

ANALYZING PUBLIC SUPPORT FOR SUSTAINABLE HOG PRODUCTION
IN NORTH CAROLINA

by

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Introduction

Agriculture holds great historical significance to rural North Carolina, and it continues to remain an instrumental industry in the economy and culture of the state. Farm operations in North Carolina alone generate billions of dollars in revenue and produce nearly half of the country's annual tobacco and sweet potato crop (Huffman 2020). However, the industrialization of agricultural practices has given way to a wide variety of new environmental issues. Industrial-scale farms would not be possible in North Carolina today without the increase in contract farming and the shift from crops, namely tobacco, to livestock in the late 1990s (Driscoll and Edwards 2015). Hog farming practices, particularly those involving concentrated animal feeding operations (CAFOs), have raised environmental concerns and impacted surrounding communities. Understanding the political debates to make swine facilities more sustainable is of special significance due to the ubiquity of these institutions in North Carolina.

Lagoon waste results in numerous environmental conditions and consequences when improperly managed. Swine house workers themselves report higher rates of respiratory disorders, and even death, from exposure to hydrogen sulfide gas or falling into uncovered waste lagoons (Driscoll and Edwards 2015). Health impacts extend into the surrounding areas as well; community residents living near CAFOs report nausea from the odors and gasses released, contaminated drinking water, diseases like swine flu, and a lower overall quality of life. Additionally, the pork industry has had long-term economic impacts despite the large revenue it generates. Rather than source the process locally, CAFOs rely widely on outside corporations, firms, and migrant workers, often taking profit away from independent farms and farmers (Driscoll and Edwards 2015; Hribar 2010). Environmental injustice based on demographic

factors is yet another complication due to affected populations being disproportionately low-income, African American, and politically marginalized residents (Son et al. 2021).

Through the lens of the Narrative Policy Framework (NPF), this study evaluates different policy narratives that currently exist on the topic of hog farming in Wayne County, NC utilizing resident survey and producer interview data. This study addresses the research question, “Why do opposing narratives within the hog farming industry persist?” It will further examine: “What narratives are the most prevalent and how is opposition to them expressed?” This is important due to the ultimate role that perceptions play in developing subsystem beliefs and, consequently, policy outcomes. This paper starts with an overview of the hog farming industry in North Carolina and the relevant legislation, both in effect and proposed. The next section will include a brief overview of the Narrative Policy Framework (NPF) within the field of discourse network analysis. The section after includes the materials and methodology for data collection, followed by the research study findings and a practical application of NPF for data analysis. This paper concludes with practical applications of the results along with further research opportunities.

Hog Farming in North Carolina

The state of North Carolina, located in the Southern region of the United States on the East Coast, is well known for its natural beauty, with great ecological diversity in wetlands, rivers, estuaries, and sounds of the rural east. River basins are a key feature of the state, each with notable aquatic biodiversity and flowing into either the Atlantic Ocean or the Gulf of Mexico (See Figure 1). However, many waterways and surrounding communities in the state have been threatened by the widespread adoption of modern agricultural technology and practices. The Neuse and Cape Fear River Basins are particularly vulnerable to algae blooms and

large-scale fish kills; they were deemed top ten on American Rivers' list of "Most Endangered Rivers" after fifteen CAFO lagoons flooded during Hurricane Matthew in 2016 (Rousseau 2017). The North Carolina Wildlife Resources Commission notes pollution and habitat degradation as the most significant threats to freshwater biodiversity, with "poorly managed crop and animal agriculture" listed as a specific impact (NC Wildlife 2010). This applies particularly in the pork industry, which claims almost 90% of livestock facilities approved by the NC Department of Environmental Quality (NC DEQ 2023). Out of all farm operations in North Carolina, 2,238 are licensed swine producers, housing several of North Carolina's eight million head inventory (NASS 2023).

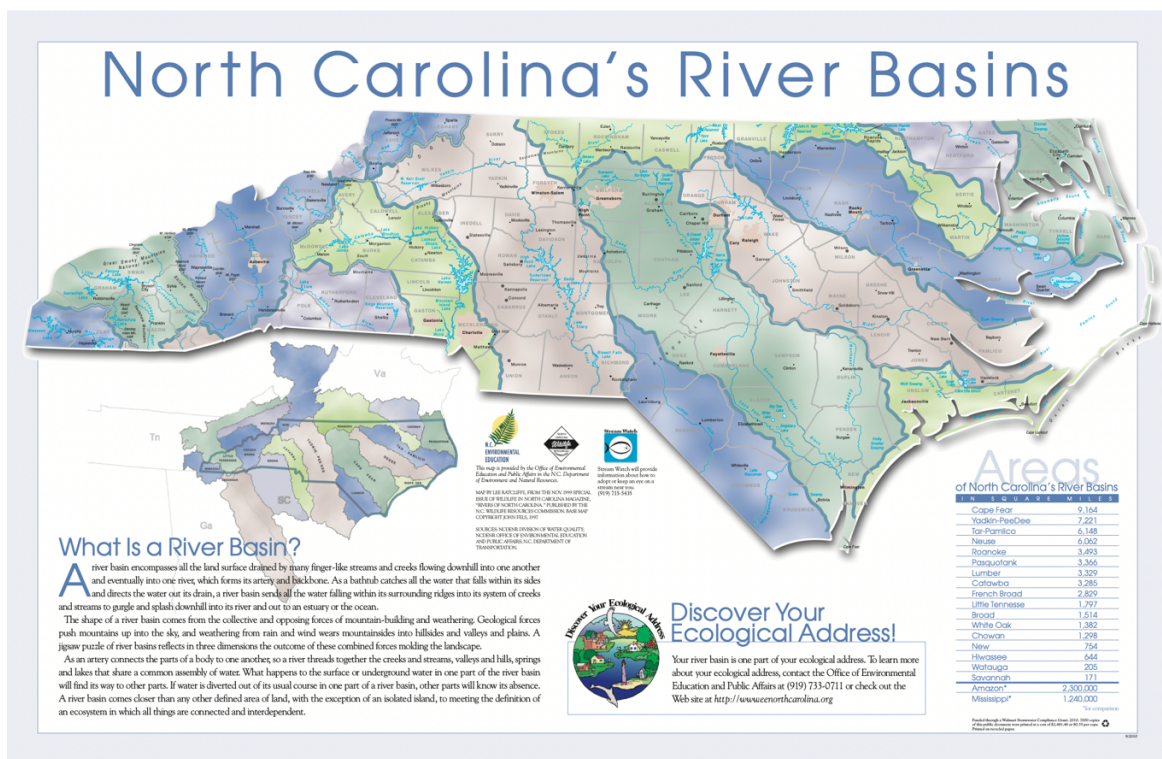


Figure 1. North Carolina River Basins.
Source: NC Wildlife Resources Commission (2010)

In comparison to other agricultural industries, hog farming in North Carolina is among the most significant livestock industries. Cattle, goats, sheep, and chickens are all prevalent

livestock, but only turkeys surpass the relative national hog contribution on the state level.

Following only Minnesota, North Carolina reports the second-highest turkey production in the United States at 30 million head every year (ERS 2023). Comparatively, hog production in North Carolina ranks third highest in the country after only Iowa and Minnesota as of March 2023 (USDA 2023). As shown in the table below, these three states account for over 55% of hog inventory in the country (Table 1).

State	Breeding		Market		Total	
	2023 (1,000 head)	2023 as percent of 2022	2023 (1,000 head)	2023 as percent of 2022	2023 (1,000 head)	2023 as percent of 2022
Iowa	900	100	22,600	102	23,500	102
Minnesota	500	94	8,500	105	9,000	105
North Carolina	790	99	7,210	100	8,000	100
United States	6,096	100	67,014	101	73,109	101

Table 1. Breeding, Market, and Total Hog Inventory – March 1, 2023.

Source: NASS, Agricultural Statistics Board, USDA (2023)

Thanks to new developments, North Carolina grew to be one of the top hog producers in the United States. The state hog population saw a fivefold increase to more than 10 million hogs between 1982 and 1997, outnumbering humans on the coastal plains (Driscoll and Edwards 2015). Despite the significant growth in headcount, the number of permitted farms remained relatively consistent. Based on statistics from individual counties in North Carolina, it is noteworthy to add that the distribution of hog farms aligns geographically with the production of the main hog feed ingredients (Curliss 2018). Crops are similarly prominent in North Carolina, especially corn, soybeans, sweet potatoes, cotton, and tobacco. After farmers were encouraged to diversify from tobacco, many rural farming communities shifted to crops for grain, like corn and soybeans, due to the abundance of pork processing plants nearby (Krueger 2020). The convenience of pork processing plants in the vicinity is another reason for the concentration of

facilities in the East. Eight processing plants operate between Duplin County, Sampson County, and Wayne County alone, and the largest pork plant in the world is located in Bladen County (Driscoll and Edwards 2015). Smithfield Foods holds jurisdiction over more than 90% of the state's pork industry and has based its North Carolina operations in Tar Heel, Bladen County, for over three decades.

Agricultural eastern North Carolina was selected as the focus of this study because of its distinct relevance. Figure 2 displays estimates of hog concentration in North Carolina by county, with Duplin and Sampson tied in the clear lead. While Bladen and Wayne County report the second and third highest number of hogs, nearly every trailing county is located in the same area.

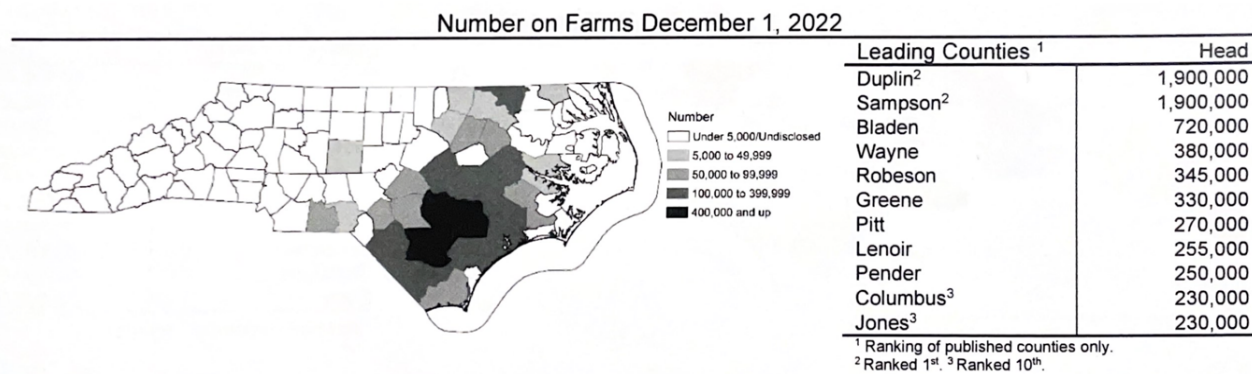


Figure 2. NC Hogs County Estimates.
Source: USDA, North Carolina Field Office (2023)

Concentrated Animal Feeding Operations

Traditionally, hogs were sourced in small groups from independent farmers who formed individual networks with slaughterhouses and wholesalers. This drastically changed with the introduction of concentrated animal feeding operations (CAFOs). To hold this classification, the facility must also be considered an animal feeding operation (AFO). These are lots where animals are confined and maintained for at least 45 days per year, and “crops, vegetation, or

forage growth are not sustained over a normal growing period” (Hribar 2010). When they are properly monitored, these facilities have several benefits which may include low-cost animal products, support for the local economy, and full-time job opportunities.

Swine CAFOs involve three key components, “the hog house, the waste ‘lagoon,’ and the sprayfield,” which operate across all production stages. Hog houses include confinement pens along a center aisle, varied depending on which stage of production they support (Driscoll and Edwards 2015). While breeding sows typically have their own gestation crates, confinement pens in later stages of production are efficiently designed to fit a certain number of full-grown hogs. Given the limited mobility, waste disposal is a primary concern in hog house design; floors are suspended over concrete subflooring with slats thin enough for urine and feces, but not animal hooves. When the subfloor is flushed with water, it flows into a nearby waste lagoon. These open, earthen pits are over 25 feet deep, and they facilitate anaerobic processing alongside the evaporation of swine waste (Driscoll and Edwards 2015).

Because CAFOs support such a large number of livestock, these lagoons are often attached to sprayfields. Rainwater poses a risk of lagoon overflow, but it also dilutes waste to be distributed across an adjacent field. Sprayfield crops are selected for their ability to metabolize nitrogen and phosphorous, not for market value, and are important elements of the waste disposal process. In this way, some waste evaporates, some is metabolized into the crops, and the rest soaks into the ground or becomes runoff (Hribar 2010). A CAFO is characterized by the rate and scale of production, as the entire process from farrowing, wean to feeder, and feeder to finish lasts less than six months and involves between 2,000 and 5,000 hogs at any given time (Driscoll and Edwards 2015). They are heavily automated by machinery and require little manual labor,

but often report greater environmental impacts from increased waste production and the use of synthetic pest- and disease-resistant chemicals.

In Section 502 of the 1972 Clean Water Act (CWA), AFOs were highlighted as potential pollutants for the first time in history (Hribar 2010). As a result, the Environmental Protection Agency (EPA) introduced the National Pollutant Discharge Elimination System (NPDES) permit program, which set limitation guidelines and standards for livestock waste disposal from 1976 through the end of the 20th century. In 2003, CAFO permits and operation regulations were updated, requiring all CAFOs to apply for an NPDES permit and develop their own plan for nutrient management. A Secondary Court of Appeals decision in *Water Keeper et al. vs. the EPA* prompted further revisions to the CWA in 2003, 2008, and 2012. While the 2003 rule required CAFOs to submit nutrient management plans, these were now included with NPDES applications. All were classified as point-source pollution at the national level, but only facilities that discharge waste require these plans and public review thereafter (Driscoll and Edwards 2015; Hribar 2010).

Public opposition to swine CAFOs in North Carolina formed around 1990 in grassroots, legal, and mainstream organizations like Alliance for a Responsible Swine Industry and Concerned Citizens of Tillery. These groups organized the Hog Roundtable, and drew mass press attention, scientific study, and political debate to the hog farming industry until 1997, when hog waste grew into “the single largest and most contentious issue in North Carolina” (Driscoll and Edwards 2015). Smithfield Foods received the majority of backlash due to its presence in the industry, and then-Attorney General Mike Easley took the opportunity to negotiate a contract. In July of 2000, the Smithfield-Easley agreement essentially allowed Smithfield to pledge four months of profit, based on their revenue at that time, in exchange for ten years of operations as

usual. Smithfield was meant to provide \$15 million for research on alternative waste disposal, pledging to incorporate the new technology on their farms if economically possible, and \$50 million on cleaning abandoned lagoons. However, as they expanded into international markets, Smithfield Foods reported in 2006 that none of the research findings were cost-effective enough, and no changes were made in the interest of their corporate goals (Driscoll and Edwards 2015).

Current Legal Standards

Hog farms in North Carolina currently operate under permits from the North Carolina Department of Environmental Quality (DEQ), required of any facility with over 250 hogs. These hog operations, including lagoons and sprayfield systems, are meant to follow the standards for handling and disposing of waste as detailed in two primary guideline documents: the Swine Waste General Permit or the Swine Digester General Permit (NC DEQ 2023). Both permits for each state are renewed by the DEQ every five years, with the existing general permits set to expire on September 30, 2024. Upon release, the draft general permits for the next five-year cycle are open to public input “in writing, by phone, or by audio/video recording” (NC DEQ 2023). For better accessibility, the DEQ also hosts public hearings on the topic with a variety of both in-person and virtual options.

The Swine Digester General Permit specifically establishes regulations for how operations with digesters manage large outputs of “biogas” waste in North Carolina. After digesters alter the makeup of hog waste to produce more methane, the resulting biogas is at risk of being “vented” or “flared” (USDA 2023). Biogas pipelines are also at risk of methane and nitrous oxide leaks, releasing potent greenhouse gases, 23 and 300 times stronger than carbon dioxide, respectively (Hribar 2010). Even without the threat of biogas, activists highlight health

risks of the resulting digester waste when left uncovered or spread over fields. Over the past few decades, the hog industry has become an integral yet controversial feature of North Carolina.

To protect farms against private nuisance complaints from neighbors, Right to Farm laws were introduced in some form in every state. In North Carolina, the Right to Farm law dates back to 1979 and works in conjunction with bona fide zoning exceptions to reduce the volume of superfluous legal action against farmers (Benet 2023; Hribar 2010). These intend to protect farmers from frivolous nuisance cases. Suits like this may result in compensatory and punitive damage verdicts but are often heard by urban jury panels without agricultural experience, estranged from the reality of waste management in North Carolina. The Farm Act of 2018 signifies the fourth update to the Right to Farm laws by the General Assembly, and contains the most stringent requirements for nuisance actions to date (Farm Act of 2018; Tovar 2018). This statute is grounded in four central principles that restrict litigation. These include the freedom of farmers to alter their operations, limited time to pursue legal action, limited proximity of a complaining landowner to the farm, and a limit on the extent and kind of damages in the plaintiff's claim (Benet 2023). Given these considerations, complaining landowners cannot claim a nuisance if their ownership is acquired after the offending landowner is already operating. They must prove that their right to private enjoyment is directly and indisputably compromised.

Contract farming, beginning in 1973, also allowed corporate integrators to set production standards and ran smaller farmers who did not adopt CAFO-style production out of business (Driscoll and Edwards 2015). The standardization of operational guidelines is unique to the transition from local farms to multinational corporations; this uniformity makes it difficult to address ecological concerns for those without the financial means or influence within the industry, and contrasting narratives may present the possibility that no significant issue even

exists. Regardless of these competing narratives, the study of these operations will likely see an inevitable, concrete shift when production suffers from overwhelming waste, legal proceedings, and consumer pressures (Mosier et al. 2022). These are some of the primary factors that influence an individual's perceptions and policy, and debates surrounding hog farming are no exception.

Narrative Policy Framework

The Narrative Policy Framework (NPF) can be used to determine which stories are most commonly told about a certain issue. Within the field of discourse network analysis (DNA), DNA helps researchers define existing policy narratives. This construction focuses on identifying the most prevalent topics as well as the individual and organizational actors who participate. Specifically, the NPF adopts an empirical approach to examine and identify patterns within narratives and proposed policies. “Stories, symbols, and images” are often quantified to offer insight into policy change on three separate levels of analysis: micro, meso, and macro (McBeth et al. 2014). This approach is founded on the overarching idea that narratives affect individual opinions, which shape subsystem beliefs, and determine policy outcomes.

There are three levels of analysis to NPF. Figure 3 provides a general overview of each level of analysis alongside their practical applications. At the micro-level of NPF, *homo narrans* draws from the multidisciplinary study of narrative, crossing multiple academic fields like psychology, political science, and law. It focuses on empirically testing the role of cognition and exposure in individual decision-making, namely regarding its effects on “public policy outcomes, processes, and designs” (McBeth et al. 2014, 233). The meso-level, *agora narrans*, is the middle level named after the ancient Greek agora where citizens publicly advocated for their policy

goals. Advocacy coalitions are formed around shared beliefs at this level, which are expressed through the construction and communication of narratives. Finally, the macro-level of NPF targets the goals and culture of policy marketers instead of citizens. Although no studies have been conducted at this level, researchers argue that it is grounded in consumerism and explains how these “marketers,” interest groups, the media, and elected officials, pitch their ideas to the public (McBeth et al. 2014, 247).

	Micro	Meso	Macro
Unit of analysis	Individual	Group/coalition	Institution/culture
Core NPF variables	Policy narrative Setting Characters Plot Moral	Policy narrative Setting Characters Plot Moral	Policy narrative Setting Characters Plot Moral
Imported theories	Belief systems Canonicity and breach (In)congruence Narrative transportation Narrator trust	Belief systems Devil/angel shift Heresthetics Policy learning Public opinion Scope of conflict	Unspecified
Known applicable methods	Experiment, interviews, focus groups, cluster analysis	Content analysis, network analysis, rational choice	Historical analysis, American political development
Potential data	Survey, transcripts	Written texts, speeches, videos	Archives, secondary sources, original artifacts

Figure 3. The NPF’s Three Levels of Analysis.

Source: “The Narrative Policy Framework” (McBeth et al. 2014, 231)

This prioritizes how groups construct policy narratives to affect the policy process. In contrast, the micro level examines the narrative effect on individual decision-making, and the macro level examines how institutions and society create narratives (Shanahan 2018). Figure 4 displays the connections between meso-level and micro-level relationships in NPF. Debates and social definitions within policy decisions are interpreted as a narrative, and actors with conflicting ideas create opposing narratives. When debating new policy, “actor coalitions use narrative strategies to attempt to influence policymaking” (Schaub 2021). To explain how, when,

and why policy narratives influence the public policy process on a larger scale, the individual level must be understood (McBeth et al. 2014). This allows one to further validate large-scale assumptions and draw conclusions from broader circumstances.

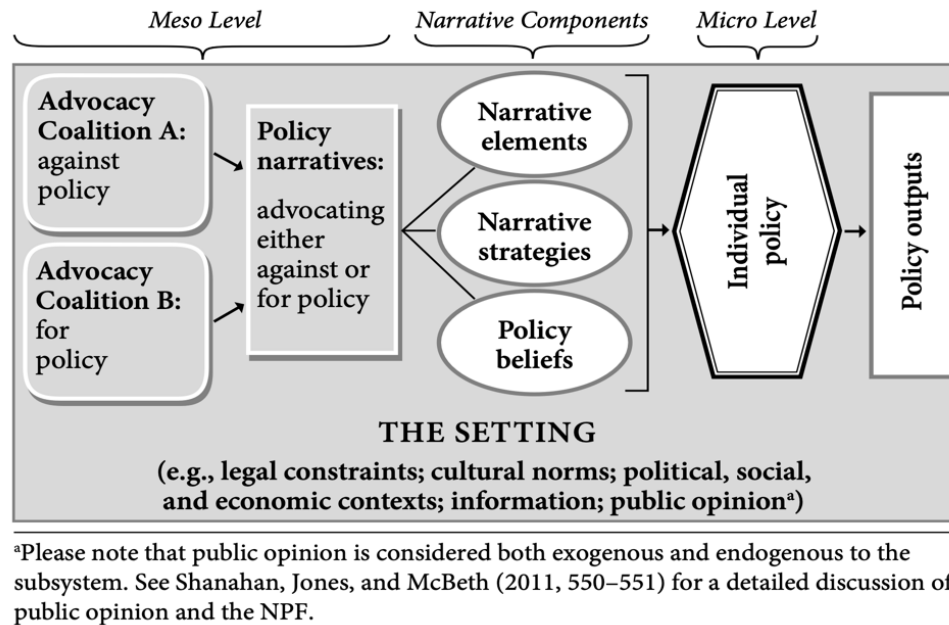


Figure 4. Model of the relationship between Meso-level and Micro-level of NPF.

Source: “The Narrative Policy Framework” (McBeth et al. 2014, 239)

Several hypotheses at the meso-level have been established to determine relationships between key research variables. The most prevalent narrative strategies in current NPF research include the scope of conflict, causal mechanisms, and the devil/angel shift (McBeth et al. 2014, 241). Out of the nine NPF hypotheses that have been previously specified, four exist on narrative strategies specifically. These are most commonly reviewed and tested using content analysis as the primary methodology. H_1 posits that actors will use narrative elements to broaden the scope of an issue and expand the size of their coalition if they perceive themselves to be losing. Actors who are perceived to be winning will use narratives to contain or shrink the policy issue, according to H_2 . H_3 incorporates heresthetics, predicting that all groups will use policy narratives

to strategically manipulate the composition of coalitions. H₄ argues that there is a higher frequency of the devil shift “in policy systems associated with policy intractability” (McBeth et al. 2014, 244). The devil/angel shift is a strategy that policy actors use to frame their opponents and themselves in a more favorable or less favorable light. In a devil shift, opponents are framed as more powerful or evil; conversely, groups stress their own heroics and capabilities when the angel shift occurs. Shanahan et al. (2013) conducted research measuring personal identification with the hero and labeling others as the villain and found that the eventual winning coalition most utilized the angel shift, while the eventual losing coalition favored the devil shift.

Depending on the research study, there are variations in the Narrative Policy Framework approach. However, a study under this framework cannot violate any of the five core assumptions of NPF. Narratives must focus on the social construction of policy reality over objectivity, follow bounded relativity or systemized interpretations, have generalizable components, follow the three aforementioned levels of analysis, and assume *Homo narrans*, reflecting the emotional over reasonable nature of humans (Jones 2018). This approach was first developed in the late 1990s by Michael Jones, Mark McBeth, and Elizabeth Shanahan, and has since been increasingly applied as a scientific approach. Jones, McBeth, and Shanahan have also played a central role in documenting the existing guiding hypotheses. In the United States alone, NPF has been used to examine online gun policy debates, hydraulic fracturing narratives in New York, and the Affordable Care Act at the Capitol (Merry 2018; Gottlieb et al. 2018; Smith-Walter 2018). Because NPF is applicable across many fields, researchers may simplify or alter it to suit their own research designs. Jones (2018) also supports the idea that bridging the gap between interpretive and scientific methods is needed to develop generalizable narrative concepts.

Methods and Methodology

This study answers the research question, “Why do opposing narratives within the hog farming industry persist?” Additionally, it will examine the question, “What narratives are the most prevalent, and how is opposition to them expressed?” This study answers these questions through an evaluation of group and coalition narratives. It applies the meso-level of NPF to a singular county in eastern North Carolina—Wayne County. Wayne County is the fourth leading county in hog production in North Carolina (See Figure 2). It stands out among the top four producers of hogs and shares direct borders with the two counties with the largest concentration of hog populations. Furthermore, these borders lie along the Neuse River, whose overseers have investigated and reported increasing rates of pollutants from farming operations (NC DEQ 2023). Water contamination from animal waste is a persistent issue concerning White Oak Farm in Wayne County. After repeated offenses and recorded evidence of a major spill in May of 2022, the North Carolina DEQ fined the operators but delayed launching proper investigations for over a year (Atwater 2023). Although production intensity in Wayne County does not rank first, it still accounts for almost ten percent of all hogs in the state. This, combined with recent spills, community discourse, and geographic centrality justifies its selection for this study.

Data for the study was collected via interviews and an online survey, thus resulting in a mixed methods analysis. Semi-structured interviews were administered to delve deeper into individual narratives of hog and pig farmers themselves, exploring the underlying values, beliefs, and experiences that shape their opinions. These interviews utilized the semi-structured questions (See Appendix A) and were conducted through online video calls on Zoom. Interviews lasted between 20 and 30 minutes apiece. Audio and video footage were collected for each interview and later transcribed and disposed of per IRB standards. Recruitment of participants was assisted

by Jan Archer, a hog farmer of 48 years and former president of the National Pork Board. Archer agreed to contact six producers who are members of the NC Pork Council requesting interview participation; one did not reply and two declined to participate.

Over six weeks (January 28th to March 5th), a total of four interviews were scheduled and conducted with hog farmers. Each individual owned and operated a multi-generational hog farm, largely centralized in the southern half of Wayne County, at the time of their interview. Figure 5 shows the variety of interviewee locations and survey distribution sites across Wayne County on a map of all permitted animal operations from the DEQ, powered by Esri World Geocoder (2024). Orange dots represent swine state permits, blue dots represent cattle permits, and grey represents animal individual permits (including horses or smaller scale farms).

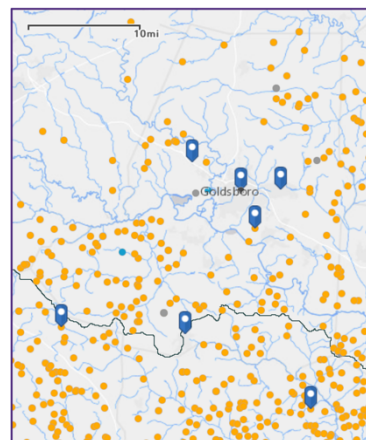


Figure 5. Map of interviewee locations and survey distribution sites.

In addition to interviews, an online survey was distributed to residents in Wayne County to capture a broad spectrum of community or public-based opinions on hog farming. It included questions on attitudes, perceptions, and experiences related to hog farming practices, along with the option to opt into interviews at a later date (See Appendix B). Recruitment for the surveys through in-person distribution of physical fliers (Figure 6) with the Qualtrics link and QR code on March 4th and March 7th. A total of 68 copies were distributed at Piggly Wiggly, Mount Olive Family Medicine Center, New Hope Methodist Church, and Wayne School of Engineering on both days. This dual-method strategy offers quantitative data for statistical analysis to be paired with qualitative data for a deeper understanding of narratives that influence public opinion. The

Narrative Policy Framework guided this analysis, focusing on how policy narratives shape and are shaped by meso-level community perspectives.

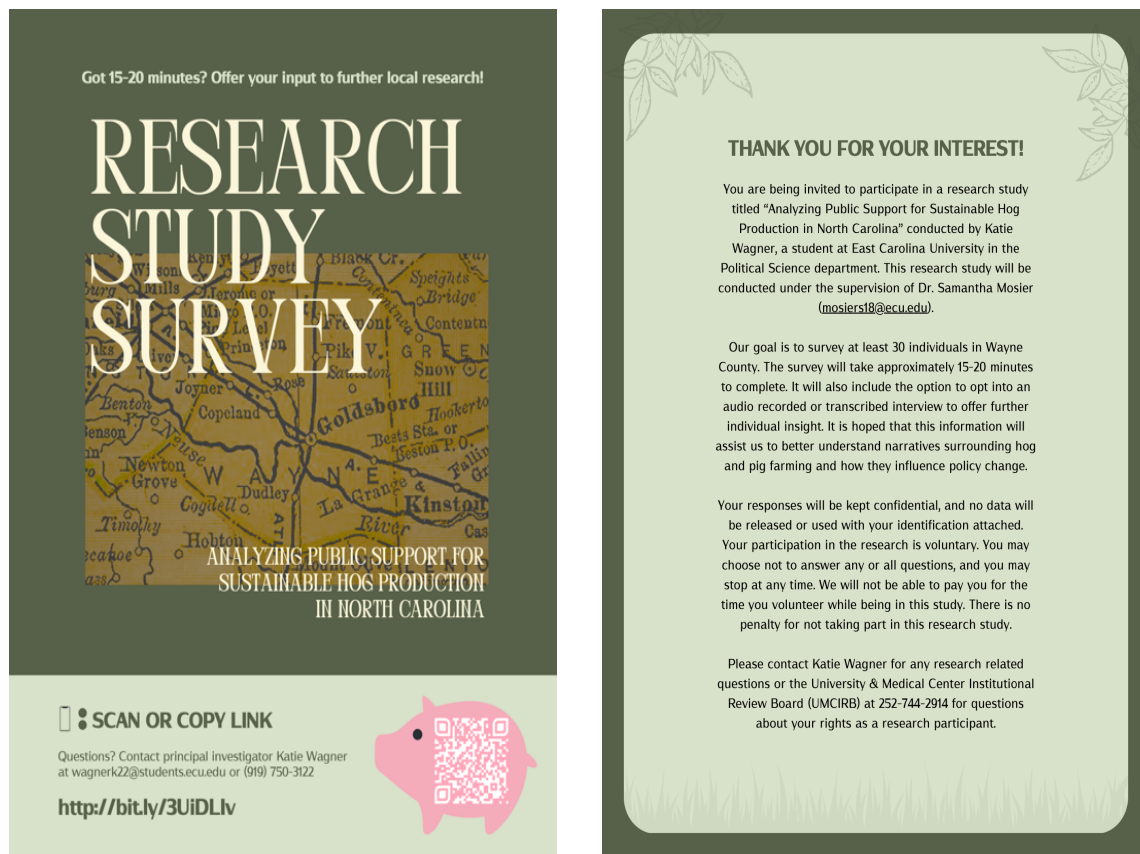


Figure 6. Front (left) and back (right) sides of flyer distributed for surveys.

The survey received a total of 23 responses, three of which contained only responses on eligibility, with a total $N = 20$ used for data analysis. 15 surveys were finished to completion, but limited data and quotes were used from all 20 responses. Although seven participants offered their personal information for future survey purposes, these names, email addresses, and phone numbers were disregarded due to time constraints. Finding an online outlet for distribution that agreed to be affiliated with hog farming research was a significant obstacle to this study given the political attention surrounding this subject. Complications with survey distribution delayed the research timeline, but it was nonetheless beneficial to include survey data, although limited.

All participants were asked for their input with utmost neutrality and objectivity. General survey respondents and hog farmers revealed that each one held their own, occasionally opposite, narratives which were executed simultaneously. The NPF acted as a theoretical lens through which survey and interview data were analyzed. Utilizing NPF aided in the identification, interpretation, and understanding of underlying policy narratives embedded in the responses of survey participants and interviewees. Survey data reveals prevalent themes and patterns in public opinions, while the interview data prioritizes the producers and processes in extracting nuanced responses and individual stories. This study explores how narratives influence public attitudes towards hog farming, and consequently shape and are shaped by broader policy discourse.

Results and Analysis

From the meso-level of the Narrative Policy Framework, identifying groups and advocacy coalitions is the first step in isolating policy narratives and the components used to express them. The results of this study reveal a natural grouping of two primary advocacy coalitions. Hog and pig farmers or producers form the first advocacy coalition against stricter policy, while environmental groups and community residents with no farming affiliation stand in direct contrast. Some residents said they remained neutral; however, their responses still reflected narrative components and associations similar to one advocacy coalition or another. Almost three-quarters of survey respondents reported that they felt existing governmental policies were adequate or they had no opinion, but they still frequently attributed elements such as “economic impact” and “sustainability” to the hog farming industry alongside their pro-policy counterparts. Firsthand individual experience or familial affiliation with the hog farming industry

was, as a whole, the most reliable factor for predicting coalition alignment. As a result, policy beliefs and narrative strategies can be identified as well.

Demographic information was first collected to determine whether respondents were representative of the population of Wayne County. The demographics by age and household income were widely varied, and balanced between genders (Table 2). Respondents were entirely White and largely middle-class residents residing in Wayne County (NC) outside city limits. According to estimates from the United States Census Bureau (2023), there are approximately 118,686 people in Wayne County. Of this population, 62.1% identify as only White, 32.5% are Black or African American, and 13.4% are Hispanic or Latino. 14.1% of Wayne County residents over 5 years old speak a language other than English at home. The median household income in 2022 is \$54,323, lower than the median survey response. 90.6% of households have a computer and 86.9% of households purchase a broadband Internet subscription (Census.gov 2023).

Table 2. Demographics of survey respondents by gender and age/household income.

By Age			By Household Income		
	Male	Female		Male	Female
18-24	0	2	\$25,000-\$50,000	0	1
25-34	0	0	\$51,000-\$75,000	2	0
35-44	2	0	\$76,000-\$100,000	3	2
45-54	1	3	\$101,000-\$125,000	3	1
55-64	2	4	\$126,000-\$150,000	0	2
65 and above	5	1	\$151,000-\$175,000	1	1
			Prefer not to say	1	3

Given these statistics, Internet access should not have been a significant obstacle to online data collection. It is noteworthy that the average demographics match the profiles of the

interviewed producers, therefore survey data may favor communities more likely to be familiar with the hog farming industry. This is likely due to a combination of the distribution location and the online nature of the survey itself. To account for limited experience with or access to technology and English resources, it would be most beneficial to collect in-person survey data for future research. Time permitting, polling tables with paper surveys would allow a greater percentage of Black and Latino residents to participate.

Recurring themes between farmer interviews and affiliated resident surveys comprise Advocacy Coalition A. All four pork producers spoke on how their multi-generational farm was owned and operated by the family. Due to the nature of the farm, it is necessary that they live on or near their operations and closely monitor any changes. Three of the four interviewees emphasized the difficulty of being on-call 24/7, working every weekend and holiday, and limiting the distance and duration of all vacations. They highlighted good stewardship as a priority, given that the farms directly affect their quality of life. One farmer said in an interview, “[Farming is] our livelihood. We’re certainly not going to do anything within our power and within our knowledge to harm the environment. I’m the seventh generation, and I hope there are seven more generations after me” (Producer 3, 2024, Interviewed by Author, Online).

Producers attribute calls for stricter regulation to the lack of awareness of the day-to-day events on their farms. Two producers who operated wean-to-feeder and feeder-to-finish operations specifically recalled their invitation to the public for anyone curious or concerned about their management or waste disposal. These invitations are notable narrative strategies as they would be used, if accepted, to discourage individual policy outcomes. Efforts to contain the issue to the farm itself confirm H₂ to maintain the status quo under existing policies. It can also be argued that prompting unaffected populations to file complaints manipulates the size or

demographics of Coalition B and confirms H₃. Producer 2 and Producer 3 both stated that maintaining the cleanliness of their farms and their commitment to sustainability were goals that they were proud of (2024, Interviewed by Author, Online). Each of the four producers used the phrase “regulated out of business,” “overregulated to bankruptcy,” or another similar variation.

In direct opposition, environmental advocacy resources and unaffiliated resident surveys constructed Advocacy Coalition B and shared narrative elements in favor of new policies. They reported personal experiences and highlighted the disparate impact of hog farming based on socioeconomic and racial demographics (Son et al. 2021). This is an accurate reflection of H₁: Advocacy Coalition B expanded the social range of hog farming issues to expand their coalition. Recurring themes centralized around the environment and quality of life, specifically concerning air and water pollution. Aligned with recent CAFO policy development, narrative discourse around animal waste management reflects these same priorities. Literature on CAFOs contributes to the narrative in favor of greater regulation, especially that written by the Center for Disease Control, the Department of Environmental Quality, and the Waterkeeper Alliance. The general permits for CAFOs alongside the lagoons and spray fields which these permits allow are both heavily criticized for their impact on the environment and public health.

These elements were commonly driven by photographic strategies of waste spills and the pollution or casualties that result, notable elements that may be associated with a devil shift and confirm H₄. One producer recalled a lawsuit against North Carolina pig farmers; producers were under a gag order, and jurors were not allowed to visit their farms. She recalled the props introduced by prosecution attorneys and individuals during the hearings. “They actually wheeled a pig, a plastic pig with poop all over it, fake looking poop, in the courtroom and allowed that to sit in front of the jurors” (Producer 2, 2024, Interviewed by Author, Online). These approaches

effectively frame pork producers as evil. Advocacy Coalition B utilizes comparatively visual narrative strategies compared to the experience-based conversation of Advocacy Coalition A.

While some community residents expressed neutrality or no opinion, their responses shared narrative elements with Advocacy Coalition B. Based on the survey results, these respondents were more likely to refer to the farms over the farmer as a central actor. Resolving adverse health and environmental conditions were highlighted as key policy outputs.

Despite community indifference, both the surveys and interviews supported the idea that farming is a difficult business. These sentiments were shared elements across all actors within Advocacy Coalition A. Thousands of animals, regardless of the livestock, are expensive to own and raise on a single farm, no matter the type of livestock. One producer explained how farming machinery and monitoring technology are additional costs of hundreds of thousands of dollars and require repairs over time. All operations are “at the whim of the markets and the weather” (Producer 1, 2024, Interviewed by Author, Online). Learning how to mitigate risks after losing every baby pig to disease was another financially, emotionally, and physically devastating experience that this producer discussed. Interviews revealed that the combination of animal disease, the availability of labor, and the lack of trust in farming operations were three of the most dangerous vulnerabilities for hog and pig producers.

After graduating college and returning to take over her family farm in Goldsboro, one producer was told by her father, “You’re gonna have to have tough skin if you’re in this business” (Producer 2, 2024, Interviewed by Author, Online). Another recalled a conversation with her daughter: “When my daughter was nine, she said, ‘Please sell the farm before you die so I don't have to inherit it’” (Producer 1, 2024, Interviewed by Author, Online). In the story of the hog farming industry, it is evident from narrative elements that farmers enter the industry fully

aware that obstacles exist and persist. As a result, they express perspectives using defensive strategies such as preventative legislation in the Right to Farm Act. Coalition A also emphasizes unity within the community support system that this common opposition has formed.

Aside from regulation, encroaching housing developments and urban activities were mentioned in several interviews and surveys as obstacles facing farms and farmers. The Right to Farm Law, as previously introduced, is a practical application of farmer protections in this case. Even so, community complaints contribute to the other obstacle reported in nearly half of the surveys: the misconception that farmers do not care about the environment nor the communities surrounding them. As a whole, the survey results support a proactive approach by the farmer to counter disinterest and misinformation alongside careful consideration of priorities to balance the health of both the environment and the communities.

Each interview and survey participant was prompted for their thoughts on the Swine Waste General Permit and Swine Digester General Permit for the upcoming cycle beginning in October 2024. One producer said that he did not anticipate too many new changes, but he explained: “What I do kind of have a problem with is the fact that we’re actually applying for a permit that we have not seen” (Producer 4, 2024, Interviewed by Author, Online). Litigation of the same permit conditions between activist groups and farmers is ongoing and has been for the last five years. Permits are often similar to previous iterations, but it was difficult for him to know which conditions may or may not be included; farmers are not provided a draft of the permit before the application deadline. Another producer reflects on working under a general permit, saying it makes her a better farmer, but she believes some amendments proposed every five years simply are not workable. When asked about how conversations might be used to reach a compromise, she explains,

“They have these conversations amongst themselves, but they never allow the farmers to take part. And that’s really hard. I mean, that’s really hard as a millennial farmer and someone who’s trying to teach the best kind of stewardship on their farm to hand down to their children and to the general public, to not be invited to the conversation” (Producer 2, 2024, Interviewed by Author, Online).

Seven out of 20 survey respondents reported “I do not know about these policies./I have no opinion” when asked about the current hog farming regulations; this result was matched by the seven who answered “Yes,” agreeing that existing policies were adequate. Altogether, a majority (70%) feel that existing governmental policies are adequate or have no opinion. Supporting these statistics, residents wrote in the survey themselves, “I feel that farming has no impact on my, or my family’s, health” and “farming is not a conversation in my life.” This indifference is surprising, seeing as the lack of knowledge and understanding were recurring themes when discussing obstacles facing farms and farmers.

To collect narrative elements from the general population on a nuanced topic in the simplest way, residents were asked to score ten given terms by their relevancy to the context of hog farming on a scale of 1-10, where 1 = completely irrelevant and 10 = completely relevant (Figure 7). The average of these scores ($n = 19$) were each greater than 5, revealing that residents found all terms relevant to hog farming to a certain degree, regardless of their individual policy narratives. “Sustainability” and “Economic Impact” received the highest average scores. Residents were also asked to rank the same terms in order of what they believe is most relevant to least relevant to hog and/or pig farming. Figure 8 displays the top responses for $n = 19$ survey results to determine which ideas are most frequently prioritized. Across residents, the ranking data reflects similar findings to the scored, but “Water” or “Transportation” never placed highest.

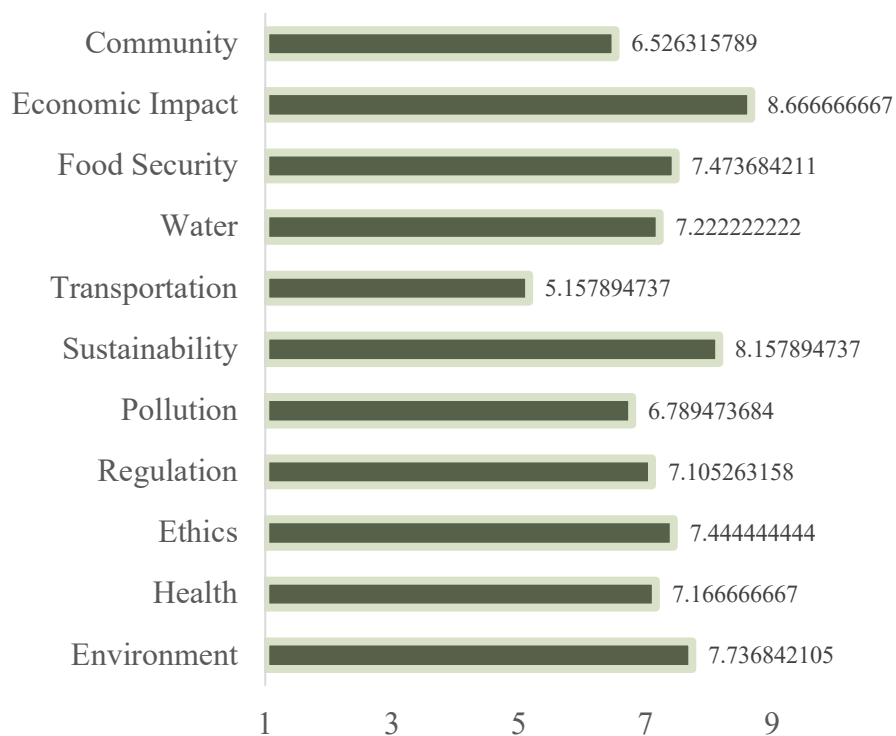


Figure 7. Average relevancy of terms in relation to hog farming.

It was unexpected that water issues were mentioned in free-response questions, not as a ranked choice, given the prevalence of water pollution as an element of waste disposal conversations.

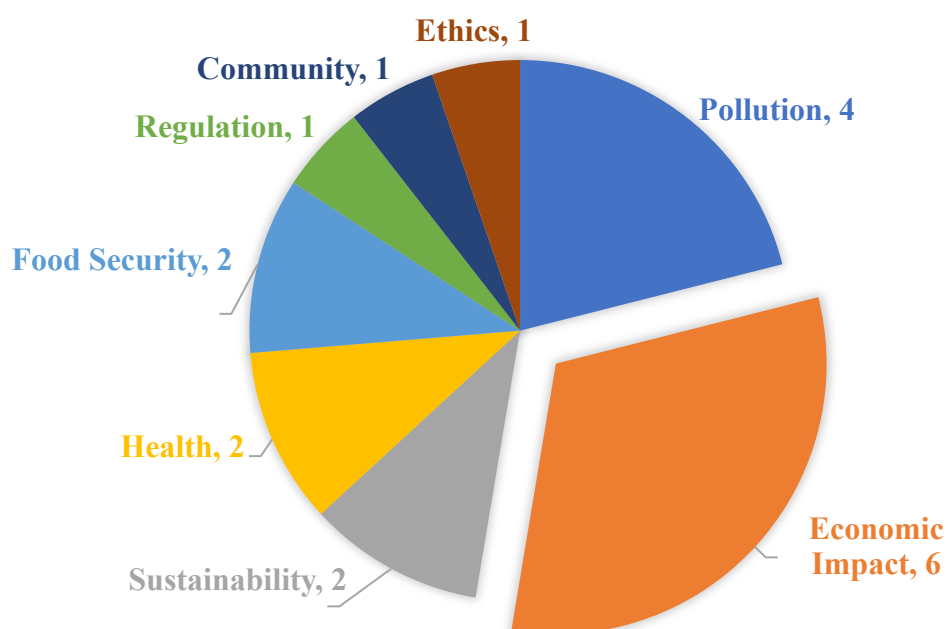


Figure 8. Most relevant word or phrase to hog and/or pig farming.

Narrative perception is key to DNA, so it is vital to identify factors that are perceived as the cause of any adverse conditions, as opposed to factors that may have been scientifically proven to be most relevant. To understand which health and environmental conditions community residents have experienced, and to what extent, participants reported on their personal experiences with conditions that may affect overall quality of life. “Unpleasant odors” were most consistently reported in 13 surveys where $n = 15$, with “poor outdoor air quality” following as the second most frequent result. To a lesser extent, “headaches/dizziness” and “nausea/vomiting” were reported in four surveys where $n = 15$. The survey asked residents to rank activities in order of those to which they most attribute negative conditions. Figure 9 displays the results as percentages from most to least responsible; the ranking of each activity from 1-10 was collapsed into three categories for visualization of diverse perceptions. “Most responsible” includes those ranked 1-3, “Moderately responsible” includes ranks 4-7, and “Least responsible” includes the 8-10 rankings. Particulate matter and personal health conditions held the highest percentage of top rankings, while livestock-related activities were noticeably low.

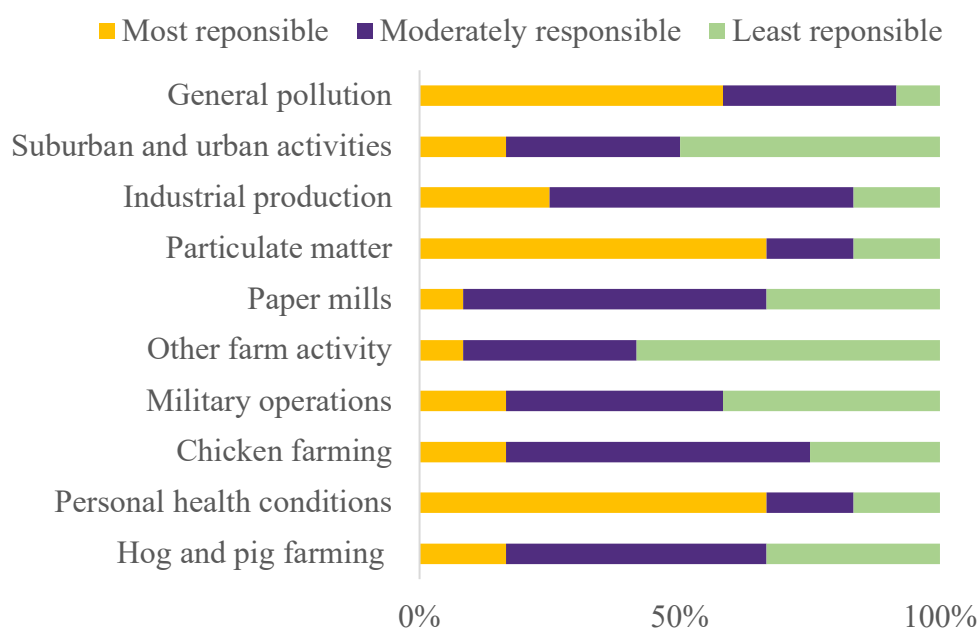


Figure 9. Activity most attributed to any health or environmental conditions.

Opposing narratives within the hog farming industry persist as a reflection of individual perspectives and interests, based on data from this research study. Stakeholders within the industry hold the greatest influence over policy narratives, and these central actors have proven to be hog producers and policymakers. The two narratives for policy change and against policy change form the most central advocacy coalitions and policy narratives surrounding the hog farming industry. Through a combination of educational outreach to universities on behalf of farmers, market pressure on behalf of the community resident, and advocacy or litigation from both parties, these interests are expressed using a wide variety of narrative strategies. Moving forward, residents, producers, and organizations must consider that common themes exist, even among diverse, even opposing, perspectives. Sustainability and economy reflect common interests across their respective subsystem beliefs. This reveals that while farmers and advocacy groups are often both environmentalists, there is a mutual understanding that economic interests will take precedence due to corporate influence in policymaking.

Ethical Concerns of Research

Due to the participative nature of this study, some ethical concerns included consent and privacy. This was accounted for by requiring all survey and interview participants to provide their clear voluntary and informed consent beforehand. Interview participants completed a digital consent form via email, and online participants agreed to the conditions by starting the survey. Survey responses were kept anonymous, and those who expressed interest in an interview had their personal information removed due to the complications in survey distribution and IRB approval. Additionally, the sensitive topic of hog farming may have been an obstacle when in direct contact with those living in the industry, but participants were questioned and reported on respectfully and responsibly.

Limitations of Research Design

Some constraints of this study can be found in sampling bias; the sample is not an accurate reflection of Wayne County. This can be attributed to the distribution method and was accounted for in the analysis. Temporal factors also limit the findings to the time-specific context of Wayne County hog farming in 2024 and cannot account for long-term shifts in opinion. In a similar regard, this study may also have limited generalizability due to its focus on conditions and conversations in Wayne County. Interviewees could have played into response bias, especially given the face-to-face interactions, to avoid judgment or backlash for disagreement. Finally, the sample size, number of interviews, and depth of analysis were limited by the availability of time and money. Establishing the scale of research throughout this paper acknowledges these limitations to enhance transparency and credibility for future research.

Conclusion

The billion-dollar farm industry of the eastern coastal plains, particularly in hog farming, faces constant challenges amid industrialization. Understanding ongoing public debates on hog farming practices and state-level legislation is crucial given the significance of these institutions to North Carolina. This study has determined that opposing narratives persist within the hog farming industry, influenced by both knowledge of the industry and personal interests. Specifically, it was determined that advocacy coalition alignment is shaped by individuals' direct experience with attributed consequences. Through the use of discourse network analysis, the results demonstrate how specific narratives influence public attitudes toward hog farming. The most prevalent narratives in this research study were either for or against stricter regulations for hog and pig farmers in the state, coexisting and in direct opposition. Factors such as physical

proximity and mental proximity to farming operations play causal roles in coalition formation and identification.

Recognizing diverse perspectives in the hog farming industry is key to environmental awareness, informed policymaking, and constructing subsystem beliefs. While discussions about hog farming may be contentious and rarely involve easy conversation, these findings further emphasize the importance of representing diverging perspectives and leveraging narrative strategies to uncover common ground. The Narrative Policy Framework highlights existing discourse in Wayne County, but this approach has the potential to be applied on a broader scale across North Carolina. Future research could further explore applications of NPF for an objective understanding of advocacy coalition groups and their narratives, strategies, and interactions on a larger scale. By embracing diverse narrative viewpoints and approaches, inclusivity and sustainability may remain at the forefront of North Carolina's hog farming industry.

Resources

- Atwater, Will. July 2023. "Wayne County wetland continues to suffer: Farm with massive hog waste spill nets new violations amid bacteria concerns." *NC Health News*, www.northcarolinahealthnews.org/2023/07/28/wayne-county/.
- Branan, Robert. 2023. "Neighbor Complaints and Response: the Basics of North Carolina's Right to Farm and Bona Fide Zoning." *NC State Extension*, <https://farmlaw.ces.ncsu.edu/land-use-and-zoning/land-ownership-and-liability/neighbor-complaints-and-response-the-basics-of-north-carolinas-right-to-farm-and-bona-fide-zoning/>.
- Census.gov. 2023. "Wayne County, North Carolina." *United States Census Bureau*, <https://www.census.gov/quickfacts/fact/table/waynecountynorthcarolina/PST045222>.
- Curliss, Andy. 2018. "The truth about... why hog farms are in Eastern North Carolina." *NC Pork Council*, <https://ncpork.org/truth-hog-farms-eastern-north-carolina/>.
- Driscoll, Adam and Edwards, Bob. June 2015. "From Farms to Factories: The Social and Environmental Consequences of Industrial Swine Production in North Carolina." *Twenty Lessons in Environmental Sociology*, New York: Oxford University Press.
- ERS USDA. 2023. "Turkey Sector: Background & Statistics." *Economic Research Service*, <https://www.ers.usda.gov/newsroom/trending-topics/turkey-sector-background-statistics/>.
- Farm Act of 2018, N.C. SESS. LAWS 2018-113, Senate Bill 711.
- Gottlieb, Madeline, Ernst Bertone Oehninger, and Gwen Arnold. 2018. "'No Fracking Way' vs. 'Drill Baby Drill': A Restructuring of Who Is Pitted Against Whom in the Narrative Policy Framework." *Policy Studies Journal*, 46(4): 798–827.
- Hribar, Carrie. 2010. "Understanding Concentrated Animal Feeding Operations and their Impact on Communities." *National Association of Local Boards of Health*, https://www.cdc.gov/nceh/ehs/docs/understanding_cafos_nalboh.pdf.
- Huffman, M. 2020. "Potential Impacts of the 25 Percent Tariff Levied by the European Union and United Kingdom on U.S. Tobacco, Tobacco Products and Sweet Potatoes." *NC State Agricultural and Resource Economics*, <https://cals.ncsu.edu/agricultural-and-resource-economics/news/potential-impacts-of-the-25-percent-tariff-levied-by-the-european-union-and-united-kingdom-on-u-s-tobacco-tobacco-products-and-sweet-potatoes/>.
- Jones, Michael D. 2018. "Advancing the Narrative Policy Framework? The Musings of a Potentially Unreliable Narrator." *Policy Studies Journal*, <https://doi.org/10.1111/psj.12296>.
- Krueger, K. 2020. "North Carolina Agricultural Statistics 2020." *North Carolina Department of Agriculture & Consumer Services*, <https://www.ncagr.gov/stats/AgStat/NCaStatBook.pdf>.

- Liggett, B. 2018. "Power of Rural." In *Campbell University Magazine*, Spring 2018.
<https://magazine.campbell.edu/articles/power-of-rural/>.
- McBeth, M., Jones, M., and Shanahan, E. 2014. "The Narrative Policy Framework." In *Theories of the Policy Process*, Westview Press, United States.
- Merry, Melissa. 2018. "Narrative Strategies in the Gun Policy Debate: Exploring Proximity and Social Construction." *Policy Studies Journal* 46(4): 747–70.
- Mosier, S., Iverson, G., Humphrey, C. 2022. "Steppingstones for Ecological Modernization: A Case Evaluation of ESTs for Hog (*Sus domesticus*) Production." *Agric Res* 12, 135–141.
<https://doi.org/10.1007/s40003-022-00632-9>.
- NASS. 2023. "State Agriculture Overview." *National Agriculture Statistics Service*,
https://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=NORTH%20CAROLINA.
- NC DEQ. 2023. "Animal facility map." *NC Department of Environmental Quality*,
<https://deq.nc.gov/cafo-map>. (<https://www.deq.nc.gov/about/divisions/water-resources/permitting/animal-feeding-operations/animal-facility-map>.)
- North Carolina Wildlife Resources Commission. 2010. "North Carolina's River Basins." *NC Wildlife*, <https://www.ncwildlife.org/Conserving/Habitats/North-Carolina-River-Basins/NCRiverBasinMap>.
- Rousseau, Katie. 2017. "America's Most Endangered Rivers® 2017." *American Rivers*,
https://www.americanrivers.org/wp-content/uploads/2017/04/MER2017_FinalFullReport_04062017.pdf.
- Schaub, S. 2021. "Public contestation over agricultural pollution: a discourse network analysis on narrative strategies in the policy process." *Policy Sciences*, (2021) 54:783–821.
<https://doi.org/10.1007/s11077-021-09439-x>.
- Shanahan, Elizabeth A., Jones, Michael D., & McBeth, Mark K. 2018. "How to conduct a Narrative Policy Framework study." *The Social Science Journal*, 55:3, 332-345, DOI: 10.1016/j.soscij.2017.12.002
- Smith-Walter, Aaron. 2018. "Victims of Health Care Reform: Hirschman's Rhetoric of Reaction in the Shadow of Federalism." *Policy Studies Journal*, 46(4): 894–921.
- Son, J. Y., Muenich, R. L., Schaffer-Smith, D., Miranda, M. L., & Bell, M. L. 2021. "Distribution of Environmental Justice Metrics for Exposure to CAFOs in North Carolina, USA." *Environmental research*, 195, <https://doi.org/10.1016/j.envres.2021.110862>.
- Tovar, K. 2018. "An Update on North Carolina Nuisance Lawsuits." *Iowa State University Center for Agricultural Law and Taxation*, <https://www.calt.iastate.edu/article/update-north-carolina-nuisance-lawsuits>.

USDA NASS. 2023. "Hogs county estimates." *United States Department of Agriculture & Consumer Services*,
https://www.nass.usda.gov/Statistics_by_State/North_Carolina/Publications/County_Estimates/Hogs.pdf.

USDA NASS. 2023. "Surveys: hog inventory." *United States Department of Agriculture*,
<https://downloads.usda.library.cornell.edu/usda-esmis/files/rj430453j/5999pk51d/73667k688/hgpg0623.pdf>.

Appendices

Appendix A

Semi-Structured Interview Questions

Can you tell me about your farm?

What is your major production focus?

Who is your integrator/who do you contract with?

Do you work with any other livestock or crops?

How long have you been producing?

Is this a family farm?

Have you worked in any other locations?

Based on your experiences, how do you think hog production has been perceived?

What do you believe is the biggest obstacle facing hog farms and farmers?

What do you think is the biggest misconception?

Was there any situation in which you believe you have been treated unfairly?

In your experience, which factors may be specific to Wayne County?

How have these problems changed or evolved over time?

Do you think the existing governmental policies for hog farming are adequate?

What is your opinion of the Swine Digester General Permit for 2024?

What actions can be taken to best address these issues?

Is there anyone you would recommend I contact next?

Any final thoughts?

Appendix B

Structured Survey Questions (Qualtrics)

Part 1: Demographics

- Are you a resident of Wayne County, North Carolina?
 - Yes
 - No (If NO, terminate survey)
- Do you reside within the official city limits of the following cities? Select one.
 - Goldsboro
 - Fremont
 - Pikeville
 - Dudley
 - Mount Olive
 - Seven Springs
 - None (I live in Wayne County, but not within city limits)
 - Other: _____
- What is your age?
 - Under 18 years (If UNDER 18, terminate survey)
 - 18-24 years
 - 25-34 years
 - 35-44 years
 - 45- 55 years
 - 56- 65 years
 - 65 and above

- What is your race/ethnicity? Select all that apply.
 - ☐ Asian or Pacific Islander
 - ☐ Black/African American
 - ☐ Hispanic/Latino
 - ☐ American Indian/Native American
 - ☐ White/Caucasian
 - ☐ Other: _____
- What is your gender?
 - ☐ Man
 - ☐ Woman
 - ☐ Non-binary / third gender
 - ☐ Prefer not to say
- What is your household income?
 - ☐ Less than \$25,000
 - ☐ \$25,000 – \$50,000
 - ☐ \$51,000- \$75,000
 - ☐ \$76,000 – \$100,000
 - ☐ \$101,000 – \$125,000
 - ☐ \$126,000-\$150,000
 - ☐ \$151,000 – \$200,000
 - ☐ Above \$200,000
 - ☐ Prefer not to say

Part 2: Experience

- Do you or anyone in your family live within a 10-minute drive of a hog or pig farm?
 - Yes, I live near a hog or pig farm.
 - Yes, someone in my family lives near a hog or pig farm.
 - Yes, both someone in my family and I live near a hog or pig farm.
 - I am not sure if I live within a 10-minute drive of a hog or pig farm.
 - No, none of these statements apply.
- [Display if YES to previous] How long have you or your family lived within a 10-minute drive of a hog or pig farm?
 - Less than one year
 - Between 1-5 years
 - Between 5-10 years
 - Over 10 years
- Do you or anyone in your family have experience working with hogs and/or pigs? Check all that apply.
 - Yes, I have firsthand experience.
 - Yes, someone in my family has experience.
 - No, neither of these statements applies.
- How would you rank your personal perceptions of hog and/or pig production on a scale from 1 to 5?
 - 1, Positive
 - 2, Mostly positive
 - 3, Neither positive nor negative
 - 4, Mostly negative

- 5, Negative
- How relevant do you find each of the following words to hog or pig farming (1 = completely irrelevant and 10 = completely relevant)?
 - Environment / Health / Ethics / Regulation / Pollution / Sustainability / Transportation / Water
 - Rank your top choices in order of what you believe is most relevant to least relevant to hog and/or pig farming.

Part 3: Elaboration

- What do you believe are the biggest obstacles facing hog and/or pig farms and farmers?
- What misconceptions exist regarding hog and/or pig farms and farmers?
- Do you believe the existing governmental policies for hog farming are adequate?
 - Yes, existing governmental policies are adequate.
 - No, hog farming operations should be more strictly regulated.
 - Partially, there are some changes that should be made.
 - I do not know about these policies./I have no opinion.
- [Display if NO or PARTIALLY is selected] At which level should hog farming regulations be increased?
 - Local, state, or federal
- To what extent, if any, have **you** experienced any of the following health and environmental conditions? (Not at all, Rarely, Occasionally, Frequently)
 - Unpleasant odors
 - Shortness of breath
 - Headaches/dizziness

- Nausea/vomiting
- Poor water quality
- Noise pollution and anxiety
- Poor outdoor air quality
- To what extent, if any, have **your family members** experienced any of the following health and environmental conditions? (Not at all, Rarely, Occasionally, Frequently)
 - Same choices as above
- To which activity do you most attribute these conditions? Rank the following activities from most responsible (1) to least responsible (10). (Choice randomization)
 - Personal health conditions
 - Hog or pig farming
 - Chicken farming
 - Military operations (i.e. Seymour Johnson AFB)
 - Other farm activity
 - Paper mills
 - Particulate matter (e.g. pollen)
 - Industrial production
 - Suburban and urban activities (e.g. neighbors)
 - General pollution (e.g. cars)
- Any final thoughts?

Part 4: Interview

- Would you be willing to participate in an interview?
 - Yes

- No
 - Maybe
- [Display if YES or MAYBE]
 - Preferred name
 - Email address
 - Phone number
 - What is your preferred method of contact?