell In the Air"?. (University of North Carolina at Chapel Hill, School of Public Health). Found at http://checc.sph.unc.edu/rooms/

library/docs/Hogs/hogcase.html

Mason, J. & Singer, P. 1980. *Animal Factories*. New York: Crown Publishers.

National Pork Producers Council. 1999. *1998-1999 Pork Facts*.

Natural Resources Defense Council. 1998. *America's Animal Factories: How States Fail to Prevent Pollution from Livestock Waste*. Project Director: Marks.

North Carolina Pork Council. 1997. *Facts & FAQs*.

Pimental, D. 1984. "Energy Flow in the Food System". In *Food and Energy Resources*, eds. D. Pimental & C.W. Hall, 1-23. Orlando: Academic Press.

Pretty, Jules N. 1995. *Regenerating Agriculture*. Washington, D.C.: Joseph Henry Press.

Schiffman, S.S., Sattely-Miller, E.A., Suggs, M.S., & Graham, B.G. 1998. *In Pigs, Profits, and Rural Communities*, eds. E. P. Durrenberger & K.M. Thu ,84-102. Albany: State University of New York Press.

United States Department of Agriculture. 1998. *Agriculture Fact Book '98.*

Young, J.A. 1982. "Productive Efficiency and the Adaptations of Small-Scale Farmers". *Human Organization* 41, 208-215.