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Concentrated Animal Feeding Operations: What are the Potential Community Costs?

by

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Introduction

This practice guide is intended for individuals who wish to better understand concentrated animal feeding operations (CAFOs), specifically swine operations. The guide provides a brief history of CAFOs; discusses the difference between CAFOs, Animal Feeding Operations (AFOs), and Confined Feeding Operations (CFOs); and describes the potential community costs associated with these operations. This guide is useful for rural planners, city officials, community members, and livestock farmers as a means of addressing potential community costs associated with larger livestock operations.

The Issue

While concentrated animal feeding operations have become increasingly prevalent throughout the United States, they tend to concentrate in particular regions. There are five top hog-producing states in the U.S which cumulatively represent 67 percent of hog production and the majority of swine concentrated animal feeding operations (United States Department of Agriculture National Agricultural Statistics Service Information [USDA-NASS], 2009). In order from most to least production, these states include Iowa, North Carolina, Minnesota, Illinois, and Indiana (USDA-NASS, 2009). These operations are lucrative for the nation's economy as a whole and for the individual states that generate revenue from the production of livestock. However, there are potential and significant disadvantages for community members living near these operations. The following is a discussion of four types of community costs associated with CAFOs and how they impact the communities of people living nearby. Though this guide looks at the U. S. hog industry, it focuses on the EPA Region 4[1], and specifically Indiana as a case study for discussion of swine operations.

History of CAFOs

According to the United States Department of Agriculture National Agricultural Statistics Service, the U.S. has experienced a decrease in the number of swine operations since 2002. For instance, in 2002 there were 78,895 swine operations, but in 2007 there were 75,442 operations nationwide (USDA-NASS, 2007). However, the reduction of swine operations is deceptive because the production of hogs and pigs has increased across the country due to more efficient agricultural practices such as concentrated animal feeding operations, or CAFOs. In 2002, there were 60,405,103 hogs and pigs produced; in 2007 there were 67,786,318 (USDA-NASS, 2007).

Table 1 displays the number of swine farms and the number of hogs and pigs categorized by the size of the operation. The table compares the trends associated with CAFO meat production for the U.S. and Indiana. Though the intention of this guide is to focus on swine farming in states within EPA Region 4, Indiana is used as a case study of swine farming both because of its proximity to EPA Region 4 and its status as a top hog-producing state. For both the U.S. and Indiana, the smaller operations are decreasing both in terms of their production rates and number of farms, while the larger operations are increasing on both of these measures. Total production overall increased for both the U.S. and Indiana from 2002 to 2007.

[1] EPA Region 4 includes the following states: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, and 6 Tribes.

Table 1: Total Inventory for Hogs and Pigs 2002-2007: United States and Indiana

Total Farms with Hogs and Pigs	2007 Farms	2007 Number	2002 Farms	2002 Number	Percent Change from 2002 to 2007 (Farms/Number)
United States					
1 to 99	52,521	622,032	48,635	772,157	7.99%/-19.44%
100 to 499	7,114	1,821,586	12,366	3,090,663	-42.47%/-41.06%
500 to 999	3,558	2,488,234	6,010	4,175,405	-40.8%/-40.41%
1,000 to 1,999	4,013	5,527,798	5,148	6,849,279	-22.05%/-19.29%
2,000 to 4,999	5,356	16,532,918	4,530	13,798,995	18.23%/19.81%
5,000 or more	2,850	40,793,750	2,206	31,715,604	29.19%/2862%
Total	**75,442**	**67,786,318**	**78,895**	**60,405,103**	**-4.38%/12.22%**
Indiana					
1 to 99	1,839	31,903	1,758	40,470	4.61%/-21.17%
100 to 499	515	144,285	1,046	273,660	-50.76%/-47.28%
500 to 999	317	211,646	495	343,481	-35.96%/-38.38%
1,000 to 1,999	258	354,006	388	509,793	-33.51%/-30.56%
2,000 to 4,999	320	1,022,412	263	764,312	21.67%/33.77%
5,000 or more	171	1,904,805	137	1,546,854	24.82%/23.14%
Total	**3,420**	**3,669,057**	**4,087**	**3,478,570**	**-16.32%/5.48%**

Source: USDA- National Agriculture Statistics Services, 2007

Table 2 highlights the states that are served by EPA Region 4, showing the number of farms with 2,000 to 4,999 hogs or pigs and with 5,000 or more. Florida is omitted because it does not contain operations of this size. Table 1 categories that demonstrated the trends of livestock operations have also been omitted since Table 2 only lists states within EPA Region 4 that have larger CAFO operations.

Table 2: U.S. EPA Region 4: Total Hogs and Pigs 2002-2007

Total Farms with Hogs and Pigs	2007		2002		Percent Change from 2002 to 2007 (Farms/Number)
	Farms	Number	Farms	Number	
Alabama					
2,000 to 4,999	13	49,942	12	43,700	8.33% / 14.28%
5,000 or more	18	105,540	13	90,806	38.46% / 16.23%
Georgia					
2,000 to 4,999	24	79,731	24	76,729	0% / 3.91%
5,000 or more	14	142,112	17	170,435	-17.65% / -16.62%
Kentucky					
2,000 to 4,9999	24	69,377	26	81,825	-7.69% / -15.21%
5,000 or more	16	184,600	16	166,967	0% / 10.56%
Mississippi					
2,000 to 4,999	22	79,336	17	61,306	29.41% / 29.41%
5,000 or more	21	243,337	20	(D)	5% / NA
North Carolina					
2,000 to 4,999	542	1,783,259	622	2,045,177	-12.86% / -12.81%
5,000 or more	608	7,587,708	618	7,514,379	-1.62% / .98%
South Carolina					
2,000 to 4,999	18	60,249	16	52,035	12.5% / 15.79%
5,000 or more	20	201,245	21	175,144	-4.76% / 14.90%
Tennessee					
2,000 to 4,999	13	44,996	17	56,130	-23.53% / -19.84%
5,000 or more	5	34,750	7	77,943	-28.57% / -55.42%

Source: USDA-National Agricultural Statistical Services, 2007
Note: Florida is not listed because there are no hog farms in these categories located within the state.
Symbols: (D) means withheld

The increased intensity of animal meat production has occurred gradually throughout the past half century in the U.S. This transformation is a reflection of competition within the meat industry and demonstrates the economic forces behind efficient agricultural practices. As a result of meat competition and the necessity for cost-efficient production practices, the number of CAFOs has increased throughout the nation (Spinelli, 1991). These operations are able to house thousands of animals, utilizing less space and decreasing economic costs for their production. Once having been number one, pork meat sales have been declining since the 1950s, now sitting behind the beef industry. An increase in productivity was necessary for hog farmers to compete in the meat industry, particularly against the beef and poultry industries, which are leaner meats. The competition contributed to the emergence of CAFOs in the hog industry which resides on smaller plots of land with a higher concentration of livestock (Spinelli, 1991).

These trends have continued throughout the US in the meat industry, and as such the use of CAFOs has become common practice. In addition to swine, the dairy, poultry and other livestock industries have also utilized these modes of operating. Though these practices increase the capacity for mass production of animals, there is potential for negative impacts on the animals

and the residents living near these operations. Fortunately, smaller operations remain (see Table 1), but the majority of livestock produced are from CAFOs. In 2005, factory farms provided 40 percent of the overall meat production in the world (Nierenburg, 2005). The next section will discuss the distinction between larger CAFOs, animal feeding operations (AFOs), and smaller confined animal feeding operations (CFOs).

Difference between CAFOs, AFOs and CFOs

The EPA's National Pollutant Discharge Elimination System (NPDES) regulates CAFOs and AFOs/CFOs, particularly the larger animal feeding operations (U.S. EPA-NPDES 2009). The NPDES defines AFOs as facilities where animals are stabled/confined or fed/maintained for 45 days or more within any 12-month period (U.S. EPA-NPDES 2009). CFOs are used interchangeably with the definition of AFOs. A CAFO is an AFO that houses more than 1,000 animal units (AUs), or is designated a CAFO by permitting authorities (U.S. EPA-NPDES 2009). An animal unit will vary according to the type of animal, but for swine operations it is considered a swine weighing over 55 pounds multiplied by .04; 1,000 AU equals 2,500 swine. Each state is required to follow these minimum regulations set by NPDES, but states can require more strict regulations for CAFOs (U.S. EPA-NPDES 2009). Table 3 and Table 4 below list the distinctions between small, medium and large CAFOs for swine weighing 55 pounds or more and swine weighing less than 55 pounds. Both Tables 3 and 4 distinguish between small, medium or large CAFOs through the application of regulatory definition or designation. These distinctions identify whether producers are required to obtain a permit from the NPDES. In 2008, the EPA adjusted their regulations to remove the obtainment of a NPDES permit and operations that have the potential to discharge are the only feeding operations required to apply. Also, the EPA added a requirement for all CAFOs to submit a Nutrient Management Plan (NMPs). This plan mimics some of the regulations for NPDES permits and is discussed in a subsequent section in more detail. However, the distinctions of size in Tables 3 and 4 still demonstrate the variety of sizes of operations.

Table 3: Small, Medium and Large CAFO distinction weighing 55 lbs or more

An AFO that has	Is a…	By:
At least 2,500 swine weighing 55 lbs or more	Large CAFO	Regulatory Definition
From 750-2,499 swine weighing 55 lbs or more & meets one medium category discharge criteria	Medium CAFO	Regulatory Definition
From 750-2,4999 swine 55 lbs or more & has been designated by permitting authority	Medium CAFO	Designation
Fewer than 750 swine weighing 55 lbs or more & has been designated by permitting authority	Small CAFO	Designation

Source: EPA Producer's Compliance Guide for CAFOs, 2008

Table 4: Small, Medium and Large CAFO distinction weighing less than 55 lbs

An AFO that has	Is a…	By:
At least 10,000 swine weighing less than 55 lbs.	Large CAFO	Regulatory Definition
From 3,000 to 9,999 swine weighing less than 55 lbs & meets one of medium category discharge criteria	Medium CAFO	Regulatory Definition
From 3,000 to 9,999 swine weighing less than 55 lbs. & has been designated by permitting authority	Medium CAFO	Designation
Fewer than 3,000 to 9,999 swine weighing less than 55 lbs & has been designated by permitting authority	Small CAFO	Designation

Source: EPA Producer's Compliance Guide for CAFOs, 2008

Case Study: Indiana and Swine CAFOs

As one of the top producers of swine, Indiana has thousands of animal feeding operations including swine, poultry and cattle. There are almost 61,000 livestock farms in Indiana, 645 of which are CAFOs (NASS, 2007). To be considered a CAFO there are thresholds, as mentioned above, based on the type of livestock which is mandated by the Indiana Department of Environmental Management (IDEM) and reflect the EPA's standards: 700 mature dairy cows, 1,000 veal calves, 1,000 cattle other than mature dairy cows, 2,500 swine above 55 pounds, 10,000 swine less than 55 pounds, 500 horses, 10,000 sheep or lambs and 55,000 turkeys.

CFOs, which are also known as AFOs, are smaller and typically less problematic because of their size (Indiana Department of Environmental Management [IDEM], 2009). Indiana law defines a CFO as any animal feeding operation engaged in the confined feeding of at least 300 cattle, or 600 swine or sheep, or 30,000 fowl(such as chickens, turkeys or other poultry); again, this reflects the federal definition of a CFO/AFO.

CAFOs are considered to be more controversial than CFOs because they are larger and tend to have more negative consequences associated with them. Operations falling within the CFOs thresholds are considered small farms and require less stringent regulations by state or federal authorities. Each state must adhere to the regulations made by the EPA. The additional resources in the appendix provide the general rules associated with animal feeding operations for both Indiana and the EPA. Other states' regulations may vary, but all states have the minimum expectations of the EPA's NPDES.

As mentioned previously, Indiana is the fifth-largest hog-producing state, a ranking it has maintained for several years (NASS, 2007). Indiana, as with the other top-ranked hog-producing

states, depends on livestock operations, particularly swine, for economic revenue. In Indiana alone, swine production accounted for $704 million of $2.25 billion in livestock cash receipts in 2007 (Growing IN Agriculture, 2010). In 2005, Indiana Governor Mitch Daniels proposed doubling hog production (Indiana Pork, 2007; Growing IN Agriculture, 2005). Indiana residents have spoken out against these operations through various avenues including citizen action groups, newspapers, and media coverage. For instance, Indiana CAFO Watch[2] is a website dedicated to providing information to residents about CAFOs in the region. Governor Daniels has responded by dubbing these citizens and opponents of factory farming "eco-terrorists," illustrating the tension between state economic initiatives and residential and community concerns (Arnot, 2007).

Historically, Indiana has benefitted immensely from these operations. Indiana's swine operations have fallen from approximately 48,000 farms in 1965 to roughly 2,800 hog farms in 2007 (NASS, 2007). However, the number of farms is inversely related to the size of the farms' animal populations. These operations are appealing because one operation can house as many as half a million swine, poultry or cattle. These statistics and production practices demonstrate that community costs may be worsening for community members because the larger concentration of animals has the potential for more adverse conditions than smaller operations or CFOs.

In 2008 and 2009, Indiana began the Certified Livestock Producer Program which is a state-run program promoting better relationships between communities and livestock producers. The aim of the program is to recognize livestock producers that go above and beyond the state-mandated regulations. For instance, producers make a commitment to the environment, animal well-being and food security, emergency planning, bio-security and being a good neighbor. Aspects of the program involve informing adjacent property owners about the farms themselves. This initiative is voluntary for any livestock producers and could demonstrate that producers are concerned with better relationships in the community. Although this program is voluntary, participation indicates that there are initiatives for community notification.

CAFO Regulations, Permit Process and Community Notification

All CAFOs are regulated by the federal government through the EPA, which assigns permits for the NPDES. The permitting regulations are approved by the state authority of the operations location except in the following states: Alaska, Idaho, Massachusetts, New Hampshire, New Mexico, and Oklahoma. As previously mentioned in the CAFO, AFO/CFO discussion, NPDES regulations cover effluent limitations, special conditions, standard conditions and monitoring, record-keeping and reporting requirements. The NPDES standards were created under the Clean Water Act of 2003 which identified CAFOs as point source dischargers. These regulations are a legal contract for CAFO producers and are required to set limits on the strains these operations have on the environment. The EPA Region 4 CAFO operations regulations can be found on both the EPA's website and the states' agricultural websites, which include the federal regulations and any additional state regulations (see Appendix A).

[2] *Indiana CAFO Watch is a community-based, citizen action group. The website link is listed in Appendix A.*

Permit Process and Community Notification: Indiana

Each state has requirements for their permit process, below are listed the steps of Indiana's permitting process policy that focus on the notification of community members. This portion of the larger permitting process can be the most problematic. The process obligates prospective CAFO permits as follows:

1. The applicant, when applying for a National Pollution Discharge Elimination System (NPDES) permit for a CAFO on undeveloped land or for a previously unapproved CAFO, within 10 working days of the application's submittal, notifies the owners of land adjacent to the proposed CAFO.
2. IDEM notifies local officials (county commissioners, mayors, town board presidents) when an application is received.
3. A petition for review of the decision may be submitted to the Indiana Office of Environmental Adjudication (OEA) within 18 days of the mailing date of the decision.
4. Once OEA receives the application, an advertisement is placed in the largest daily published newspaper in the county of the farm location. The ad includes information about the submittal of the NPDES general permit application. This enables interested parties to opportunity to submit comments to IDEM during the review period and during the permit term regarding the eligibility of the applicant for an NPDES general permit.

   (Indiana Department of Environmental Management, CAFO Permit Process, http://www.in.gov/idem/4994.htm#permitrequirements , 2009)

Throughout this process, citizens are not offered information regarding potential costs and benefits or other facts about the potential effects of these operations; instead, they are informed about the prospective site and allowed to voice concerns. Although Indiana does benefit economically from the production of meat, particularly swine, there may be a cost for communities living within the vicinity of these operations. For instance, there are social, environmental, physical and mental health costs as well as economic costs associated with these operations and these may not be known by, or mentioned to, residents during the permitting process.

Furthermore, while the process for obtaining a permit provides the community with an opportunity to voice its concerns in Indiana, not all states include community notification elements. In Kentucky, the Kentucky Senate Bill 105, has proposed legislation that could prevent local governments and communities from requiring stricter policies for livestock operations (Kentucky Legislation 2010). When a similar bill was passed in Ohio, the overseeing board represented family farmers, a crucial feature that the Community Farm Alliance would like to have included in the Kentucky Bill. This bill with the revisions and comments about the bill can be viewed on the Community Farm Alliance website which is listed in Appendix A.

There are loopholes within the permitting process. For instance, in the state of Indiana, permits do not have to be obtained for sites that do not contain animals but that do store manure (Aukerman 2010). In Union, Indiana, there is a dairy farm operation that trucks its manure to

Henry County, Indiana. The lagoon storing the manure does not require a permit and therefore is not regulated or monitored by IDEM (Aukerman 2010). IDEM is aware of these types of operational procedures; however, the changes necessary to protect the environment in the permitting process have not been addressed.

Potential Community Costs

Community costs include potential social, environmental, physical and mental health, and economic concerns. Social costs due to foul odors include the inability to keep doors and windows open in homes and an unsuitable environment for outdoor recreation and other activities. Environmental costs include water, soil and food contamination, and environmental nuisances such as noise and odors. The physical and mental health costs could include respiratory problems, headaches, and even depression. The economic costs can include decreased property values and decreased revenues within the community such as businesses relocation or avoidance. These costs may seem negligible when compared to the proposed economic gains, but they carry particular weight because they are a matter of social justice and may also have unanticipated negative economic consequences.

Social Costs

As stated previously, one social cost is that residents living near these facilities are prevented from opening their windows or from enjoying outdoor recreation. Assessments of community health and socioeconomic issues surrounding CAFOs revealed that rural communities tend to rely on the outdoors for recreation (Donham, Wing, Osterberg, Flora, Hodne, Thu and Thorne, 2007). The presence of CAFOs disrupts leisure time outdoors. Wing and Wolf's (2000) study states that residents report the prevention of opening windows, in their homes, due to living within a two-mile radius of CAFOs, which supports the argument that residents may experience decreased quality of life in regions with dense CAFOs. "Homes are no longer an extension of or a means for enjoying the outdoors. Rather, homes become a barrier against the outdoors that must be escaped" (Donham et al., 2007: 317). Outdoor quality of life is particularly important to rural communities and often viewed as a community asset due to the lack of city congestion and industrial pollution. By-products of CAFOs undermine quality of life by preventing residents from enjoying the natural environment.

An in-depth study of six rural communities found conflicting opinions between CAFO and non-CAFO producers, they documented harassment of vocal opponents of CAFOs by anonymous sources, and hostile perceptions of both CAFO supporters and opponents of CAFOs (Wright, Flora, Kremer, Goudy, Hinrichs and Lasley, 2001). Conflicting views of CAFOs further the argument of social costs surrounding these operations. These findings are indicative of social costs outside the quality of life within the residential areas. Adverse community relations can arise from these types of operations.

Environmental Costs

Examples of environmental costs include the potential for insect infestations, manure storage problems which can lead to water pollution, soil contamination, the risks associated with siting in

karst[3] regions (particularly located in southern Indiana, Kentucky, central Tennessee, and northern Alabama) and environmental justice issues such as burdening disadvantaged communities. Insect considerations are a primary concern for both community members and for livestock. Insects are, of course, a part of any agricultural practice; however, insect *infestations* are the real problem. The larger CAFO operations are more prone to infestations than smaller operations due to the greater numbers of livestock and waste. The contributions to insect infestations of both the type of chemicals used in CAFOs and the type of manure storage system can be mitigated with a well-designed plan which effectively attempts to maintain clean barns, pastures and animal confinement areas. This can be done by cleaning standing water, clearing weeds and brush, fixing broken drain tiles, removing manure, spilled feed, wet straw or any decaying material, and using air tight garbage cans. (Steeves and Williams, 2007). The EPA requires CAFOs to submit a Nutrient Management Plan (NMP). This document includes sections for: adequate storage, mortality management, diversion of clean water, prevention of direct contact, proper chemical handling, site-specific conservation practices, manure/soil testing, land application procedures, and records and documentation. NMPs are procedures for CAFOs to follow for prevention of disease and environmental issues, and every CAFO has to submit a plan for its operation (EPA, 2003). NMPs can improve the conditions for animals in CAFOs, and they can prevent further environmental problems if the guidelines are used properly.

Manure storage systems are also relevant to issues of water pollution and soil contamination. The EPA counts 60 percent of all the rivers and streams in the U.S. as having impaired water quality due to agricultural runoff (Floegel, 2000). Runoff is related to manure storage facilities and it is very important for CAFOs to be cognizant of the potential pollution that can result from the type of facility used. Nitrogen and phosphorous are both important considerations for manure storage facilities because excess of either is toxic for both water and soil. Table 5 lists types of storage methods, whether the storage method has a lagoon, and the estimated loss of nitrogen and phosphorus. Table 5 indicates that open sources of manure contribute to an excess of nitrogen and phosphorus which are naturally occurring elements. Excess phosphorus and nitrogen can become runoff and these elements can be overly abundant in rivers, lakes, and streams. Manure storage techniques which do not use open sources of manure such as the mechanical scraper, flushing open-gutter, flushing below gutter, and the anaerobic lagoon. CAFOs, depending on the size of the operation, should consider these environmental components when addressing which facility to use.

[3] *Karst is a landscape with a layer or layers of dissolvable bedrock usually carbonate rock such as limestone.*

Table 5: Manure Storage Facilities and Environmental Considerations

Storage Method	Lagoon Requirement	Estimated % of Nitrogen Lost	Estimated % of Phosphorus Lost
Below Floor Slurry	No	70-85	**90-95**
Outside Storage Slurry	No	70-75	**80-90**
Mechanical Scraper	Varies	15-30 (with lagoon) 70-75 (without lagoon)	**35-50 (with lagoon)** **80-90 (without lagoon)**
Flushing Open-Gutter	Yes	15-30	**35-50**
Flushing Below-Gutter	Yes	15-30	**35-50**
Anaerobic Lagoon	Yes	15-30	**35-50**
Open Lot	No	55-70	**65-80**

Source: University of Minnesota and University of Nebraska Cooperative Extension, 2007

Another important factor to consider is whether the region is karst or cavernous. Southern Indiana and most of Kentucky, for example, are karst regions with an abundance of limestone. Limestone is a porous rock and for this reason it is more susceptible to ground water and soil contamination. Most livestock operations are not supposed to be located in these regions; however, it is important to mention for planning knowledge. Planners and residents should be aware of these regions in the event that a CAFO site has been proposed. CAFOs built in these regions should use caution and preventative measures to address potential contamination.

Environmental justice is defined as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, geographic location or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (IDEM, 2008). Research has indicated that the location of CAFOs often results in burdens that are disproportionately distributed across race and class. Studies in North Carolina have shown that large-scale swine operations tend to be located in low-income, minority populated regions specifically in the eastern part of North Carolina (Wing et al., 2000; Stretesky et al., 2003). Rapid growth of swine CAFOs were correlated with the presence of higher African-American and black populations and with negative externalities such as environmental degradation, health outcomes, and reduced economic resources (Stretesky et al., 2003). Duplin and Samson counties, the two top pork producers in North Carolina, have shown a correlation with concentrations of hog farms and nonwhite areas specifically in the eastern, northern and southern parts of the state. These areas have the lowest population density or ruralness, concentrated in areas of highest disease rates, least access to medical care, and greatest need for economic development and better educational systems (Wing et al., 2000). These environmental

injustices are environmental and social costs affecting disadvantaged groups in society. Ignoring environmental justice issues will continue the problem and neglect the importance of addressing how environmental burdens should be distributed in society.

Physical and Mental Health Costs

Physical and mental health costs include respiratory health problems such as wheezing, coughing, asthmatic attacks, and bronchitis, or anxiety or depression due to noxious odors from these operations. Researchers focusing on North Carolina have surveyed residents to understand the environmental stressors and perceived control of life and personal health while living near large-scale hog farms. Residents reported experiencing respiratory, sinus, and nausea problems which they associated with the hog farms and others feared contamination of their drinking water (Bullers, 2005). A survey of residents living in eastern North Carolina within two miles of a livestock operation returned similar results. Survey participants, specifically those located near hog operations, self-reported increased occurrences of headaches, runny noses, sore throats, excessive coughing, diarrhea, and burning eyes compared to residents not in the immediate vicinity of hog operations (Wing and Wolf, 2000).

Physical health and mental health are important issues for residents and are related to the social costs associated with living in the proximity of these operations. Residents experiencing physical and mental health issues such as respiratory problems or anxiety and/or depression are potentially experiencing a decrease in their quality of life related to social costs. Everyday social interactions can be thwarted by the affects of the physical and mental health costs, and the rural life association of beautiful landscapes and less pollution is being challenged. Information and research is important for residents to be aware of, and the manure storage system considerations are useful in alleviating some of these issues. Planners and producers of CAFO operations should consider the various systems that can potentially be used for CAFOs. For example, as discussed in the environmental costs section, manure storage facilities such as anaerobic lagoons which can reduce emissions which in turn reduces odor. Another consideration is the proximity to residential communities in the region or wind patterns of the region. These concerns could significantly change the face of CAFOs or they could contribute to the evidence of changing the face of the industrial agriculture model.

Economic Costs

Economic costs are often recorded as property value depreciation or decreased monies associated with businesses within the community. Several studies have focused on depreciated property values near swine operations. Two studies both noted that, in North Carolina and Iowa, residents living in two-mile proximity of a swine CAFO faced decreasing property values (Palmquist et al., 1997; Herriges et al., 2005). One report noted that homes downwind (as opposed to upwind) of swine operations face a greater decrease in their property values (Herriges et al, 2005). Table 5 provides a summary of these studies and shows how economic costs are a serious consideration for, and threat to, residents living in regions with CAFOs.

Table 6: Estimates of Property Values Loss from Location of Animal Feeding Operation

Authors	State	Animal Type	Change in Property Price
Bayoh, Irwin, Roe, 2004	Ohio	Various	Small
Herriges, Secchi, Babcock, 2005	Iowa	Swine	-6% to +4%
Kim, Goldsmith, Thomas, 2004	North Carolina	Swine	-2%
Palmquist, Roka, Vukina, 1997	North Carolina	Swine	-3.6% to 0%

Source: Roman Keeney, 2008. Purdue Extension Education Store.
Note: Two studies were compiled by Ulmer and Massey, 2006. Estimates were based on the percentage reduction of the price of a house when a CAFO (1,000 animal units) is located at a distance of 1 mile from the home. The exception is Herriges, Secchi, and Babcock whose range of estimates is for a 1.5 mile distance from the home. Kim, Goldsmith, and Thomas use assessed value of the home rather than a purchase price.

Other economic costs include local businesses that may be affected by the odors from the CAFOs. There is a lack of literature examining these types of costs; however, one can assume that local businesses, particularly restaurants with outdoor seating, could face decreased business during warmer months when the smells are more abundant. Local businesses are often at the heart of small, rural communities; therefore, these smells can be affiliated with social costs as well as economic costs. Local community events located near CAFOs could also face decreased attendance which could lead to economic losses within the community. An effect from these situations could be residents choosing to leave the community which decreases potential revenue for the community and decreases in the community life.

Direct and Indirect Actors

There are numerous individuals and groups that might directly or indirectly contribute to solving the problem of community awareness of CAFOs and their impacts. Direct actors include the producers, state agricultural agencies, and state agencies such as state environmental management departments, and local planning commissions. The direct actors have the most power in the problem-solving context. In Indiana, for example, IDEM has considerable influence; they have a direct say in which CAFOs are approved and have the power to change the process for issuing CAFO permits.

Indirect actors include communities living near, or potentially living near, CAFOs. They have the ability to oppose these operations; however, community members may not have adequate information about these operations and their potential harm (Keeney, 2008). Communities are allowed to voice concerns during the permit process, but this type of participation often does not grant communities the final say in who receives a permit. By right, community members should have influence because they are personally affected, whether positively or negatively, by these operations. Therefore, the combination of these direct and indirect actors affects the outcome of solving or striving to solve the problem.

Focusing again on the state of Indiana as a case study regarding CAFO policy, we find that the state's CAFO permit process affects several of the actors, both direct and indirect. For instance, the permit process directly impacts the producer's ability to find a suitable site for a CAFO. Indirectly, the permit process will affect the community and the land bordering the prospective CAFO site. Therefore, any impediment to the process might not be favored by local and state officials or producers and CAFO operators.

In Indiana, there are citizen action groups that have taken a stand against conditions arising from the location and operation of CAFOs including Indiana CAFO watch, Coxton Neighborhood, and Citizens Action Coalition. The Coxton Neighborhood group exists to inform local citizens in Lawrence County, Indiana about the "growing threat of unrestricted confined animal feeding operations (CAFO or CFO) and our ongoing battle to see the county take the proper steps to safeguard the property value and health of all Lawrence County residents" (Coxton Neighborhood, 2010). Links to these websites are included in Appendix A. These groups emphasize that, in certain situations, communities oppose these operations. These members use their own experiences with CAFOs to advocate change within their communities and others.

Potential Solutions

As mentioned previously, a community could potentially face adverse health, environmental, economic and social conditions due to the presence of CAFOs. Officials who do not disclose to communities the potential costs of a nearby CAFO during the permitting process may be protecting the state's economic gains. Opposition to CAFOs is a potential threat to state revenue. However, this scenario could potentially damage relationships among the community actors and the state officials, creating mistrust and skepticism. States that value the relationship between officials and local community residents can mitigate these outcomes by communicating with the community about the potential costs.

State nuisance laws can alleviate the potential for damage to one's property and offer one avenue for solutions to CAFO problems. These laws vary state by state, according to precedence set forth in prior disputes. They are intended to protect property owners from "unlawful" property infringements, protecting non-farmers' property rights or well-being rights. They can be challenged by right-to-farm laws which offer protection for the farmers. These laws will also vary by state, but they often provide protection to CAFOs from the challenges made by rural residents. For instance, if the minimum federal and state regulations are being met by the farmers then it may be difficult for residents to make use of nuisance laws. States can affirm the farmers' right-to-farm, even when this conflicts with the interests of rural residents.

In addition to nuisance and right to farm laws, many residents have challenged Governor Mitch Daniels in Indiana with allegations of suffering in Indiana. Attorney Richard D. Hailey represents a dozen Indiana citizens in lawsuits against CAFO operators in Indiana (Higgs 2010). Hailey's legal team recently won a CAFO legal battle in Jackson County, Missouri for $11 million. The hope of residents and Hailey is to use the courts as a means of regulating what the state has been neglecting. The pending cases are indicative of the residential responses to these operations and will set the standards for the legality of CAFO externalities.

Residents have experienced a range of community costs by living near these operations. For instance, resident Allen Hutchison has also experienced the nuisance of CAFOs living in Randolph County Indiana which is the site to the Union Go's Dairy operation. Hutchison observed large bubbles forming atop of liners covering manure from CAFOs. The bubbles were full of methane gas and the company was not actively seeking to remedy the problem (Higgs 2010). He has joined the public outcry against CAFOs in Indiana and he has experienced the lack of support from state representatives such as the Indiana Department of Environmental Management.

The community costs discussed reveal that social quality of life may be jeopardized by CAFOs, environmental costs will be an issue, physical and mental health costs and economic costs will all be problematic for residents. CAFO operators can alleviate some of these issues by using best agricultural practices, including using different manure storage methods or notifying the surrounding residents when manure will be applied to the fields or moved. Several of the environmental costs mentioned in the community costs section can be addressed with similar approaches. First, it is important to recognize that CAFOs will, by nature, have insect infestation potential. However, producers can take precautions to guard against emerging infestations. Manure storage water and soil contamination issues may be addressed by using more advanced manure storage techniques.

Table 4 in the environmental costs section describes the various manure storage methods and their estimated losses of nitrogen and phosphorous. While these also have the potential to contaminate water and soil, incorporating the latest technology will minimize the risks. Topography of the potential site location, such as karst regions, should consider that land should not be pushed beyond its limitations. Identifying potential problems with CAFOs is an initial step that producers must make in order to alleviate the end costs. Mental health costs may be alleviated by fostering positive community relationships and assuring residents that all necessary precautions are being taken into account when operating a CAFO. Producers may opt to build positive relationships with residents which can benefit everyone involved. Economic costs may be improved by using the same principles. CAFOs, if clustered, excessively burden their host communities. Dispersed location of CAFOs may diminish the potential for decreased property values and any other community costs previously mentioned. If property value losses cannot be avoided, the people living in these areas who have experienced financial loss due to their proximity to CAFOs should be compensated in some form; while this is not necessarily a suggestion of monetary compensation, some action should be taken to address these issues, ideally in collaboration with the affected community members.

Environmental justice solutions begin with demonstrating the correlation between site locations and demographics of the host community. It is important to consider the argument of which came first: the site of the CAFO or the residents living in potential CAFO site regions? Regardless of the answer, CAFO sites should not disproportionately burden any community. Site location decisions should consider variables including, and reaching beyond, demographics of the community. Environmental justice cases are sensitive because often they are forms of NIMBYism or Not In My Backyard protests. It is important to understand the burdens that unfair placement of CAFOs have on the communities being affected.

The Certified Livestock Producer's Program in Indiana has a section of their program which is dedicated to alleviating the social costs associated with CAFOs. The Certified Livestock Producer's Program is a certification program which attempts to allow CAFO operators to go above and beyond the regulations set forth by the state. The program is began a pilot in 2008, and it is now a certification program. The details of the program demonstrate five main areas of interest: commitment to the environment, animal well-being and food safety, emergency planning, biosecurity and being a good neighbor. Producers, if active in the program, pledge to notify residents when the manure will be applied to fields or moved. Initiatives such as these foster better relationships and a stronger sense of community between residents and producers.

Potential Outcomes

Outlining the potential costs of a CAFO can contribute to communities having more reason to oppose CAFOs being located in their areas. Full disclosure might mean that the community, the state officials and producers could also have better working relationships. A trust between them could develop to allow for collaboration and compromise. State officials, producers, and community members may have conflicting goals, but an attempt can be made to come together and find shared interests and solutions if the lines of communication are open. If community relations cannot be remedied the legal cases that have and will ensue will introduce the precedence that will or has been set by the courts. These court cases could reveal the future of the CAFO industry.

An outcome of the permitting process should be a full disclosure of facts about CAFOs which would enable community actors to make informed decisions. Then the community could choose whether or not they thought it would be necessary to take action in opposition of CAFOs and have the necessary means to study the proposed sites. If the problem is ignored, this may further the community mistrust of CAFOs and other involved actors. However, it should be noted that communities may not be bothered by CAFOs under current conditions. Are community members aware of the potential costs and therefore willing to accept them? Are community members unaware and therefore unable to recognize the potential adverse conditions that may arise from CAFOs?

Conclusion

This practice guide summarizes the numerous issues surrounding CAFOs and community costs. In order to address these issues it is necessary to disclose the potential community costs whether social, environmental, physical and mental health or economic costs. The community costs can be addressed, but there will have to be compromises. There are many stakeholders involved with CAFOs, and the actors, whether indirect or direct, have concerns about the issue which may be conflicting.

Readers should note that while CAFOs have the potential to carry these community costs, such impacts are not inherent to every CAFO community. Depending on the size and proximity to residential areas, CAFOs may not be a major nuisance. Fostering better community relations within CAFO site communities creates an open door for community members, officials and producers to have discussions about true costs. This would be an ideal situation for direct and

indirect actors involved. As such this guide proposes a collaborative approach to addressing the issues around CAFOs.

CAFOs demonstrate the industrial agricultural model of livestock farming in the United States as we see currently. However, this type of model does not have to be the future of the industry. Our agricultural past was not based on this model and community costs associated with CAFOs might further the changes needed in the current industrial agricultural model. Discussions about CAFOs can present the current trends, the controversies and the potential pathways for the future of agricultural livestock production.

Appendix A: Additional Resources

Information on Feeding Operations Regulations:

Indiana Department of Environmental Management's Confined Feeding Operations Information: http://www.in.gov/idem/4994.htm#what

EPA's General Information on Concentrated Animal Feeding Operations: http://cfpub.epa.gov/npdes/afo/info.cfm

Certified Livestock Producer's Program in Indiana:
http://www.in.gov/isda/2400.htm

Purdue University, Social and Economic Issues and CAFOs:
http://www.ansc.purdue.edu/cafo/social_economic.shtml

Purdue University, Environmental Issues and CAFOs:
http://www.ansc.purdue.edu/cafo/environmental_issues.shtml

Purdue University, CAFO issues and solutions:
http://www.ansc.purdue.edu/cafo/list.shtml

Citizen Action Groups:

Indiana CAFO Watch:
http://www.indianacafowatch.com/index.php?option=com_weblinks&catid=2&Itemid=23#

Coxton Neighborhood:
http://www.coxtonneighborhood.com/

Citizens Action Coalition:
http://www.citact.org/newsite/modules.php?op=modload&name=News&file=index&catid=&topic=30

Community Farm Alliance:
www.communityfarmalliance.org

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