

THE LITTLE PIGGY THAT WENT TO THE MARKET: AN OVERVIEW OF RECENT DEVELOPMENTS IMPACTING NORTH CAROLINA’S HOG INDUSTRY

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Picture this: a nice spring day. The weather is not too hot, but not too cold. The window is open, a cool breeze is blowing through the curtains, and – Good Lord, what is that smell? It’s the open-faced waste lagoons on the 5,000-hog farm located down the road. The hog industry in North Carolina affects not just the pleasantness of the surrounding air, but has widespread effects on the economy, the environment, and social justice. Recent legislation and jury verdicts have made obvious the tension that comes with balancing these effects. With recent major hurricanes, the harm caused by hog farms seems to be increasing in intensity and frequency. A solution that effectively decreases the environmental and social harm imposed by hog farms, while also taking into consideration the economic incentives, is now more urgent than ever.

I. HISTORY OF HOG FARMING IN NORTH CAROLINA

A. Operational History

Wendell Murphy is credited as a major contributor to the current hog industry practices in North Carolina.¹ In the 1960’s, Murphy pioneered the integrated system of using leftover organic matter produced in grain-crop farming to feed hogs raised for slaughter.² He could then save money by using the swine waste in lieu of chemical fertilizers.³ This new system incentivized larger corporations, like meat packers or feed millers, to own and raise hogs on feedlots.⁴ Consequently, this method evolved into the large swine Concentrated Animal Feeding Operations (“CAFOs”) in North Carolina today, where major corporations own and control

¹ See Elanor Starmer & Timothy A. Wise, *Living High on the Hog: Factory Farms, Federal Policy, and the Structural Transformation of Swine Production 2* (Global Development and Environment Institute, Working Paper No. 07-04, 2007), <http://www.ase.tufts.edu/gdae/Pubs/wp/07-04LivingHighOnHog.pdf>.

² See *id.*

³ See *id.*

⁴ See *id.*

every stage of the operation.⁵ Murphy not only went on to become the largest hog producer in the nation, but also an active member in both the North Carolina House of Representatives and North Carolina Senate.⁶ During his time in the legislature, he helped to enact “Murphy’s laws” which even further promoted swine CAFOs in North Carolina by allowing the warehousing of thousands of live hogs.⁷

Due to Murphy’s pioneering, North Carolina is now ranked second in the nation in hog production;⁸ and in 1995, hogs surpassed tobacco to become the state’s top farm product.⁹ The state now has more pigs than people overall, and in some eastern counties pigs even outnumber people fifty-to-one.¹⁰ Since the 1980’s, these farms have become more concentrated in Eastern North Carolina than in years past. In fact, “[i]n 1982 only one North Carolina county lacked commercial hog farms; by 1997, following the period of intensive growth, approximately 95% of all swine production had concentrated in the eastern counties of the coastal plain, particularly in the southern portion of this region.”¹¹

Unfortunately, this tremendous growth of the hog industry has come with some less desirable changes. There has been a substantial decrease in small, independently owned hog farms. Large corporations like Smithfield Foods have either contracted with these farmers, thereby shifting the small farms to CAFOs, or driven those farmers without a contract out of

⁵ See Wendee Nicole, *CAFOS and Environmental Justice: The Case of North Carolina*, 121(6) ENVTL. HEALTH PERSPECTIVES A182, A185 (2013).

⁶ See Starmer, *supra* note 1, at 2; see also Nicole, *supra* note 5, at A185.

⁷ Nicole, *supra* note 5, at A185.

⁸ Cordon M. Smart, *The "Right to Commit Nuisance" in North Carolina: A Historical Analysis of the Right-to-Farm Act*, 94 N.C. L. REV. 2097, 2105 (2016).

⁹ John D. Burns, *The Eight Million Little Pigs-A Cautionary Tale: Statutory and Regulatory Responses to Concentrated Hog Farming*, 31 WAKE FOREST L. REV. 851, 854 (1996).

¹⁰ See Adam Driscoll & Bob Edwards, *From Farms to Factories: The Social and Environmental Consequences of Industrial Swine Production in North Carolina*, in TWENTY LESSONS IN ENVIRONMENTAL SOCIOLOGY 153, 154 (Kenneth A. Gould & Tammy L. Lewis, eds., 2014).

¹¹ *Id.* at 155.

business.¹² Furthermore, with an increase in the size and prevalence of hog farms, comes an increase in hog waste. According to the North Carolina Pork Council, there are about 3,300 active hog waste lagoons in North Carolina.¹³ The sheer magnitude of this waste is eye opening. Hogs produce about four times as much waste as humans, which is why eastern North Carolina has a daily hog waste production approximately equal to the daily waste production of the entire human population of the state of California.¹⁴ However, human waste, unlike hog waste, is both chemically and mechanically treated before it is released into the environment.¹⁵ These massive swine farms deal with the stinky situation by allowing the untreated waste to move from beneath the holding buildings to unlined, open-air lagoons.¹⁶ These lagoons function as a holding place where the solid hog waste can anaerobically decompose and the liquid portion can evaporate into the atmosphere.¹⁷ The untreated waste remains in these lagoons until it is applied to spray fields as fertilizer.¹⁸ These spray fields generally do not grow marketable crops, but instead grow crops that attempt to metabolize the phosphorus and nitrogen in swine waste.¹⁹ The waste that is not metabolized then soaks into the ground or becomes runoff.²⁰

B. Legal History

Generally, federal environmental statutes have left CAFOs lightly regulated.²¹ Although the majority of North Carolina's legislative activity has been aimed at protecting hog farmers,

¹² *See id.* at 156.

¹³ *Hurricane Florence's Impact on NC Hog Farms*, NC PORK COUNCIL, <http://www.ncpork.org/florenceimpact/> (last visited Oct. 17, 2018).

¹⁴ Burns, *supra* note 9, at 852.

¹⁵ Nicole, *supra* note 5, at A186.

¹⁶ *Id.*

¹⁷ Driscoll & Edwards, *supra* note 10, at 158.

¹⁸ *Id.*

¹⁹ *Id.*

²⁰ *Id.*

²¹ Vanessa Zborek, "Yes, in Your Backyard!" *Model Legislative Efforts to Prevent Communities from Excluding CAFOs*, 5 WAKE FOREST J.L. & POL'Y 147, 161 (2015).

the North Carolina General Assembly (“NCGA”) has imposed some limits on the creation of new waste lagoons. In 2007, the NCGA attempted to stifle the construction of new waste lagoons by requiring performance standards for the permitting of any new construction under the Swine Farm Performance Standards Bill.²² Although this law essentially created a moratorium on new lagoons, it did not affect any structures existing before 2007.²³

Neighbors negatively affected by existing hog farms have been able to push back by filing nuisance lawsuits. However, a significant impediment to filing a successful nuisance claim against these hog farms is the North Carolina Right-to-Farm (“RTF”) Act. Originally enacted in 1979, the act is one of the “first and most influential RTF laws in the country.”²⁴ The 1979 version essentially gave preexisting agricultural and forestry operations an affirmative defense to a nuisance action if (1) they had been in existence for over a year, (2) they were not originally nuisances, and (3) there was no water pollution on the plaintiff’s property.²⁵ Other than the addition of forestry in 1992 to the list of operations protected under the law,²⁶ there have not been any major changes in the RTF Act up until 2013.²⁷

II. RECENT LEGAL DEVELOPMENTS

A. Judiciary

In 2013, over 500 neighbors brought suit against Murphy-Brown, LLC (owned by Smithfield Foods) claiming the waste lagoons surrounding plaintiffs’ properties constitute

²² See N.C. Gen. Stat. § 143-215.10I (2018).

²³ See Eric L. Klein & Graham C. Zorn, *North Carolina Legislature Limits Nuisance Lawsuits, Reducing Potential Liability for Hog Farming Industry*, Nat’l L. Rev. (Sep. 11, 2017), <https://www.natlawreview.com/article/north-carolina-legislature-limits-nuisance-lawsuits-reducing-potential-liability-hog>.

²⁴ Smart, *supra* note 8, at 2116.

²⁵ *Id.*

²⁶ AN ACT TO PROTECT FORESTRY OPERATIONS FROM NUISANCE SUITS UNDER CERTAIN CIRCUMSTANCES, 1992 N.C. Sess. Laws 892 (H.B. 978).

²⁷ N.C. Gen. Stat. § 106-701 (2018).

nuisances.²⁸ They argue that these lagoons constitute an unreasonable, substantial interference to the use and enjoyment of their properties due to issues like swarming flies, the unbearable stench, difficulty breathing, and an inability to engage in outdoor activities.²⁹ Plaintiffs were able to overcome the affirmative defense of the RTF law because the use of their land preexisted the development of the hog farms.³⁰ Three of the suits have been tried before juries. In each case, the jury determined these hog farms are nuisances and awarded the landowners multimillion-dollar damages.³¹ The damages were later reduced due to the state law limiting punitive damages to the greater of \$250,000 per person or three times compensatory damages.³²

B. Legislature

Just weeks after the filing of these lawsuits, the North Carolina Legislature amended the RTF Act to broaden the affirmative defense for swine CAFOs and limit actions brought by harmed landowners.³³ The amended law states that no nuisance action can be brought against agricultural or forestry operations unless (1) plaintiff is a legal possessor of property affected by the conditions, (2) the property is within a half mile of the source of the alleged nuisance, and (3) the action is filed within one year of the establishment of the operation or within a year of a “fundamental change” to the operation.³⁴ Under the amendments, a “fundamental change” is extremely limited and does not include a change in ownership or size, or employment of a new

²⁸ Ann Blythe, *Jury awards more than \$25 million to Duplin County couple in hog-farm case*, The News & Observer (June 29, 2018), <https://www.newsobserver.com/news/local/article214096384.html>.

²⁹ See Smart, *supra* note 8, at 2125–26.

³⁰ *In re N.C. Swine Farm Nuisance Litigation*, No. 5:15-CV-00013-BR, 6 (E.D.N.C. Nov. 8, 2017) (“[Plaintiffs’] land use had been in existence well before the operation of the subject farms began. . . [a]t bottom, plaintiffs’ nuisance claims have nothing to do with changed conditions in the area, and therefore, as a matter of law, the right-to-farm law does not bar these claims.”).

³¹ Blythe, *supra* note 28; see also Craig Jarvis, *Jury Awards Hog Farm Neighbors their Biggest Verdict Yet* (August 3, 2018), <https://www.newsobserver.com/news/business/article215971170.html>.

³² N.C. Gen. Stat. § 1D-25 (2018).

³³ Smart, *supra* note 8, at 2129.

³⁴ N.C. Gen. Stat. § 106-701(a) (2018).

technology.³⁵ The legislature also went even further to allow defendants an award for costs and attorneys fees when a nuisance claim is found to be “frivolous or malicious.”³⁶

III. ECONOMIC INCENTIVES V. ENVIRONMENTAL JUSTICE

The divergence between the recent legislative action and jury verdicts highlights the competing interests surrounding the hog industry in North Carolina. Two major interests called into question are economic incentives and environmental justice impacts.

A. Economic Incentives

The North Carolina Pork Council has estimated that the hog industry in North Carolina supplies about 46,000 jobs and generates about \$6.5 billion in sales annually.³⁷ However, there is debate about how much the industry actually benefits Eastern North Carolina. Most of the farming operations are mechanized, and thus a single farmer can potentially operate an entire 3,000-hog farm.³⁸ Since CAFOs are so capital intensive rather than labor intensive, most jobs are not on the actual farms themselves, but concentrated in slaughterhouses.³⁹ These slaughterhouse jobs tend to be low skill, low paying, and sometimes tied to illegal labor practices.⁴⁰

Furthermore, because of the vertically integrated system, Smithfield Foods arguably reaps most of the profits from the swine industry.⁴¹ Vertical integrators capture most of the profits by owning and controlling most stages of production and contracting with hog farmers for “minimal rewards for their labor.”⁴² Moreover, Smithfield Foods itself, which owns more than

³⁵ N.C. Gen. Stat. § 106-701(a)(1) (2018).

³⁶ N.C. Gen. Stat. § 106-701(f)(1) (2018).

³⁷ See Driscoll & Edwards, *supra* note 10, at 164.

³⁸ See *id.* at 159.

³⁹ See *id.* at 166.

⁴⁰ See Stuart Allen et al., *North Carolina Hog Farming: From Family Farms To Corporate Factories* 7 (Kenan-Flagler Business School, White Paper No. W07-008, 2007), https://www.researchgate.net/publication/297282961_North_Carolina_Hog_Farming_From_Family_Farms_to_Corporate_Factories.

⁴¹ See Driscoll & Edwards, *supra* note 10, at 165.

⁴² Allen, *supra* note 40, at 10.

90% of the North Carolina pork industry,⁴³ is owned by the Chinese company, WH Group.⁴⁴ If Smithfield arguably has a monopoly on pork production in North Carolina and is owned by an international company, it's unlikely that the economic benefits of these hog farms are actually getting back to the North Carolinians who are left with the environmental side effects. Generally, profits from corporate-owned farms have been found to leave the surrounding community almost immediately.⁴⁵ Some claim these farms actually “ruin [the] economic vitality of rural communities.”⁴⁶ Higher paying industries may be dissuaded from coming to the area because these low paying, foul-smelling, and environmentally damaging swine practices create a problematic image for the community.⁴⁷

The hog industry has argued that employing new technologies to mitigate the environmental issues of their waste practices is too costly.⁴⁸ The waste methods currently employed keep operational costs low,⁴⁹ and thus keep the price of pork production in North Carolina competitive in a global market.⁵⁰ New technologies have been tested in both public and private studies in an attempt to find a cost-effective solution to the harmful effects of these swine CAFO waste practices.⁵¹ Some proposed technologies include storage covers, composting waste, solid and liquid waste separation, waste to energy practices, and different land application methods.⁵²

⁴³ See Driscoll & Edwards, *supra* note 10, at 156.

⁴⁴ Anne Blythe, *Jury awards hog farm neighbors \$50 million*, THE NEWS & OBSERVER (April 26, 2018), <https://www.newsobserver.com/news/business/article209927914.html>.

⁴⁵ See Allen, *supra* note 40, at 10.

⁴⁶ Michelle B. Nowlin, *Sustainable Production of Swine: Putting Lipstick on A Pig?*, 37 VT. L. REV. 1079, 1097 (2013).

⁴⁷ Allen, *supra* note 40, at 7.

⁴⁸ *In Lawsuit Chatter, Be Wary of So-Called Solutions*, NC PORK COUNCIL, <https://www.ncpork.org/wary/> (last visited Jan. 3, 2018).

⁴⁹ See Allen, *supra* note 40, at 2.

⁵⁰ See *id.* at 9.

⁵¹ See Nowlin, *supra* note 46, at 1117.

⁵² *Id.*

In order to promote these Environmentally Superior Technologies (“ESTs”), the North Carolina General Assembly created a Lagoon Conversion Program in 2007, where swine farms could apply for financial assistance to convert their waste systems to ESTs.⁵³ This seemed to be a step in the right direction, but despite the availability of government funding, most of the farms participating in the program dropped out by the end of the study due to cost concerns.⁵⁴

In 2000, Smithfield Foods agreed to conduct a study in collaboration with the State of North Carolina to research ESTs and then implement those found economically feasible.⁵⁵ Although a few technologies were found to effectively reduce environmental harm, none of the technologies considered were determined to be economically feasible.⁵⁶ Interestingly, however, this study did not take into account any social costs imposed by swine CAFOs, nor did it consider the possibility of future cost-share programs or other subsidies.⁵⁷

In contrast, another study conducted after the Smithfield Foods study found that an improved second generation “Super Soil” technology could potentially pay for itself.⁵⁸ This “Super Soil” method includes solid separation, nitrification/denitrification, and phosphorus removal/disinfectant.⁵⁹ The technology met all of the 2007 performance standards for a new lagoon by eliminating 98% of suspended solids, 97% of ammonia, 99% of odors, and 99% of pathogens.⁶⁰ Furthermore, through the sale of both carbon reduction credits and water quality

⁵³ See N.C. Division of Soil and Water Conservation, *Annual Report to the Environmental Review Commission of the North Carolina General Assembly on the Implementation of the Lagoon Conversion Program*, N.C. LEG. 1 (2015), <https://www.ncleg.net/documentsites/committees/ERC/ERC%20Reports%20Received/Archives/2015/Department%20of%20Agriculture%20and%20Consumer%20Services/2015-Oct%20Lagoon%20Conv%20Prog%20Rpt.pdf>.

⁵⁴ See *id.* at 3.

⁵⁵ See Nowlin, *supra* note 46, at 1118.

⁵⁶ See *id.* at 1121.

⁵⁷ See *id.*

⁵⁸ John H. Loughrin et al., *Development of a second-generation environmentally superior technology for the treatment of swine manure in the USA*, 100 BIORESOURCE TECH. 5406, 5415 (2009).

⁵⁹ *Id.* at 5406.

⁶⁰ *Id.*

credits, combined with an increase in hog production, the cost of the technology was almost completely paid for by its economic benefits.⁶¹

B. Environmental Justice Impacts

The environmental impacts of hog waste practices in North Carolina are expansive and not entirely known. Pollutants can escape from the lagoons in multiple ways. Waste particles can be released into the air when the fields are sprayed, runoff from spray fields can flow into the water table, excess nutrients from the unlined pits can seep into the groundwater, and lagoons can breach due to large amounts of rain and extreme weather events.⁶² Hog waste contains over twice the amount of nutrients as human waste.⁶³ As a result, these lagoons contain high levels of harmful nutrients, pathogens, and bacteria.⁶⁴ Methane, a potent greenhouse gas, is also released into the atmosphere during the anaerobic digestion process within lagoons.⁶⁵ Similarly, ammonia concentrations in the air downwind of CAFOs tend to be higher than those in the surrounding watershed.⁶⁶

Not only do local landowners have to deal with obnoxious odors, but studies have shown a wide variety of health effects correlated with living near these lagoons. Health issues can range from eye, nose, and throat irritation, to respiratory difficulty and high blood pressure.⁶⁷ Alarmingly, one study even found a correlation between higher infant mortality and proximity to hog farms.⁶⁸

⁶¹ *Id.* at 5415.

⁶² See Nicole, *supra* note 5, at A186.

⁶³ See Burns, *supra* note 9, at 852.

⁶⁴ See Smart, *supra* note 8, at 2106.

⁶⁵ See F.M. Byers et al., *Methane emissions from swine lagoons in Southeastern US*, 90(1) AGRICULTURE, ECOSYSTEMS, & ENVIRONMENT 17, 17 (2002).

⁶⁶ See Liyao Huang et al., *CALPUFF and CAFOs: Air Pollution Modeling and Environmental Justice Analysis in the North Carolina Hog Industry*, INT'L J. OF GEO-INFORMATION 150, 150 (Jan. 2015).

⁶⁷ See Nicole, *supra* note 5, at A187.

⁶⁸ See Julia Kravchenko et al., *Mortality and Health Outcomes in North Carolina Communities Located in Close Proximity to Hog Concentrated Animal Feeding Operations*, 79 N.C. Med. J. 278, 278 (2018).

All of these negative environmental and health effects have been shown to disproportionately affect low-income and minority populations.⁶⁹ One study from North Carolina found 7.2 times as many hog operations in areas with over 21% of people in poverty, compared to areas with less than 4.9% of people in poverty, after adjusting for population density.⁷⁰ The same study found hog operations are five times as likely to be present in communities with high percentages of nonwhite populations.⁷¹ Some argue that this industry has just “followed the path of least resistance” to these places where people are less likely to object and land is cheap.⁷² The people who have the means to move away from these operations do, thereby increasing the already high percentage of low-income neighbors.⁷³

IV. IMPACTS OF HURRICANE FLORENCE AND SIMILAR STORMS

Hurricanes and similar large weather events can greatly increase the negative environmental impacts of hog waste lagoons on surrounding areas. Hurricane Fran and Hurricane Floyd caused hog waste lagoon breaches and resulted in widespread environmental harm.⁷⁴ Fran caused at least four lagoons to rupture, overtop, or become inundated, and subsequently caused millions of liters of waste to flow into the Cape Fear River.⁷⁵ Floyd similarly caused the release of an estimated 250 million gallons of hog waste into waterways and nearby homes and businesses.⁷⁶ Furthermore, although the North Carolina Division of Water

⁶⁹ See Dana Cole et al., *Environmental injustice in North Carolina's hog industry*, 108 ENVTL. HEALTH PERSPECTIVES 225, 228 (2000).

⁷⁰ *Id.*

⁷¹ *Id.*

⁷² Nicole, *supra* note 5, at A183.

⁷³ *See id.*

⁷⁴ See Phil Bowie, *No act of God: Hurricane Floyd caused a water pollution catastrophe when it swept through the huge hog farms of North Carolina*, 21(4) THE AMICUS J. 16, 16 (2000).

⁷⁵ See Troy D. Alphin et al., *Hurricane Effects on Water Quality and Benthos in the Cape Fear Watershed: Natural and Anthropogenic Impacts*, 9(1) ECOLOGICAL APPLICATIONS 9 350, 351, (1999).

⁷⁶ Bowie, *supra* note 74, at 20.

Quality estimated only 45 swine lagoons breached or flooded after Floyd, satellite imagery taken after the hurricane indicates the estimate to be closer to 230 lagoons affected.⁷⁷

Similar breaches of swine lagoons occurred after Hurricane Florence. As of October 9, 2018, the North Carolina Division of Environmental Quality reported that 33 lagoons had discharges into the surrounding area, 6 lagoons had structural damage, and 10 lagoons were likely to overflow in the near future due to impacts of Hurricane Florence.⁷⁸ The North Carolina Pork Council notes that nearly 98% of North Carolina's active lagoons have not experienced these issues,⁷⁹ but just one breached lagoon can cause widespread damage. In 1995, a single eight-acre lagoon breach released over 22 million gallons of waste to flow into the New River.⁸⁰ And, these reported statistics of the impact of Florence on swine waste lagoons may underestimate the damage. Accurate data can be difficult to collect due to misunderstandings of what constitutes a breach, as well as problems with proper inspection and reporting.⁸¹ In sum, the number of breaches due to Hurricane Florence may be under reported and those that were reported had significant impacts on surrounding areas.

Climate change is projected to increase hurricane intensity and destructiveness.⁸² Furthermore, some models project increases in the frequency of hurricanes due to global warming.⁸³ The increase in frequency and destructiveness of hurricanes will increase the

⁷⁷ See Lawrence Band et al., *The Potential Impact of Flooding on Confined Animal Feeding Operations in Eastern North Carolina*, 110 ENVTL. HEALTH PERSPECTIVES 387, 389 (2002).

⁷⁸ N.C. Department of Environmental Quality, *DEQ Dashboard: Animal Operations – Swine Lagoon Facilities*, N.C. DEQ (Oct. 9, 2018), <https://deq.nc.gov/news/deq-dashboard#animal-operations---swine-lagoon-facilities>.

⁷⁹ *Hurricane Florence's Impact on NC Hog Farms*, *supra* note 13.

⁸⁰ Nicole, *supra* note 5, at A186.

⁸¹ *Id.*

⁸² Kerry Emanuel, *Increasing destructiveness of tropical cyclones over the past 30 years*, 436 NATURE 686, 686 (2005).

⁸³ Thomas Knutson et al., *Tropical cyclones and climate change*, 3 NAT. GEOSCIENCE 157, 157 (2010).

probability of swine waste lagoon breaches resulting in negative impacts on the surrounding environment and community.

V. GOING FORWARD

The economic incentives driving North Carolina's hog industry need to be balanced with the extensive environmental and social harm resulting from hog farming practices. Recent storm events like Hurricane Florence highlight the urgency of finding an equitable solution to this problem.

Using a Hand Formula analysis⁸⁴, the value of the right side of the Hand Formula, (LP), is currently high due to the extensive social and environmental effects of swine CAFO waste practices, (L), and the expected increases in the probability of negative impacts from major storms, (P).⁸⁵ Furthermore, as explained above, the economic burden of preventing the harm, (B), likely only negatively affects large companies like Smithfield, rather than the economies of the surrounding community.⁸⁶ Even still, recent studies show that technological improvements like the second generation "Super Soil" technology can potentially pay for themselves.⁸⁷ Thus, the economic burden of using different waste practices is likely lower than what the hog industry is currently predicting.

It follows that the economic burden of preventing harm is arguably lower than the product of the probability and magnitude of harm ($B < LP$). Using this information, companies who operate swine CAFOs in North Carolina are acting unreasonably by continuing to use these harmful waste practices. Recent jury decisions may be an implicit recognition of this balancing

⁸⁴ See *United States v. Carrol Towing Co.*, 159 F.2d 169, 173 (2d Cir. 1947) ("[I]f the probability be called P; the injury, L; and the burden, B; liability depends upon whether B is less than L multiplied by P: i.e., whether B less than PL.").

⁸⁵ See *supra* text accompanying notes 62-83.

⁸⁶ See *supra* text accompanying notes 37-47.

⁸⁷ See *supra* text accompanying notes 58-61.

of the Hand Formula elements. It is abundantly clear, and juries in recent court decisions seem to agree, that swine CAFO waste practices in North Carolina need to change.