

Nocturnal Convenience¹: The Problem of Securing Universal Sanitation Access in Alabama's Black Belt

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ABSTRACT

On-site sanitation (OSS) is not universal in the rural United States: access to and function of available options are limited by geological, economic, regulatory, and policy constraints. In Alabama's rural Black Belt region, widespread impermeability of soils and a lack of locally accepted, cost-effective technical solutions contribute to limited access to functional OSS. Despite the existence of federal and state financial assistance programs intended to increase access to sanitation, potential beneficiaries may not be able to readily access assistance. Based on structured interviews with local stakeholders, this article provides an overview of the problem and perceived barriers to securing universal sanitation. Promising options that may increase OSS access include technical innovation, improving sanitation literacy, increasing the accessibility of financial assistance programs, and policy initiatives that proactively engage with underserved communities. These and other measures should be explored to create an enabling environment for the provision of universal sanitation coverage in the Black Belt.

INTRODUCTION

IN HER 2011 REPORT to the United Nations (UN) Human Rights Council, the Special Rapporteur on the Human Right to Safe Drinking Water and Sanitation, Catarina de Albuquerque, summarized the American problem of unequal access to on-site sanitation (OSS): "In the United States, it is often the poorest and the most marginalized groups that

lack access to sanitation. Without proper sanitation, human excreta contaminate drinking water sources, with severe public health implications. Ensuring access to adequate sanitation for all is not only fundamental for human dignity and privacy, but is also key to protecting water quality. States must progressively extend safe sanitation services, particularly to rural and deprived urban areas, taking into account the needs of disadvantaged groups."² Much of the population in the U.S. without access to adequate sanitation includes migrant workers and the homeless, but low-income, rural populations face access challenges as well.³ The UN report went on to cite statistics from Lowndes County, Alabama, on the estimated prevalence of failing septic systems ("40-90%") and the fact that violations have led to arrests by local law enforcement, reported in the popular media.⁴

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¹"The drinking and cooking water is caught off the roof and routed through crumpled gutterpipes into storage beneath the porch. How sound the walls of this cistern are seems to me of possible importance, 'esthetically' at least, because the wide hole in the hall, porch above the former basement, about fifteen feet away, is used for nocturnal convenience." From *Let Us Now Praise Famous Men* (Agee and Evans, 1941), describing household water and sanitation in the Depression-era Black Belt of Alabama.

²De Albuquerque, C., *Report of the Special Rapporteur on the Human Right to Safe Drinking Water and Sanitation, Catarina De Albuquerque*. Rep. N.p. (United Nations General Assembly, 2011).

³Wescoast, J., Headington, L., Theobald, R., "Water and poverty in the United States," *Geoforum* 38 (2007): 801-814.

⁴Day, Doug, "Poor People, Poor Soil, Poor Sanitation," *Onsite Installer*, April 2012. <http://www.onsiteinstaller.com/editorial/2012/04/poor_people_poor_soil_poor_sanitation>. (Last accessed on October 2, 2013).

Alabama's Black Belt

Lowndes County is in Alabama's Black Belt region (Figure 1), which was so named for the color of its organically rich, fertile soil, supporting plantation and later sharecropping economies. It is part of a larger environmental and sociocultural region that stretches, by some definitions, from East Texas to Tidewater Virginia.⁵ In Alabama, the Black Belt counties are among the poorest, with median household incomes of more than \$10,000 less than the average for Alabama, and shorter life expectancies.^{6,7} The region is characterized in part by high poverty, high unemployment,⁸ significant out-migration, relatively high percentages of people on public assistance and disability,⁹ and a high percentage of minorities, especially African Americans.¹⁰ The population is aging and faces a higher than average prevalence of obesity, infant mortality, HIV infection,¹¹ diabetes, and other indicators of poor health and well-being.^{12,13} Two factors converge there that fundamentally limit access to sanitation: (1) unfavorable geological conditions for conventional septic systems and (2) a low-income, rural population that does not have ready access to alternatives for domestic wastewater. Based on extensive interviews with stakeholders familiar with the issue and local constraints,¹⁴ this

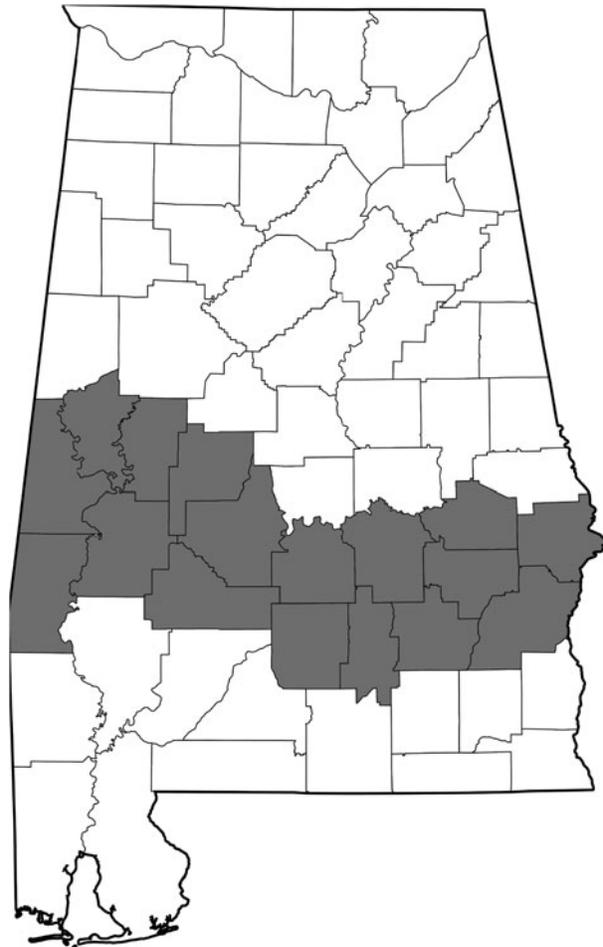


FIG. 1. Alabama counties with Black Belt shaded. Not all shaded counties are included in every definition of the Black Belt region.

⁵Tullos, A., "The Black Belt," *Southern Spaces*, April 19, 2004. <<http://southernspaces.org/2004/black-belt>> (Last accessed on December 14, 2012).

⁶"Life After Cotton," *Economist*, Aug 28, 2003. <<http://www.economist.com/node/2021280>>. (Last accessed on October 2, 2013).

⁷This figure should be contrasted with relevant local household sizes and its relation to the Federal Poverty Line (FPL). Note: The FPL in 2012 for a household of five is \$27,010. (U.S. Department of Health and Human Services, 2012; U.S. Census, 2000).

⁸"Black Belt counties continue to have high rates Alabama's unemployment rate drops to 6.8%," *Greene County Democrat*, July 2, 2013. <<http://greencountydemocrat.com/?p=7470>>. (Last accessed on October 2, 2013).

⁹Joffe-Walt, Chana, "In One Alabama County, Nearly 1 In 4 Working-Age Adults Is On Disability," *National Public Radio*, March 25, 2013. <<http://www.npr.org/2013/03/25/175293860/in-one-alabama-county-nearly-1-in-4-working-age-adults-is-on-disability>>. (Last accessed on October 2, 2013).

¹⁰Wimberly, Dale, "Quality of Life Trends in the Southern Black Belt, 1980–2005: A Research Note," *Journal of Rural Social Sciences* 25 (2010): 103–118. <[http://www.ag.auburn.edu/auxiliary/srsa/pages/Articles/JRSS 2010 25 1 103-118.pdf](http://www.ag.auburn.edu/auxiliary/srsa/pages/Articles/JRSS%2010%2025%20103-118.pdf)>. (Last accessed on October 2, 2013).

¹¹Alabama Department of Public Health (ADPH), *HIV and AIDS Cases by Public Health Area and County, Alabama* (2012). Available at: <<http://www.adph.org/aids/assets/HIV2nd-Quarter2012%28PHA%29.pdf>>. (Last accessed on August 11, 2012).

¹²Shuaib, F., Foushee, H. R., Ehiri, J., Bagchi, S., Baumann, A., Kohler, C., "Smoking, Sociodemographic Determinants, and Stress in the Alabama Black Belt," *Journal of Rural Health* 27 (2011): 50–59.

¹³Prevention Research Centers, U.S. Centers for Disease Control and Prevention, *Community Health Advisors Light Up Alabama's Black Belt*, 2006. <<http://www.cdc.gov/prc/stories-prevention-research/stories/community-health-advisors-light-up-alabama-black-belt.htm>>. (Last accessed on December 15, 2012).

¹⁴Izenberg, Maxwell, "Access Issues With Basic Wastewater Infrastructure in Rural Alabama," (MSc Thesis, London School of Economics and Political Science, 2012).

article offers a brief description of the barriers to sanitation access and potential measures that could contribute to expanding sanitation access in this challenging context.

On-site sanitation in the Black Belt

More than 40% of Alabama households use an on-site wastewater treatment system, including many residents of the largely rural Black Belt.¹⁵ Much of the Black Belt is unsuitable for conventional OSS^{16,17,18} as the clayey soils

¹⁵U.S. Environmental Protection Agency (EPA), *On-site Wastewater Treatment Systems Manual*, (National Service Center for Environmental Publications, 2006). Available at: <nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=30004GXI.txt>. (Last accessed on August 16, 2012).

¹⁶De Albuquerque, C., *Report of the Special Rapporteur on the Human Right to Safe Drinking Water and Sanitation, Catarina De Albuquerque*. Rep. N.p. (United Nations General Assembly, 2011).

¹⁷Harris, M. C., *Soil Survey of Sumter County, Alabama*. (United States Department of Agriculture (USDA) Soil Conservation Service, 1989), 1–135.

¹⁸Ford, C. Z., Harris, M. C., *Soil Survey of Hale County, Alabama*. (USDA Natural Resources Conservation Service, 2006), 1–421.

found there limit infiltration of effluent^{19,20,21} and may be classified as “severe” or “extreme” under Alabama Department of Public Health (ADPH) site classification criteria.²² Shallow bedrock or underlying impermeable layers (such as that associated with the “Selma Chalk” formation) and seasonal flooding also affect site suitability.²³ One study²⁴ estimated that almost 90% of OSS systems in the Black Belt are functioning poorly or failing due to unsuitable soil conditions. According to the ADPH regulations, when “site characteristics prohibit the use of a conventional system,” including low permeability as determined in specified percolation testing procedures, an engineered system may be required.²⁵ This includes all mound-type systems and systems with a “septic tank followed by field lines where any portion of the field line protrudes above the unaltered natural soil surface.”²⁶

Unfortunately, engineered septic systems can be substantially more expensive than conventional systems, due to added design and construction costs, and may be more expensive or complex to operate. The Wisconsin Mound is the most common engineered OSS type in the area, with estimated costs of \$9,000–\$30,000,²⁷ depending on site constraints and accessibility. While there is potential for cost-effective, packaged “off-the-shelf” systems, local knowledge of alternative systems that may work for this area and meet regulatory requirements for engineered systems is limited in practice.

Without access to alternatives, many households opt for what is locally known as a “straight pipe,” or a pipe that

conveys wastewater from the toilet to a nearby pit, ditch, stream, waste ground, or other disposal area untreated and uncontained, accessible by animals or people. According to the 2000 census, 3% of all rural Alabama households and 2,511 households in the Black Belt had incomplete indoor plumbing, mostly among rural households with residents over 65 and below the poverty line.²⁸ The relevant questions were eliminated in the 2010 census, so more recent figures do not exist, and these are probably underestimates since they rely on self-report data from householders and not inspections. Residents may not be willing to disclose straight pipes for fear of prosecution, since enforcement actions have resulted in evictions.²⁹ A more recent study of sanitation access data from 569 randomly selected households in the Black Belt found that 3.4% of households had either no access to OSS or used a cesspool.³⁰

The lack of functional wastewater containment or treatment options creates the opportunity for residents to become exposed to pathogenic microorganisms in the domestic environment. There are multiple possible routes of exposure linked with waterborne illness, some of which may be associated with failing OSS or inadequate wastewater services.^{31,32,33,34} Exposures related to compromised or failing OSS have previously been linked to outbreaks of gastrointestinal illness in the United States.^{35,36,37} Though

¹⁹Meschke, J. S., Sobsey, M. D., *Microbial Pathogens and On-site Treatment Systems*. (North Carolina State University, 1999). Available at: <<http://www.ces.ncsu.edu/plymouth/septic/98meschke.html>>. (Last accessed on December 14, 2012).

²⁰Harkin, J. M., Jawson, M. D., Baker, F. G., “Causes and Remedy of Failure of Septic Tank Seepage Systems,” 1975 Second National Conference on Individual Onsite Wastewater Systems in Ann Arbor, Michigan. University of Wisconsin: Madison. 1–8.

²¹Abu-Ashour, J., Joy, D. M., Lee, H., Whiteley, H. R., Zelin, S., “Transport of Microorganisms Through Soil,” *Water, Air and Soil Pollution* 75 (1994): 141–58.

²²Alabama State Board of Health, Bureau of Environmental Services, Division of Community Environmental Protection, *Onsite Sewage Disposal Administrative Code*. (2006, amended 2006 and 2010), Chapter 420-3-1. <<http://www.adph.org>>. (Last accessed on July 18, 2013).

²³Alabama Onsite Wastewater Association Training Center, *Wastewater Management: Why?* <<http://aowatc.uwa.edu/>>. (Last accessed on October 2, 2013).

²⁴He, J., Dougherty, M., Zellmer, R., Martin, G., “Assessing the Status of On-site Wastewater Treatment Systems in the Alabama Black Belt Soil Area,” *Environmental Engineering Science* 28 (2011): 693–699.

²⁵Alabama State Board of Health, Bureau of Environmental Services, Division of Community Environmental Protection, *Onsite Sewage Disposal Administrative Code*. (2006, amended 2006 and 2010), Chapter 420-3-1. <<http://www.adph.org>>. (Last accessed on July 18, 2013).

²⁶Johns, Olivia, “On-site sanitation access and function among randomly selected households in the rural Black Belt of Alabama,” (MSc Thesis, London School of Hygiene and Tropical Medicine, 2012).

²⁷“Septic System Design Page,” *Eco-Nomic*, October 25, 2012. <<http://www.eco-nomic.com/indexsdd.htm>>. (Last accessed on October 2, 2013).

²⁸Gasteyer, S., Vwaswani, H., “Still Living Without the Basics in the 21st Century: Analyzing the Availability of Water and Sanitation Services in the United States,” Rural Community Assistance Partnership (2004). <http://win-water.org/reports/RCAP_full_final.pdf>. (Last accessed on December 8, 2012).

²⁹De Albuquerque, C., *Report of the Special Rapporteur on the Human Right to Safe Drinking Water and Sanitation, Catarina De Albuquerque*. Rep. N.p. (United Nations General Assembly, 2011).

³⁰Johns, Olivia, “On-site sanitation access and function among randomly selected households in the rural Black Belt of Alabama,” (MSc Thesis, London School of Hygiene and Tropical Medicine, 2012).

³¹Liu, A., Ming, J., Ankumah, R. O., “Nitrate Contamination in Private Wells in Rural Alabama, United States,” *Science of the Total Environment* 346 (2005): 112–120.

³²Sworobuk, J. E., Law, C. B., Bissonnette, G. K., “Assessment of the Bacteriological Quality of Rural Groundwater Supplies in Northern West Virginia,” *Water, Air, and Soil Pollution* 36 (1987): 163–170.

³³U.S. EPA, *On-site Wastewater Treatment Systems Manual*. (National Service Center for Environmental Publications, 2002). <<http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=30004GXI.txt>>. (Last accessed on August 16, 2012).

³⁴Starr, J. L., Sawhney, B. L., “Movement of Nitrogen and Carbon from a Septic System Drainfield,” *Water, Air, and Soil Pollution* 13 (1980): 113–123.

³⁵O’Reilly, C. E., Bowen, A. B., Perez, N. E., Sarisky, J. P., Shepherd, C. A., Miller, M. D., et al., “A Waterborne Outbreak of Gastroenteritis with Multiple Etiologies among Resort Island Visitors and Residents: Ohio, 2004,” *Clinical Infectious Diseases* 44 (2007): 506–512.

³⁶Borchardt, M. A., Bradbury, K. R., Alexander, E. C. Jr, Kolberg, R. J., Alexander, S. C., Archer, J. R., et al., “Norovirus Outbreak Caused by a New Septic System in a Dolomite Aquifer,” *Ground Water* 49 (2011): 85–97.

³⁷Glberman, S., Moore, J. E., Lowery, C. J., Chalmers, R. M., Sulaiman, I., Elwin, K., et al., “Three Drinking-water-associated Cryptosporidiosis Outbreaks, Northern Ireland,” *Emerging Infectious Diseases* 8 (2002): 631–3. Available at: <<http://wwwnc.cdc.gov/eid/article/8/6/01-0368.htm>>. (Last accessed on December 14, 2012).

rarely life-threatening, gastrointestinal illnesses can be serious for some sensitive populations,³⁸ including those with HIV and other immune disorders, the elderly, young children, and pregnant women. This is particularly true where access to care is limited. One estimate from 2010 calculated approximately 1.5 licensed doctors for every 1,000 residents in the Black Belt, compared with 4.2 in Alabama outside the Black Belt.³⁹

DISCUSSION

Technical barriers

The Alabama Onsite Wastewater Association Training Center in Livingston, Alabama has played a key role in demonstrating advanced technologies that may be suitable for the area and training OSS installers. Additional targeted research and demonstration of locally viable, low-cost OSS options is needed, however, with a view toward identifying solutions that can work for the people who most need them. Micro-wetlands,⁴⁰ composting systems,⁴¹ or low-cost packaged systems may prove to be more accessible than mound or other engineered solutions which are locally more familiar to engineers and contractors. Our interviews with local engineers highlighted the need for technical innovation in the sector that is informed by locally relevant experience in other states, particularly those in the Southeast where similar hydrological and geological conditions and constraints apply.

There are existing policy barriers to innovation in this space as well, however. Low-cost engineered systems that are appropriate for treating kitchen and toilet derived household wastewater (black-water), and that bypass remaining grey-water, are non-permissible under current Health Department regulations. This is largely due to a conflict with the Environmental Protection Agency (EPA) Clean Water Act (CWA) which makes it "unlawful" to discharge pollutants to "waters of the United States" without meeting certain conditions as specified under the stringent National Pollutant Discharge and Elimination System (NPDES) permitting program.⁴² This constraint prevents the use of composting or incinerating systems

that may be low-cost and highly effective in reducing potential exposure to pathogens in the domestic environment.

Accessing funding

Because the need for costly installation of alternative systems or repair/replacement of poorly functioning or failing septic systems is locally great, low-income households and communities require external funds if they are to fix the problems themselves. Under some circumstances, multiple household or small-scale community systems may be suitable. In such cases, federal and state financial assistance programs are available.^{43,44,45,46,47,48} The scope and scale of these programs vary widely and take the form of loans, grants, bonds, and tax-credit programs. For OSS, external funds are usually not available except as direct loans to the homeowner. Critically, *availability* of funding sources may not readily translate into *accessibility* of funds to some target users, particularly those most likely to have failing OSS: the poor, the isolated, the elderly, and those without clear home titles. Grant and loan inaccessibility encompasses a broad range of interconnected financial, bureaucratic, and socioeconomic barriers associated with the application for funding for infrastructure repair, replacement, and construction. According to stakeholder interviews, the three barriers of non-responsiveness, heir property, and access to credit may be the most significant.⁴⁹

One barrier that keeps potential beneficiaries from receiving funding from some available programs is the complicated process of documenting eligibility and submitting an application, where the technical requirements for proposals are significant and the process itself is complex. Accessing and navigating the structures in place require that those eligible are sufficiently able, willing, and persistent to complete the process. Non-responsiveness⁵⁰—

³⁸Vakil N. B., Schwartz S. M., Buggy, B. P., Brummitt CF, Kherallah M, Letzer DM, et al., "Biliary Cryptosporidiosis in HIV-infected People After the Waterborne Outbreak of Cryptosporidiosis in Milwaukee," *New England Journal of Medicine* 334 (1996): 19-23.

³⁹Center for Business and Economic Research at the University of Alabama, "Physicians by County of Licensure in Alabama: May 2010." <http://cber.cba.ua.edu/edata/est_prj.html>. (Last accessed on October 2, 2013).

⁴⁰"Constructed Wetlands," *Chesapeake Stormwater Network*, 2013. <<http://chesapeakestormwater.net/training-library/stormwater-bmps/constructed-wetlands/>>. (Last accessed on October 2, 2013).

⁴¹Cabanas-Vargas, D. D., de los Rios Ibarra, E., Mena-Salas, J. P., Escalante-Rendiz, D. Y., and Rojas-Herrera, R., "Composting Used as a Low Cost Method for Pathogen Elimination in Sewage Sludge in Mérida, Mexico," *Sustainability* 5 (2013): 3150-3158. Available at: <<http://www.mdpi.com/2071-1050/5/7/3150>>. (Last accessed October 2, 2013).

⁴²Clean Water Act (CWA) § 301(a), 33 U.S.C. § 1311(a)(2006).

⁴³U.S. EPA, "Federal Funding Sources for Small Community Wastewater Systems," last modified March 6, 2012. <<http://water.epa.gov/type/watersheds/wastewater/eparev.cfm#1>>. (Last accessed on October 2, 2013).

⁴⁴Catalog of Federal Domestic Assistance, "Investments for Public Works and Economic Development Facilities." <<https://www.cfda.gov/?s=program&mode=form&tab=step1&id=bb43024afbdae1a42b2b4ffa8fa5aec9>>. (Last accessed on October 2, 2013).

⁴⁵USDA, "Water and Waste Disposal Direct Loans and Grants." <<http://www.rurdev.usda.gov/UWP-dispdirectloansgrants.htm>>. (Last accessed on October 4, 2013).

⁴⁶USDA, "UWP Revolving Fund." <<http://www.rurdev.usda.gov/UWP-revolvingfund.html>>. (Last accessed on October 4, 2013).

⁴⁷USDA, "Direct Housing Loans." <http://www.rurdev.usda.gov/HAD-Direct_Housing_Loans.html>. (Last accessed on October 4, 2013).

⁴⁸USDA, "Rural Repairs and Rehabilitation Loans and Grants." <http://www.rurdev.usda.gov/HAD-RR_Loans_Grants.html>. (Last accessed on October 4, 2013).

⁴⁹Izenberg, Maxwell, "Access Issues With Basic Wastewater Infrastructure in Rural Alabama," (MSc Thesis, London School of Economics and Political Science, 2012).

⁵⁰Though "responsiveness" on the part of the granting agency could be improved as well by making the process simpler to meet the needs of beneficiaries.

interruptions in the back-and-forth communication between potential beneficiaries and programs—has been identified by stakeholders as a major barrier to accessing OSS and community wastewater funding.⁵¹ The problem of non-responsiveness may be particularly acute among elderly applicants, because the already lengthy application requires up-to-date information for submission from the program beneficiary (i.e., new driver's license copy, home insurance information). Providing such documents can be burdensome for elderly applicants and they may give up, and the application is dropped. If the beneficiary wants to access funds, he or she is required to start the application process over again.

The locally prevalent institution of heir property presents an obstacle to accessing OSS funding. Heir property, or land legally held by multiple individuals, usually related, is most common in the African American community in the rural South and has been linked with an array of land tenure issues and land loss.^{52,53} This can lead to uncertainty about who has rights to land and homes and whose permission must be gained to access home improvement funding. When discussing the U.S. Department of Agriculture (USDA) Rural Development-504 Program, which provides loans and grants for rural home repair and rehabilitation, a respondent noted the difficulties associated with heir property in Alabama:

The thing that we find is the most difficult is clear titles. To be able to repair your home or use a federal housing program, you have to be able to prove that it's your home. A lot of elderly women we work with, if their husband died prior to 1982, they didn't inherit that home....She may have lived there the past thirty years, but she is not the owner....She is still not the owner of that home [but] her children are, so she can't repair it.⁵⁴

Apart from the basic financial reality that the costs of appropriate OSS systems may be completely out of reach for many of the poorest who most need them, homeowners' credit history and access to credit also limit options for securing subsidized funding for OSS. An applicant's credit rating is a common eligibility criterion

for state and federal loan assistance or subsidy programs for home repair (infrastructure repair and replacement). The inability of many households to establish a credit history or to demonstrate the ability to repay loans disqualifies many households from relevant financial assistance programs. Access to credit sources themselves for private home improvement loans are also lacking. Local financial institutions may be unwilling to provide full banking services to low-income individuals as clients, particularly for lending; many residents of the region remain "underbanked."⁵⁵ One respondent emphasized how the problem has become engrained and accepted as a "cultural belief that nobody will be able to access banking resources."⁵⁶

Priorities and sanitation literacy

For those without access to adequate sanitation, installation of a functioning system may or may not be a priority. Given the challenging task of identifying a solution that will work and completing a possibly onerous and extended process for securing funding, homeowners must be extremely motivated to pursue this problem proactively, assuming that their property rights and financial constraints allow them the option of doing so. Sanitation literacy, or basic knowledge about one's own needs and responsibilities for managing household waste, has been identified by stakeholders as fundamentally limiting the expansion of adequate OSS access in the Black Belt. Sanitation literacy plays an important role in generating demand for OSS as well as promoting the regularity of essential maintenance by households with systems. Because decentralized sanitation always requires active maintenance of the users, the notion that waste can be flushed away without further thought is not realistic, but it may be what homeowners would prefer to expect.

Regulation and enforcement

Apart from normative expectations that homeowners should have more knowledge about sanitation options and responsibilities—expectations that may not be realistic in most communities, including affluent ones—regulation and enforcement can play a role in OSS function and access. In practice, regulations in place are not sensitive to the needs of many Black Belt communities for OSS options that are workable under local economic and geological constraints. Because regulations may present unrealistic expectations of homeowners' access to advanced, engineered systems, enforcement is limited and seen as politically difficult. Responsibility for low access to functioning OSS rests also with those who are charged with crafting and enforcing regulations.

⁵¹After being approved for a program loan, it may take an extended period of time, often years, to install, replace, or repair a septic tank. Due to the program demands for up-to-date information from the program beneficiary (i.e., new driver's license copy, home insurance information), often the elderly individual will give up and stop responding. In such a case, the beneficiary is dropped and will have to start over again. One respondent in the non-profit sector affirms that, "90% will be dropped...[before completed repairs]...due to non-responsiveness."

⁵²Gilbert, J., Sharp, G., "Fractionated Heir Property: A Comparison of Land Inheritance Problems among Native Americans and African Americans," (paper presented at the annual meeting of the Rural Sociological Society, Albuquerque, NM, August 2001).

⁵³Graber, C. S., "Heirs Property: The Problems and Possible Solutions." *Clearinghouse Review* 1978: 273–84.

⁵⁴Izenberg, Maxwell, "Access Issues With Basic Wastewater Infrastructure in Rural Alabama," (MSc Thesis, London School of Economics and Political Science, 2012).

⁵⁵Restina, N. P., Belsky, E.S., *Building Assets, Building Credit: Creating Wealth in Low Income Communities*. (Brookings Institution Press, 2005), 299.

⁵⁶Izenberg, Maxwell. "Access Issues With Basic Wastewater Infrastructure in Rural Alabama," (MSc Thesis, London School of Economics and Political Science, 2012).

Access to adequate wastewater infrastructure varies in the U.S.⁵⁷ Rural households are generally responsible for the capital and ongoing maintenance costs of functional on-site treatment systems themselves,⁵⁸ usually at greater per-capita costs than for urban households that have the opportunity to connect to a centralized system. Although OSS regulation has been complex and dynamic in the USA,^{59,60} two unstated assumptions seem to underlie regulation: (1) progressive settlement of rural areas is through expansion or suburbanization from urban centers,^{61,62,63,64,65} with rural areas adopting suburban and ex-urban regulations; and (2) homeowners can and should assume the responsibility for maintaining household infrastructure, and that this can be financed through a mortgage loan. In the Black Belt of Alabama and in the context of the rural endemic poor, these assumptions do not generally hold. Residents may be living in older homes on family land that goes back generations, certainly before OSS was common enough for sanitarians to recognize that entire communities were located in areas where conventional septic is unworkable. Real estate transactions that are coupled to the regulatory process for OSS in many places may not occur with the same frequency or with as much oversight from code inspectors. In the Black Belt in 2013, enforcement of existing sanitation laws would burden many households with an unaffordable responsibility and could lead to displacement of people who may have nowhere else to go. This is widely seen as an intractable problem: resources that could help solve the problems are not widely accessible to beneficiaries, and enforcement is not politically or morally tenable when potential

solutions are out of reach. Blame for the situation is variously assigned by stakeholders, but the need for leadership in the public health and engineering communities is clear if it is agreed that all households should have access to sanitation.

CONCLUSIONS

Local testing, demonstration, adoption, and diffusion of innovative technologies and approaches to rural sanitation for geologically and economically challenged communities are possible in the Black Belt, but a concerted effort is required on the part of local stakeholders and communities. Promising, cost-effective options exist from outside Alabama that may be worth identifying and importing, and further local research on this point is critically needed. In the near term, making financing for functional OSS more accessible to user communities would be a key common-sense first step in expanding access. If existing programs are not reaching those who might benefit most, improving the process to be sensitive to beneficiaries would help.

Adoption by ADPH and the Alabama Department of Environmental Management (ADEM)/EPA of forward-thinking, proactive, collaborative regulation and enforcement that engages these problems as explicitly important and potentially soluble would meaningfully advance the goal of universal sanitation access in Alabama. The existence of federal and state financing programs to subsidize rural OSS access already suggests broad recognition that sanitation is a public good that must be universal to be most effective in protecting community health. Clearly, resources do not exist to provide fully subsidized advanced engineered systems to all the households who might need them in the Black Belt, but neither is it realistic to apply current regulations on rural sanitation to these communities when existing options are out of reach. Efforts to recognize and include communities that are facing these challenges would be helpful in advancing the conversation about how to extend sanitation access for all.

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⁵⁷Gasteyer, S., Vwaswani, H. "Still Living Without the Basics in the 21st Century: Analyzing the Availability of Water and Sanitation Services in the United States." Rural Community Assistance Partnership (2004). <http://win-water.org/reports/RCAP_full_final.pdf>. (Last accessed on December 8, 2012).

⁵⁸Throughout this article, "access" will refer to availability, quality, costs, and information, unless explicitly explained or defined otherwise.

⁵⁹Kreissl, J. F., "Onsite wastewater disposal research in the United States." In *Alternative Wastewater Treatment*. (D. Reidel Publishing Company, 1982).

⁶⁰Plews, G.D., "The Adequacy and Uniformity of Regulations for Onsite Wastewater Disposal—A State Viewpoint." In *Proceedings of the National Conference on Less Costly Treatment Systems for Small Communities*. (U.S. Environmental Protection Agency, Cincinnati, OH, 1977).

⁶¹Rural sanitation expansion in Alabama was driven in the early twentieth century by hookworm eradication programs, begun by the Rockefeller Foundation in 1909, followed in the post-WWII period when the growth of suburbs around Birmingham and Mobile led to widespread codification of sanitary rules governing domestic wastewater.

⁶²Ludden, Forest E., *The History of Public Health in Alabama, 1941–1968*. (Alabama Department of Public Health, Montgomery, 1970).

⁶³Humphreys, Margaret, "How Four Once Common Diseases Were Eliminated From The American South." *Health Affairs* 2009. <<http://content.healthaffairs.org/content/28/6/1734.full>>. (Last accessed on October 2, 2013).

⁶⁴Page, Walter H., "The Hookworm And Civilization: The Work of the Rockefeller Sanitary Commission in the Southern States," *The World's Work: A History of Our Time*. (1912), 504–518.

⁶⁵Jefferson County Department of Health, "History—Public Health Before 1917." <<http://www.jcdh.org/About/Histor-y.aspx>>. (Last accessed on October 2, 2013).