Analyses of Septic System Installation Trends in North Carolina

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ABSTRACT

This study examines the distribution of Operation Permits (OPs) and septic system repairs across North Carolina from 1995 to 2021, identifying significant disparities linked to geographical features, population density, and soil composition. A total of 746,928 OPs were issued, with Johnston County leading at 28,955, followed by Wake at 23,439, and Dare at 21,059. In contrast, Tyrrell County had the fewest at 568. The state also recorded a total of 151,491 septic repairs, with Dare County experiencing the most at 9,969. The findings highlight the impact of local environmental factors on septic system maintenance needs and underscore the necessity for county-specific management strategies to enhance public health and sanitation efficiency in North Carolina.

INTRODUCTION

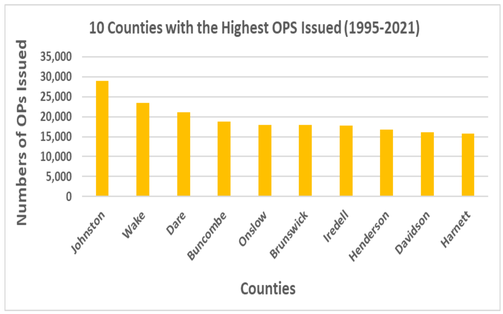
Septic systems are underground wastewater treatment structures that integrate technology and biological processes to manage domestic wastewater (USEPA, 2023). Widely used in North Carolina, where nearly half of the population relies on them, these systems ensure the effective treatment and disposal of sewage (NC State Extension Publication, 2016). The process begins in the septic tank, where solids settle and oils float, both separated from the effluent by tank structures. The effluent then filters through the soil in the drainfield, removing harmful pathogens before it merges back into the groundwater (Katz et al., 2011). Maintaining and repairing septic systems is crucial to prevent groundwater contamination and protect public health, particularly near sensitive water sources. Repairs, which may include modifying or replacing parts of the system, require permits from local authorities to ensure compliance with health and environmental standards. Such regulatory oversight is vital to prevent system malfunctions that can lead to public health emergencies, costly cleanups, and long-term environmental damage. By adhering to regulations and focusing on regular maintenance, the integrity of groundwater supplies is preserved, enhancing public health and environmental sustainability.

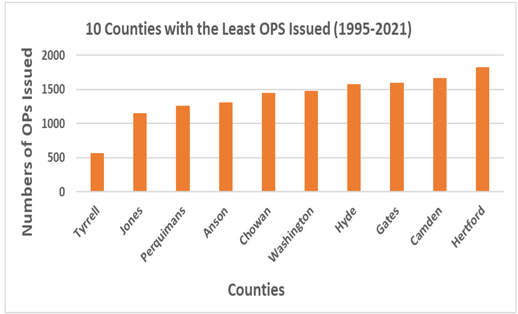
MATERIALS & METHODS

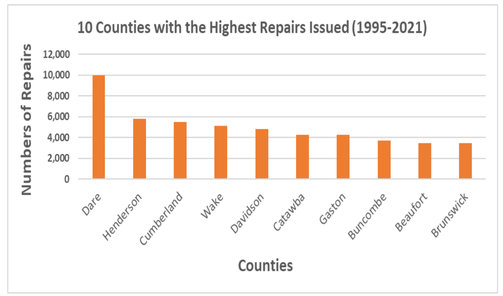
The data for Operation permits and Repair permits were collected from the NCDHHS and analyzed using MS Excel.

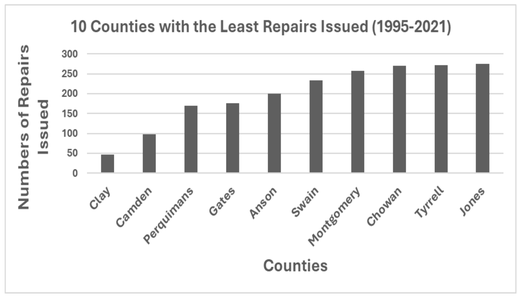
The application is the first request for a septic system evaluation or repair made to the county. The county evaluates the soil to see whether it is suitable for a septic system and then provides an Improvement Permit (IP) specifying the kind and placement of the authorized system. The county issues a Construction Authorization (CA), which is frequently given concurrently with the IP, to start installation or repairs after receiving the final site plan. An operation permit (OP) is issued by the county following installation and a final inspection that includes an as-built drawing of the system architecture. This permit provides a specified repair site for future maintenance and verifies that the system meets legal and regulatory requirements.

RESULTS

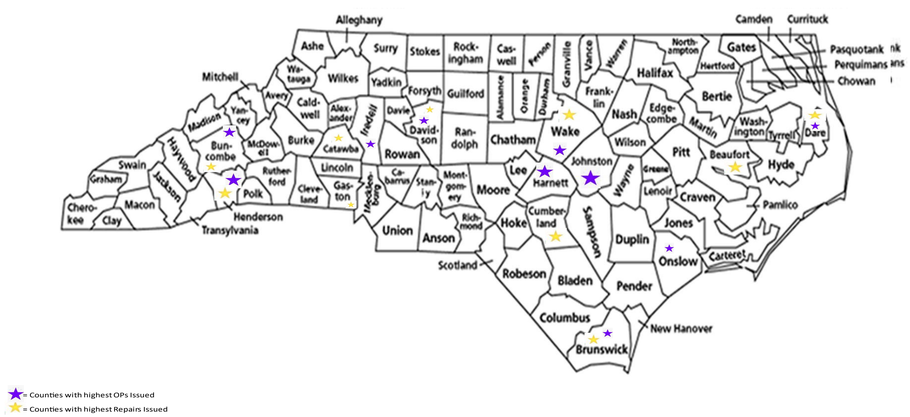




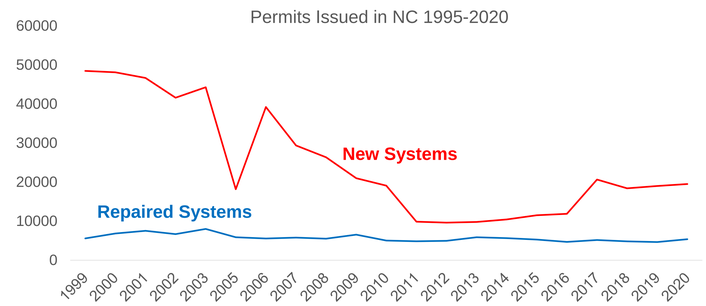




Six of the counties with the highest (top 10) number of new system permits also had the highest (top 10) number of repairs including Wake, Davidson, Dare, Henderson, Buncombe, and Brunswick. These counties are spread across the coastal plain, piedmont, and mountains, and are near relatively large population centers.



RESULTS & DISCUSSION



Over 745,000 new septic systems were installed in North Carolina between 1995 and 2021. Over 151,000 systems have been repaired during that period. There are currently over 2 million septic systems in NC. While the number of total systems in NC has Increased over the past 3 decades, the number of systems repaired each year has remained relatively steady (~6,000/yr).

From 1995 to 2021, the issuance of Operation Permits (OPs) across North Carolina's 100 counties reveals significant disparities in infrastructure demands, reflecting the state's varied ecological makeup. Johnston County led with 28,955 OPs, reflecting high septic system activity due to its growing urban environment, followed by Wake County with 23,439 and Dare County with 21,059, the latter influenced by its coastal sensitivities. This variation is emblematic of the diverse environmental challenges—from the loamy soils of the western mountains to the sandy clays of the coastal plains—requiring tailored septic system management strategies. Conversely, counties like Tyrrell and Jones issued the fewest repairs, indicating different scales of septic system usage, influenced by lower population densities and differing soil types. The data underscores the need for region-specific management to effectively address the unique septic system demands across North Carolina, balancing robust maintenance in populous areas with sufficient sanitation in less populated regions.

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