This article details the process of converting hog waste into energy by breaking down bacteria in hog waste to create biogas. This fuel is burned to create electricity to power the hog farm, with surplus electricity being sold back to local electric companies. If all hog farms in NC did this, it could power 24,000 homes; however, many farmers are reluctant to convert their farms to this new technology. Conversion to the new technology can be costly to build and maintain, even with the availability of grants. The article also considers how farmer culture can factor into decisions about waste-to-energy systems. Many NC hog growers are ideologically conservative and may be unwilling to apply for government grants. Mike Williams, Director of the Animal and Poultry Waste Management Center at NCSU, explains: “I have had producers tell me, ‘If I’m participating in a project that is incentivized by the government at all, that’s a hard thing for me to discuss with my family around my dinner table’”. Some farmers also fear change in the hog industry that could lead to new growth; currently, the limited supply makes hog farming permits extremely valuable, giving farmers the agency to ask for higher prices if they chose to sell.

AUTHOR CREDENTIALS
Jess Clark is a journalist and master’s student at the School of Journalism and Mass Communication at UNC Chapel Hill; Dree Deacon is a rising senior in the UNC School of Journalism and Mass Communication pursuing a BA in Business Journalism with a minor in Social and Economic Justice. The work they did was part of the Whole Hog project, which “aims to shed light on the energy dynamics within the hog industry in North Carolina,” exploring the “complex set of relationships among those with an economic, environmental, cultural and political stake in the industry.” (“About,” Whole Hog)

HOW DID WE FIND IT?
We found this article by doing a Google search for [hog farm industry north Carolina], where we discovered the Whole Hog webpages, which provide investigative journalism considering multiple aspects of the NC hog farming industry.

CITATION
This book defines the specific needs of the small town and rural populations of the United States and Canada from the familial, societal, economic, agency, and empowerment perspectives. It recognizes the diverse range of cultural and ethnic groups, including African Americans, American Indians, and Canadian First Nations People. Addresses the traditional way of life found in rural communities and offers approaches to enhance it. Assembles the research and experiences of leading practitioners in the rural environment. Chapter 5, titled “Squeals and deals: the impact of corporate hog farming on rural communities” deals specifically with hog farming and rural communities.

The authors of this book are, Iris B. Carlton-Laney, Richard L. Edwards, and P. Nelson Reid. Iris Carlton-Laney currently works at the School of Social Work, University of North Carolina at Chapel Hill. Iris does research in Developmental Psychology, Health Psychology and Clinical Psychology.

From library homepage (library.campbell.edu) we clicked on the Books & Media tab and did a keyword search for [ "hog farming" AND rural ]

The high price of cheap pork: The explosive growth of hog farming in Illinois has come at a harsh cost to rural communities -- and weak state laws offer residents little protection.

On the field next door, pork producers had erected a 3,600-hog confinement facility, where hundreds of thousands of gallons of manure emit gases that have ruined the Heissingers' quality of life. Under one of several loopholes in Illinois law that promote the growth of industrial hog confinement, Heissinger's neighbor did not need to notify nearby residents that he had partnered with the giant producer Cargill Pork in 2007 to construct a facility where thousands of hogs would be penned on slotted concrete floors.
There has been a dramatic shift from small-scale production toward vertically integrated factory farms or large, single-phase specialized farms. The number of hog farms has declined by more than 70% over the past 15 years. A USDA report states, "Once dominated by small operations that practiced crop and hog farming, the industry has become increasingly concentrated among large operations that produce hogs on several different sites. Further, large operations that specialize in a single phase of production have replaced farrow-to-finish operations that performed all phases of production." Farms with over 5,000 pigs are expected to account for over 88.0% of industry revenue in 2017. IBISWorld forecasts industry concentration to continue through 2022.

Major producers compete on a vastly different basis than independent farmers. Major producers are involved in all points of the production chain, from feed production to farming, processing and retailing. Independent farmers compete largely on price. Farmers that become contractors also compete in the proximity of their farms to the major processor they contract with.

It is getting harder to start a small hog farm, or remain independent. Major barriers to entry include: 1) Regulations governing the industry, 2) the difficulty in securing contracts with downstream processors. Additionally, the industry has experienced a rise in globalization. Smithfield Foods Inc., was recently acquired by China-based WH Group. The deal, estimated at $4.7 billion, is one of the largest Chinese takeovers of a US company.

Complying with regulations and ordinances currently favor the major producers. The industry is regulated by all levels of government: Environmental Protection Agency (EPA) regulations include water-pollution regulations set out under the 1972 Clean Water Act. Enforcement of EPA regulations varies among states, and many states only pursue enforcement following citizen complaints. In most states, the board of health grants piggery permits. For start-up hog farms, county zoning policies also impact location decisions.

Small hog farmers may benefit from American customers pushing back. Animal welfare is increasingly gaining importance for large and independent producers. ... It has also opened the market for smaller farmers to compete with larger operators on the grounds of animal welfare [also non GMO, and no additives]. For example, some smaller producers have turned to organic production ....

AUTHOR CREDENTIALS

Jack Curran is an IBISWorld analyst. He aggregates data from publicly available sources which he supplements with calls on industry contacts and non-public sources, in-house data and economic modeling, and the his knowledge of industry. IBISWorld reports are collected by many university and corporate libraries.

HOW DID WE FIND IT?

From the library homepage (library.campbell.edu) we did a “Databases” search for [IBISWorld]. On the IBISWorld homepage, we searched for [“hog farm”] in the IBISWorld search box.

CITATION

The purpose of this poll is to ascertain the level of engagement Campbell students’ have with the issue of clean drinking water and the care and use of the local watershed that provides water for the campus.

Methodology: Personally request random students selected from every floor and the Starbucks coffee shop at the Wiggins Library to complete a print survey about ‘water and watersheds.’ The survey was conducted on February 4-5, 2018.

Discussion: The table presents a summary of key data. Interestingly, none of the ‘I refrain’ comments about swimming in or going out on the Cape Fear River cited water quality. Comments included ‘can’t swim,’ ‘scary,’ ‘don’t live near the river,’ and ‘snakes.’

Findings:
- Campbell students take water quality seriously and spend the money to filter water they have doubts about.
- Campbell students have a positive perception of the quality of Cape Fear River.
- A large portion of Campbell students would support a service project about ‘clean water’ or a ‘clean watershed.’

**AUTHOR CREDENTIALS**

The author is an interested person who was curious to discover if his fellow students thought clean drinking water was an important issue and how Campbell students interacted with the local ecosystem that provides the campus water supply.

**HOW DID WE FIND IT?**

As primary research, the survey was created, collected, and analyzed by the author.
The article begins with the author’s trip to a concentrated animal feeding operation (CAFO) in Duplin County, NC with Kemp Burdette, a member of the Cape Fear River Alliance. A confrontation with CAFO operators ensues. The industrial takeover of hog farming in NC was engineered by Wendell Murphy, owner of Murphy Family Farms. He was elected to the NC House in 1983, and the NC Senate in 1988. In the late 1980s people became aware of ecological, economic, and human harm done from CAFO’s due to high levels of hog waste in ground water and surface water. In 2002 Devon Hall, from Duplin County, founded the Rural Empowerment Association for Community Help (REACH). Hall partnered with Steve Wing, a public health professor from UNC. Wing studied air-quality in neighborhoods within a mile of the CAFOs, later known as the Duplin Health Awareness Project. His tests expanded to water quality and a project with Waterkeeper that was manned by Riverkeepers. Wing made reports to the Department of Environmental Quality (DEQ), and Hall recruited community organizers. Their effort resulted in a moratorium on future hog farms in 2007 by the NC Legislature.

William Tom Butler a CAFO contract farmer who owns Butler Farms (in Harnett County) states that most contract farmers are not pleased with the status quo “We have a contract that’s not worth the paper it’s printed on.” Butler is a very responsible hog farmer, he covers his waste lagoons and captures the gases to produce alternative energy.

In 2003 Dr. Michael Mallin, a biologist from UNCW began studying the impact of CAFOs on the aquifer near Stocking Head Creek in Duplin County and found it to be polluted. “The DEQ admits that there are intakes for municipal water systems on area rivers, which means that even if locals aren’t using well water, they can still be bathing in, cooking with, and drinking water tainted with hog waste.” DEQ’s budget has been gutted by anti-regulation legislators. In 2014 REACH, Waterkeeper Alliance, and the NC Environmental Justice Network, supported by Earth Justice filed a Title VI case with EPA’s Office of Civil Rights, alleging that the state’s lax regulation decimates against people of color.
ABSTRACT / KEY DETAILS

The clustering of North Carolina’s hog concentrated animal feeding operations (CAFOs) in low-income, minority communities has raised concerns of environmental injustice and environmental racism. Several studies show that this may not be intentional discrimination, but a result of following ‘the path of least resistance’ in choosing sites. This nevertheless results in environmental injustice if minority populations are disproportionately affected, no matter the reason. In 2000 ECU sociology professor Bob Edwards studied Eastern NC counties and found that even when controlling for regional differences, counties with larger minority populations were home to greater concentrations of hog waste. Edwards also reported that large hog operations forced small farmers out of business. For centuries farms were sustainable, the waste from animals helped grow the next year’s crops. Then, starting in the 1970s, the hog industry in NC changed rapidly when Wendell Murphy applied the CAFO model. After he was elected to the NC legislature he passed pro CAFO legislation know as “Murphy’s Laws.” In 1982, all but one NC counties had a BOD, and SS concentrations were 534, 77, and 109 mg/L, respectively, from the aerobic unit of the current treatment system.
The three-stage treatment scheme (solid separation followed by anaerobic and aerobic treatment) has been applied by most hog farms in Taiwan for wastewater treatment. The objective of this study was to examine the efficacy of using a modified free water surface (FWS) constructed wetland to polish the treated swine wastewater. The FWS wetland was installed on a hog farm to conduct the treatability study. The floating plant (Pistia stratiotes L.) was grown in the wetland system and small gravels were used as the media. In the first part of this study, effluent after the aerobic treatment unit was pumped into the system for posttreatment at two different hydraulic retention times (HRTs) (2 and 4 days). In the second part of this study, effluent after the anaerobic treatment unit was pumped into the system for treatment, and the system was operated at 5- and 7-day HRTs. Influent and effluent samples were analyzed for water quality parameters including chemical oxygen demand (COD), biochemical oxygen demand (BOD), and suspended solid (SS). The results show that averaged COD, BOD, and SS concentrations were 1,104, 319, and 185 mg/L, respectively, from the anaerobic unit, and averaged COD, commercial hog farm, by 1997 95% of NC hog farms were located in the eastern counties of the costa plain. ...
Assessing hog lagoon waste contamination in the Cape Fear Watershed using Bacteroidetes 16S rRNA gene pyrosequencing

Hog lagoons can be major sources of waste and nutrient contamination to watersheds adjacent to pig farms. Fecal source tracking methods targeting Bacteroidetes 16S rRNA genes in pig fecal matter may underestimate or fail to detect hog lagoon contamination in riverine environments. In order to detect hog lagoon wastewater contamination in the Cape Fear Watershed, where a large number of hog farms are present, we conducted pyrosequencing analyses of Bacteroidetes 16S rRNA genes in hog lagoon waste and identified new hog lagoon-specific marker sequences. Additional pyrosequencing analyses of Bacteroidetes 16S rRNA genes were conducted with surface water samples collected at 4 sites during 5 months in the Cape Fear Watershed. Using an operational taxonomic unit (OTU) identity cutoff value of 97%, these newly identified hog lagoon markers were found in 3 of the river samples, while only 1 sample contained the pig fecal marker. In the sample containing the pig fecal marker, there was a relatively high percentage (14.1%) of the hog lagoon ...

markers and a low pig fecal marker relative abundance of 0.4% in the Bacteroidetes 16S rRNA gene sequences. This suggests that hog lagoon contamination must be somewhat significant in order for pig fecal markers to be detected, and low levels of hog lagoon contamination cannot be detected targeting only pig-specific fecal markers. Thus, new hog lagoon markers have a better detection capacity for lagoon waste contamination, and in conjunction with a pig fecal marker, provide a more comprehensive and accurate detection of hog lagoon waste contamination in susceptible watersheds.

AUTHOR CREDENTIALS

Ann Arfkin and BK Song are researchers at the Virginia Institute of Marine Science. Prior to coming to The Virginia Institute of Marine Science Worked at UNC Wilmington. Ann recently defended her PHD in Marine Science.

Michael A. Mallin is a PhD. In Marine and Estuarine Ecology and is interested in land use and how it can contribute to water pollution.

HOW DID WE FIND IT?

From library homepage (library.campbell.edu) we searched OneSearch using the search string [“hog farms” AND waste AND water]

CITATION

A survey was administered to a random sample of residents from seven rural communities in the eastern part of Ottawa, Canada. The authors analyzed self-reported questionnaire data obtained from 723 adults and 285 children/adolescents. Health-related quality of life (HRQOL) was assessed using a survey instrument, while data were also collected for sociodemographic characteristics, the prevalence of selected health conditions, and lifestyle related behaviours (e.g., smoking) of participants. Variations in self-reported health according to the residential distance to the hog farm were evaluated using statistical analysis.

For the most part, the prevalence of selected health conditions among adults and children was not associated with how far they lived from the farm. No associations were observed with migraines, respiratory conditions (asthma, rhinitis, sinusitis, and chronic bronchitis), and allergies. However, a higher prevalence of depression was noted among those who lived within 3 km of the farm relative to those who lived more than 9 km away. Furthermore, individuals who lived closer to the hog farm were more likely to worry about environmental issues such as water quality, outdoor and indoor smells, and air pollution.

This level of worry also contributed to lower HRQOL scores for individuals who lived closer to the farm. It was also observed that the prevalence of depression was much higher among those who indicated a concern about environmental issues (18.2%) when compared to those who did not (8.0%).

**AUTHOR CREDENTIALS**

Paul Villeneuve has a Ph.D. in Public Health and is an accredited professional statistician. Amira Ali is an epidemiologist in Ottawa, Canada. Laurel Challacombe is a public health researcher.

**HOW DID WE FIND IT?**

From library homepage (library.campbell.edu) we searched OneSearch using the search string [“hog farm” AND environment]

**CITATION**

ABSTRACT / KEY DETAILS

The effects of concentrated animal feeding operations (CAFOs) on water quality were investigated at 54 agricultural stream sites throughout the North Carolina Coastal Plain during 2012 and 2013. Three general watershed land-use types were examined during the study, including 18 background watersheds with no active CAFOs (BK sites), 18 watersheds with one or more active swine CAFOs but no poultry CAFOs (SW sites), and 18 watersheds with at least one active swine CAFO and one active dry-litter poultry CAFO (SP sites).

Water-quality differences were noted for the SW and SP land-use groups relative to the BK group. Median values of specific conductance, several major ions (magnesium, sodium, potassium, and chloride), and nitrogen fractions (ammonia plus organic nitrogen, ammonia, nitrate plus nitrite, total nitrogen, and $\delta^{15}N$ of nitrate plus nitrite) were higher for the SW and SP groups compared to the BK group. No significant differences in water temperature, dissolved oxygen, calcium, total organic nitrogen, orthophosphate, or $\delta^{18}O$ of nitrate plus nitrite were noted among the land-use groups. When compared on the basis of land-use type, there was an overall measurable effect of CAFO waste manures on stream water quality for the SW and SP watershed groups. Measurable effects of CAFO waste manures on stream water quality were most evident in those SW and SP watersheds having lower percentages of wetlands combined with higher swine barn densities and (or) higher total acres available for applying waste manure at the swine CAFOs.

AUTHOR CREDENTIALS

Stephen L. Harden is a hydrologist at the South Atlantic Water Science Center, and has been an employee of the government's US Geological Survey since 1991.

HOW DID WE FIND IT?

We found this article by doing a Google search for [government reports hog farming North Carolina].

CITATION

This newspaper article printed in The Blade, an Ohio newspaper, describes the situation of a number of family farms using hog manure to fertilize their fields of corn, soybeans, and wheat. Problematically, phosphorus is washing off of these fields, covered in manure or industrial fertilizer, and is effecting northwest Ohio’s water quality. The Stateler farm is one of three in southern and northern Hardin counties to implement new practices designed to reduce nutrient runoff from their fields, including phosphorus which feeds algae growth in nearby Lake Erie. These demonstration farms are part of a larger research project on water runoff led by the U.S. Department of Agriculture. This five year project is an attempt to reduce nutrient erosion and improve water quality. Farmers and activists are both skeptical of the efficacy of the new practices. Soil erosion has been reduced, but to date, levels of dissolved phosphorous running off fields have not. Further research is warranted, but if effective, the hope is that farmers will voluntarily adopt these practices.
The research study described in this journal article was designed to uncover if the same relationship with traditional environmental justice (EJ) variables such as low income and minority populations observed in other concentrated animal feeding operation (CAFO) studies exist with the swine CAFO densities in Iowa. Spatial regression techniques were used to determine the relationships of high swine concentrations to these environmental justice variables. The researchers found that while CAFOs do cluster in certain regions and watersheds of Iowa, these high densities of swine are not associated with traditional EJ populations of low income and minority populations. While this is good, it is the researchers’ determination that the negative impacts of intensive swine production require a more complex appraisal. Populations exposed to the risks of swine production “bear the burden” of the environmental injustice of growing pork not only for the United States but also the world.

AUTHOR CREDENTIALS

Dr. Margaret Carrel teaches in the Department of Geographical and Sustainability Sciences at the University of Iowa along with author, Eric Tate. Author Sean Young was an advisee of Dr. Margaret Carrel while earning his PhD at the University of Iowa and has served as an adjunct instructor in the Department of Geographical and Sustainability Sciences at that institution.

HOW DID WE FIND IT?

From library homepage (library.campbell.edu) we searched OneSearch using the search string [“hog farming” AND watersheds]. We limited to “journal articles,” selected the limiter “peer-review,” and sorted by date (newest to oldest).

CITATION

Feeding the Hog Industry in North Carolina: Agri-Industrial Restructuring in Hog Farming and Its Implications for the US Periphery

NC is the focus of this article, since it is the second leading hog producer in the US. A study was done to see what factors are used to determine the location of large scale Hog farms. This article is both a quantitative and qualitative analysis of the rise of industrial hog farming and its impact on North Carolina’s local economies.

AUTHOR CREDENTIALS
Donnie is the Economic Policy Manager at NCSU Institute for Emerging Issues. In his work he collaborates with national, state, and local leaders from industry, government, and nonprofit organizations.

HOW DID WE FIND IT?
From library homepage (library.campbell.edu) we searched OneSearch using the search string [“hog farming” AND “North Carolina”]

CITATION
This article is about the hog waste in NC and how rural NC residents are having to deal with how hog waste disposal is affecting their everyday life as well as their health. This article talks about the recent HB 467 that was passed, which limits the damages residents can collect from hog farmers.

Author Credentials
Laura Villegas is a PhD candidate at NC State University for Agriculture and Resource Economics

How Did We Find It?
We found this article by doing a Google search for [NC Hog Farmers Opinion]

Citation
Exposing Fields of Filth: Landmark Report Maps Feces-Laden Hog and Chicken Operations in North Carolina

The EWG report on hog farming provides statistical information about the scope of hog farming waste in NC and its human impact, such as the infographic below. They also provide information about their data collection and methodology.

According to their website, the Environmental Working Group is a “non-profit, non-partisan organization dedicated to protecting human health and the environment.” (About Us, www.ewg.org/about-us). EWG conducts research related to public and environmental health and educates consumers through reports, online databases, mobile apps, and communications campaigns (About Us, www.ewg.org/about-us). The group is transparent about funding and posts annual reports online.

We found this article by doing a Google search for [ NC hog farming social justice ], where we found a link to the North Carolina Environmental Justice Network. From this page, we discovered key advocacy groups, such as Waterkeeper Alliance and Cape Fear River Watch. Having learned these key players, we were able to find this report by Waterkeeper Alliance, in collaboration with the Environmental Working Group.