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Mapping a Healthier Future

How Spatial Analysis Can Guide Pro-Poor
Water and Sanitation Planning in Uganda

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World Resources Institute: Washington DC and Kampala



PHOTO CREDITS

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- Page 1** **Girls carrying jerry cans with water.**
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Foreword

Mapping a Healthier Future: How Spatial Analysis Can Guide Pro-Poor Water and Sanitation Planning in Uganda results from a unique, cross-cutting collaboration by Uganda's Ministry of Health, Ministry of Water and Environment, and the Uganda Bureau of Statistics, together with the International Livestock Research Institute (ILRI), and the World Resources Institute (WRI). It builds on previous pioneering work by the Uganda Bureau of Statistics, the Wetlands Management Department of the Ministry of Water and Environment, ILRI, and WRI.

This publication offers a new tool that provides information through sample maps, at subcounty level, which overlay safe drinking water coverage and improved sanitation coverage with poverty hotspots. It illustrates how such data can be used to target efforts to extend coverage, and associated sanitation and hygiene efforts, most effectively with potential impact on our country's poorest communities.

Mapping a Healthier Future makes recommendations—for filling data gaps on sanitation and hygiene, incorporating mapping into local decision-making on interventions, and coordinating government responses to these development issues—which we will draw on as we move forward.

We are confident that the information contained in this document will assist Uganda in improving the reach of safe drinking water, adequate sanitation, and basic hygiene to vulnerable citizens. On behalf of the Government of Uganda, we wish to extend our sincere thanks to our development partners in this effort, the International Livestock Research Institute, the World Resources Institute, and all the stakeholders that contributed to the development of this report.



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Preface

Mapping a Healthier Future: How Spatial Analysis Can Guide Pro-Poor Water and Sanitation Planning in Uganda lays the groundwork for significant improvement in the availability of clean water and adequate sanitation across Uganda. Its approach, based on innovative spatial analysis, also has potential for widespread application in other developing countries.

This publication is the latest result of a fruitful and ongoing partnership between the Uganda government, the International Livestock Research Institute, and the World Resources Institute. The spatial analysis it contains will help decision-makers integrate and target efforts to increase access to clean water and sanitation, and to promote basic hygiene. The findings are aimed at technical and high-level officers working on poverty, health, and water issues at the national and local levels.

Ensuring that decision-makers in developing countries have the tools to identify locations with multiple deprivations—high poverty, low safe drinking water access, and lack of improved sanitation—is essential for the future well-being of these disadvantaged communities. New resource allocations and investments should not bypass them and they should not have to bear a disproportional burden as climate change impacts intensify and spread. We therefore hope that decision-makers will see the value of the sample maps, conduct their own mapping exercises, and apply their findings to interventions in the field. Such data and analysis can inform and facilitate actions that optimize poverty reduction efforts and maximize the use of available resources.

This report builds on previous pioneering work by the Uganda Bureau of Statistics and the Wetlands Management Department of the Ministry of Water and Environment, together with the International Livestock Research Institute and World Resources Institute, to map poverty hotspots and overlay these with wetland usage maps. The resulting data and analysis provided the tools to effectively target wetland-based economic development programs and policies across Uganda, community by community.

This latest collaboration, *Mapping a Healthier Future*, by a team of authors from the Ministry of Health, Ministry of Water and Environment, Uganda Bureau of Statistics, and the two international partners, is also one on which we intend to build.

The high quality datasets and maps were prepared by the Uganda government. The Uganda Bureau of Statistics—which is affiliated to the Ministry of Finance, Planning and Economic Development—produced the detailed and localized poverty maps and the maps depicting sanitation coverage. The Directorate of Water Development supplied the latest data and expertise on safe drinking water coverage. The Health Planning Department at the Ministry of Health provided analysis and coordinated the contributions from the Ugandan partners. Both the International Livestock Research Institute and the World Resources Institute supplied technical support to derive new maps and analyses.

This publication encapsulates an area of critical importance at the interface of people and environmental health. We hope that the analyses and policy implications it contains will inform national strategies and local poverty reduction efforts in Uganda and beyond.

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Executive Summary

Improving water supply, sanitation, and hygiene is central to Uganda's successful development. Such measures would affect all Ugandans and are important to every sector of the economy, but they are particularly relevant to the poor. The availability of safe drinking water, adequate sanitation, and basic hygiene can improve health, lower mortality rates, and increase work and educational achievements. In particular, better sanitation and hand-washing are among the most effective means to reduce morbidity and mortality from diarrheal diseases, which disproportionately affect the poor.

The central role of safe water and sanitation in addressing poverty in Uganda is reflected in national policy. The national framework for poverty eradication highlights the links between water, sanitation, and poverty reduction efforts. To implement the plans and policies related to safe drinking water coverage, Uganda's policy-makers have established ambitious targets for 2015. As a result, the government and development partners have made large investments in the water sector, and significant pro-poor benefits have been achieved. However, much work still remains to be done in order to ensure safe drinking water access and basic sanitation across Uganda.

One of the premises of the current report is that assuring future pro-poor benefits from water and sanitation investments will require more detailed poverty information. This is where maps such as those introduced in this publication can be helpful to decision-makers. Detailed information on the location of poor communities can help decision-makers target these vulnerable areas for investment, thereby improving health while keeping implementation costs reasonable.

One of the principal challenges in planning and implementing effective pro-poor interventions in water and sanitation is coordinating multiple actors across many sectors and using many different data sets. This report offers new tools to meet this challenge. Examining subcounties in Uganda that have fallen behind in reaching 2015 targets, the report illustrates how integrating various spatial and demographic data on poverty, water, and sanitation can strengthen efforts to promote health. Stand-alone water supply interventions have less impact on health outcomes than well-coordinated interventions that improve water supply, sanitation infrastructure, and hygiene behavior simultaneously.

The unique information presented in this report is critical to achieving greater results and identifying additional pro-poor interventions to reach Uganda's 2015 national targets. To this end, the authors identify the types of analyses available to Ugandan stakeholders, in order to encourage readers to develop their own poverty, water, and sanitation maps.

AUDIENCE AND AIMS

This report is intended for technical and high-level officers working both on poverty issues and in health and water departments at national and local levels.

- *For decision-makers concerned with reducing poverty*, the report demonstrates how comparing levels of poverty in a location with maps of access to safe drinking water, enhanced sanitation facilities, hygiene behavior, and other environmental health indicators can inform strategies to fight poverty.
- *For decision-makers in the water and health sector*, the publication shows how information on the location and severity of poverty can assist in setting priorities for interventions and how to integrate data sets about water supply, sanitation infrastructure, and hygiene behavior to support coordinated interventions.

KEY FINDINGS AND RECOMMENDATIONS

Findings

While the maps and analyses discussed in this report are primarily illustrative in nature, they support the following conclusions:

- *Poverty maps and maps of water and sanitation indicators can provide insight into the relationship between poverty, water, and sanitation;*
- *Maps showing water and sanitation indicators at the subcounty level can be used by planners to identify disadvantaged areas and examine equity issues;*
- *Combining map-based census data related to water, sanitation, and hygiene can guide more integrated campaigns to decrease the incidence of water-borne diseases; and*
- *The type of analysis presented in this report is most useful for identifying subcounties with similar poverty, water, and sanitation characteristics in order to guide geographic targeting.*

Recommendations

Strengthening the supply of high-quality data and analytical capacity can improve future planning and prioritization of water, sanitation, and poverty reduction efforts. Priority actions for policy-makers include:

- *Fill data gaps on sanitation and hygiene indicators; regularly update water, sanitation, and hygiene data; and continue supply of poverty data for small administrative areas; and*
- *Strengthen data integration, mapping, and analysis.*

Promoting the demand for such indicators and spatial analyses will require leadership from several government agencies. The following actions will help link relevant maps and analyses with specific decision-making opportunities:

- *Incorporate poverty information into water, sanitation, and hygiene interventions and in regular performance reporting for the water and sanitation sector;*
- *Incorporate water, sanitation, and hygiene behavior information into poverty reduction efforts;*
- *Promote more integrated planning and implementation of water, sanitation, and hygiene interventions; and*
- *Incorporate poverty maps and maps of water, sanitation, and hygiene indicators into local decision-making.*

REPORT OVERVIEW

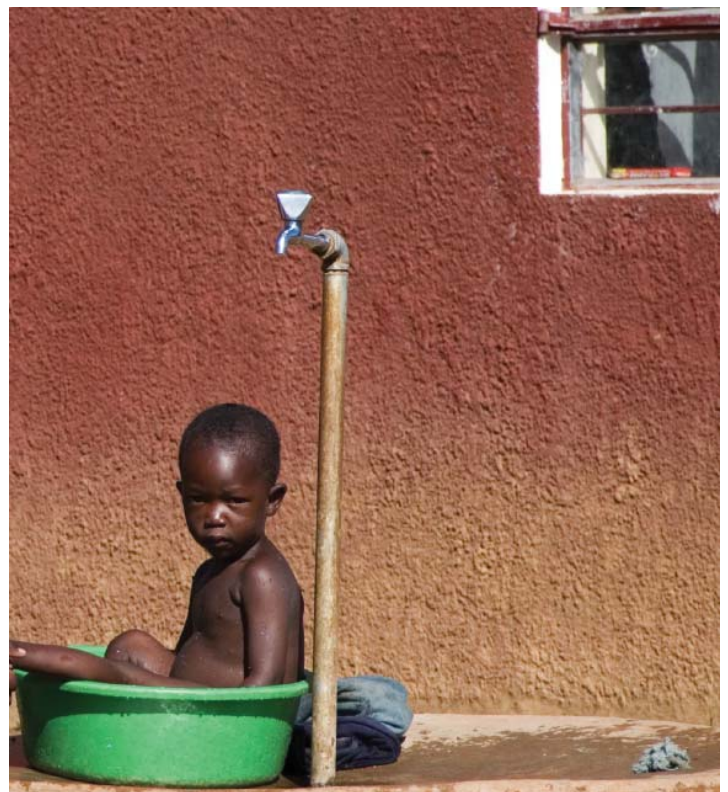
Mapping a Healthier Future: How Spatial Analysis Can Guide Pro-Poor Water and Sanitation Planning in Uganda presents maps and analyses designed to inform the policies surrounding poverty reduction efforts in Uganda and to help reach the 2015 national targets on safe drinking water and improved sanitation.

Introduction: gives an overview of the links between water issues and poverty and sets the Ugandan policy context for pro-poor water and sanitation interventions.

Safe Drinking Water Coverage and Poverty: provides an overview of the national pattern of safe drinking water coverage; introduces a series of maps linking this subject to poverty rates to illustrate how poverty maps can inform future investments in safe drinking water infrastructure in order to make them more pro-poor.

Improved Sanitation, Hygiene, and Poverty: takes an in-depth look at policies and concerns surrounding sanitation and hygiene. Maps are included showing location-specific indicators of sanitation and hygiene coverage and poverty to help guide the discussion on resource allocation.

Conclusions and Recommendations: summarizes observations from the map analyses and proposes recommendations for decision-makers regarding poverty reduction and water supply, sanitation, and hygiene in Uganda and in other developing countries.



Introduction

Water and sanitation issues affect all Ugandans and every sector of the economy. The benefits of safe drinking water supplies, sanitation, and hygiene are clear and well acknowledged by Uganda's decision-makers (see Box 1). They include improved health, lower mortality rates (especially for infants), improved livelihoods, and higher educational achievement, particularly for women and children. These benefits are not only worthy goals in themselves, but are an essential means of reducing poverty and achieving sustained economic growth (WHO, 2001).

Why Mapping Matters

A primary challenge for government agencies working on water and sanitation issues is that planning and implementing effective interventions requires coordination among multiple actors within and outside government and across many sectors (see Box 2). Most of these agencies are faced with the additional challenge of tying their water and sanitation interventions to poverty reduction efforts. This involves even more stakeholders and coordination across the myriad of plans and policies introduced to deal with poverty reduction, improved drinking water supply, sanitation, and hygiene.

Box 1

WATER SUPPLY, SANITATION, AND HYGIENE: THE LINKS TO HEALTH, LIVELIHOODS, AND EDUCATION

Links to Health

Epidemiological studies for many countries have documented the links between health benefits and the supply of sufficient quantities of clean water, investments in adequate sanitation facilities, and widespread adoption of appropriate hygiene practices (Esrey et al., 1991; Esrey, 1996; Hutley et al., 1997; WSSCC and WHO, 2005). Improving water supply, sanitation, and hygiene is therefore central to Uganda's successful development.

Consumption of contaminated water, for example, has led to outbreaks of typhoid, cholera, dysentery, hepatitis, and guinea worm. Water-related diseases directly caused roughly 8 percent of Ugandan deaths in 2002 (WHO, 2006). In some districts, cholera has become an endemic disease (WHO, 2001-2004; MoH, 2005b; MoH, 2008a).

Unclean water can be especially deadly for infants and young children. Diarrheal diseases are a major killer and were responsible for 17 percent of all deaths of children under 5 years in the country (WHO, 2006). Studies have also documented the links between lack of sanitation and clean water, and child malnutrition—leading to long-term health impacts (Checkley et al., 2003; Checkley et al., 2004).

Inadequate volumes of water result in poor hygiene practices, which in turn increase the risk of disease. Average rural water consumption, for example, ranges from 12 to 14 liters per person per day, significantly lower than the national target of 20 liters per person per day (MFPED, 2004). The risk of disease is even higher with poor hygiene and if soap isn't used for handwashing. Simply washing one's hands cuts the risk of diarrhea in half (MWE, 2007).

Proper sanitation prevents drinking water contamination and the spread of diseases. For example, shallow, uncovered latrines can easily overflow during rain and mix with drinking water. Human waste, if not disposed of correctly, also attracts flies that spread diseases. Poor sanitation also results in increased illness which in turn impacts livelihoods and economic development.

Links to Livelihoods and Educational Attainment

Limited access to clean water, poor sanitation facilities, and inadequate hygiene also affect livelihoods and educational attainments. Since lack of clean water leads to poor health, it in turn reduces a family's ability to work, decreasing family income and increasing health expenditures. Death of the main

income earner can plunge a family into poverty. Even barring death, inadequate sanitation hurts a country's economic activity. In Uganda, 9 percent of the population reported falling ill from diarrhea in 2005/06, more than twice the rate in 2002/03 (4 percent). Among the people suffering from diarrhea, 82 percent lost up to one week of productive time (UBOS, 2006a).

When fresh water is not readily available it increases the time burden on family members responsible for water collection. The average Ugandan spends 28 minutes collecting the family's drinking water, but there are large variations between regions (10 minutes in Kampala versus 58 minutes in the Northern Region) (UBOS, 2006a). This time could be spent on other productive endeavors. In some regions, this has negative effects on education, since children bear much of the burden of collecting water for the family.

Inadequate sanitation also impacts educational attainment. Lack of sanitation facilities or inappropriate construction of these facilities (such as not providing sufficient privacy) has resulted in higher dropout rates of adolescent girls in primary schools (Asingwire and Muhangi, 2001).

Box 2**WATER, SANITATION, AND HYGIENE EFFORTS: KEY PLAYERS**

| Institution | Role |
|--|--|
| Ministry of Water and Environment | Policy formulation, setting standards, strategic planning, coordination, quality assurance, provision of technical assistance, and capacity building. |
| Directorate of Water Resources Management (DWRM) | Responsible for managing, monitoring and regulating water resources through issuing water use, abstraction, and wastewater discharge permits. |
| Directorate of Water Development (DWD) | Lead agency responsible for providing technical oversight for the planning, implementation, and supervision of the delivery of urban and rural water and sanitation services (including water for production). Provides capacity development and other support services to local governments and other water supply service providers. |
| National Water and Sewerage Corporation (NWSC) | Autonomous entity responsible for the delivery of water supply and sewerage services in the major towns and large urban centers. |
| Ministry of Finance, Planning and Economic Development | Mobilization and allocation of financial resources including coordination of donor inputs and the privatization process. |
| Ministry of Local Government | Establish, develop, and facilitate the management of efficient and effective decentralized government systems capable of delivering the required services. |
| Ministry of Health | Promotion of hygiene and household sanitation. |
| Ministry of Education and Sports | Promotion of sanitation and hygiene education in schools. |
| Ministry of Gender, Labor and Social Development | Coordination of gender-responsive development and community mobilization. |
| Ministry of Agriculture, Animal Industries and Fisheries | Planning, coordination, and implementation of all agriculture development in the country, including irrigation development, aquaculture, and livestock development. |
| Local Governments | Provision and management of water and sanitation services in rural areas and urban areas outside the jurisdiction of NWSC, in liaison with DWD. |
| User Communities | Planning, implementation, and operation and maintenance of the rural water and sanitation facilities. User communities are also obliged to pay for urban water and sanitation services provided by NWSC and other service providers. |
| Donors | Provide financial resources for implementation of water sector activities. |
| Private Sector | Valuable resource for design, construction, operation, and maintenance of water and sanitation facilities. Conduct training and capacity building for both central and local government staff. Provision of other commercial services including mobilization of financial resources for water sector development activities. |
| Nongovernmental Organizations (NGOs) and Community-Based Organizations (CBOs) | Supplement public sector efforts and ensure that concerns of the underprivileged and poor are accounted for. Provide financial and planning support to communities and local governments. |

Source: MWE, 2008.

Maps—and the geographic information systems (GIS) that underlie them—are powerful tools for integrating data from various sources and therefore can be the vehicle necessary to overcome these coordination challenges. Maps showing indicators of poverty, drinking water supply, sanitation, and hygiene development can provide decision-makers with a more coherent picture of how poverty reduction, safe drinking water, improved sanitation, and better hygiene are related, leading to more effective plans and interventions (see Box 3 illustrating such use in Kenya). Better and more detailed spatial analyses of water, sanitation, and poverty indicators can be used to examine whether current policies

and interventions are targeting the crucial issues and localities. Maps can also be an effective vehicle for communicating to experts across sectors. In addition to informing various government actors, access to improved spatial information can help empower the public to query government priorities, advocate for alternative interventions, and exert pressure for better decision-making.

RATIONALE, APPROACH, AND AUDIENCE

Mapping a Healthier Future results from a partnership of Ugandan and international organizations and compares,

Box 3**WATER, SANITATION, AND POVERTY MAPS IN KENYA**

In Kenya, the national Water and Sanitation Programme, a 5-year (2005–2009) US\$ 65.5 million effort funded by the Danish and Swedish development agencies Danida and Sida, used poverty maps to reach the most disadvantaged administrative areas. The Programme selected the poorest 362 of 2,500 Locations (an administrative unit with on average 10,000 people in rural areas). Locations were chosen in stakeholder workshops with the help of an index showing the poorest Locations with the lowest water and sanitation coverage. Half of the index value was determined by the poverty level in the Location, using data provided by Kenya's Central Bureau of Statistics and based on the country's poverty map. The other half of the index incorporated indicators of safe drinking water access, sanitation coverage, and past investments. This is the first time a major water program in Kenya has specifically targeted the poorest Locations.

Source: Jorgensen, 2005.

for the first time, new poverty maps with maps of various water and sanitation indicators. By providing illustrative examples of maps that can be developed with these indicators and analyses of what they mean for policy, this report shows decision-makers in the water and health sectors how information on the location and severity of poverty can assist in setting priorities for interventions. Similarly, decision-makers concerned with reducing poverty levels will see how comparing levels of poverty in a given location with maps of access to safe drinking water, enhanced sanitation facilities, hygiene behavior, and other environmental health indicators can help fight poverty. Integration of multiple data sets can also strengthen efforts to promote health. Stand-alone water supply interventions have less impacts on health outcomes than well-coordinated interventions that improve drinking water supply, sanitation infrastructure, and hygiene behavior simultaneously (WSSCC and WHO, 2005). This publication strives to show the kinds of analyses that are possible in the Ugandan water and sanitation sectors in order to encourage other analysts and decision-makers to develop their own poverty, water, and sanitation maps.

Three factors make this an opportune time to use a spatial analysis of poverty, water, and sanitation indicators to help prioritize investments:

1. *Availability of comparable data at subcounty level.* The Directorate of Water Development at the Ministry of Water and Environment has consistently monitored investments in the drinking water infrastructure (and the level of functional water sources) and can now provide suitable indicators for small administrative areas such as subcounties or parishes. The Uganda Bureau of Statistics released poverty data for subcounties in November 2006 and December 2008. It can also supply census data on water, sanitation, and basic necessities (such as clothing, blankets, shoes, soap, and sugar) at the subcounty and even the parish level.
2. *Demand from sector planners.* Commissioners responsible for planning efforts in both the health and water sectors have expressed interest in incorporating poverty data in their planning and regular sector performance reporting.
3. *Impending debate on criteria to allocate District Conditional Grants.* The latest annual Water Sector Performance Reports (MWE, 2007; MWE, 2008) recommend reviewing the allocation formula for District Water and Sanitation Conditional Grants (funds from the Government of Uganda's budget allocated to districts to invest in improved water and sanitation). The reports suggest taking into consideration other criteria such as the needs of the least-served communities and the differences in per capita investment costs of selected locations. The reports also emphasize that districts should address equity issues among subcounties to a greater extent when allocating resources for rural water supplies. Integrated maps such as those introduced in this publication can help supply the information needed to act on these recommendations.

To show that spatial analyses of poverty and environmental health indicators can improve the information and analytical base for decision-making, this report examines the following:

- Access to safe drinking water sources;
- Access to improved sanitation facilities; and
- How combining maps of unsafe drinking water sources, lack of sanitation facilities, and lack of basic necessities such as soap can guide water supply, sanitation, and hygiene behavior interventions.

Maps of the detailed data on safe drinking water access and sanitation facilities are compared to the 2005 poverty maps (the most recent set of maps at subcounty level). These overlay analyses can be used by different decision-makers for the following purposes:

- *Directorate of Water Development (DWD)* and other water sector institutions (both national and local) such as the Water Policy Committee and the Water and Sanitation Sector Working Group to better align investments in the water sector with poverty reduction objectives, such as prioritizing new water infrastructure efforts in high poverty areas so that the employment and income effects from these investments accrue primarily to poorer communities.
- *Ministry of Health (MoH), Directorate of Water Development, and Ministry of Education and Sports* to prioritize efforts to improve sanitation, for example by funding sanitation education campaigns and leveraging resources for improved sanitation in communities with high poverty rates and densities.

- *Ministry of Finance, Planning and Economic Development (MFPE), Budget Monitoring and Accountability Unit, and other institutions implementing and monitoring Uganda's Poverty Eradication Action Plan (PEAP) and the upcoming National Development Plan to highlight areas of multiple deprivations, such as high rates of monetary poverty, high dependence on unsafe drinking water sources, and high density of households with unsafe sanitation practices; and to locate areas where poverty reduction investments could be aligned with water and sanitation efforts.*
- *Local governments and other local actors such as District Water and Sanitation Committees or Inter-District Coordination Committees to design and implement pro-poor water, sanitation, and hygiene efforts.*
- *Civil society groups to hold decision-makers accountable for better integration of water, sanitation, hygiene, and poverty issues in policy-making.*
- *International development cooperation partners to link poverty interventions with health and water sector interventions and prioritize budget support for the Poverty Action Fund (established to allocate government expenditures directly to poverty-reducing services and priority programs).*

POLICY FRAMEWORK FOR WATER, SANITATION, AND HYGIENE INTERVENTIONS

Sectoral policies establish the overall policy framework for specific water, sanitation, and hygiene interventions. Two policies—the National Water Policy and the National Environmental Health Policy—are especially relevant in the context of this publication.

The National Water Policy provides the main framework for improving water supplies. To ensure sustainable management and use of Uganda's water resources, the Policy promotes the principles of integrated water resources management (involving various national and local actors) and emphasizes priority allocation of water for domestic use (MWLE, 1999 cited in UN-WWAP and DWD, 2005). It also highlights the importance of equity issues in water supply services—both from a geographic and income perspective—by promoting the principle of “some for all, rather than all for some”¹ (MWLE, 1999).

The National Environmental Health Policy emphasizes the importance of environmental sanitation, which includes: safe management of human excreta and associated personal hygiene; the safe collection, storage, and use of drinking water; solid waste management; drainage; and protection against disease vectors (MoH, 2005a). Safe disposal of excreta, handwashing, adequate water quantity

for personal hygiene, and protecting water quality all influence the morbidity and mortality of diarrheal diseases.

To implement these plans and policies, Uganda's policy-makers have established targets for water supply and sanitation coverage for both urban and rural areas. To achieve these targets they have developed very specific sectoral strategies and investment plans. Between 2001 and 2015, Uganda intends to spend approximately US\$ 951 million and US\$ 481 million for investments in rural and urban areas, respectively (MWE, 2007).

The national targets for water supply and sanitation coverage for 2015 are (MWE, 2008):

- **Urban areas:** 100 percent safe drinking water coverage (defined as the percentage of the urban population with access to a safe drinking water source within a walking distance of 0.2 km) and 100 percent sanitation coverage (defined as the percentage of the population with sanitation facilities in their place of residence), with at least an 80 percent effective use and functionality of facilities.
- **Rural areas:** 77 percent safe drinking water coverage (defined as the percentage of the rural population with access to a safe drinking water source within a walking distance of 1.5 km) and 77 percent sanitation coverage (defined as the percentage of the population with sanitation facilities in their place of residence), with at least an 80 percent effective use and functionality of facilities.

Since the early 1990s, Uganda has made significant progress in implementing these policies and plans and has moved closer to its 2015 targets. The Water Sector and Sanitation Performance Report of 2008 (MWE, 2008) put rural access to safe drinking water at 63 percent and urban access at 61 percent in 2007/2008. The percentage of households with access to improved sanitation stood at 62 percent and 74 percent for rural and urban households, respectively, in 2007/2008 (MWE, 2008).

LINKING POVERTY, WATER, AND SANITATION

Poverty can be both a cause and a consequence of poor sanitation and unsafe drinking water sources. Poor families, for example, have limited resources to invest in building adequate sanitation facilities within their homes. In general, government policy considers the construction of sanitation facilities a household responsibility rather than a government obligation. Similarly, poor communities may not have sufficient resources to maintain water and sanitation infrastructures once the original capital investments have been made.

Although the average national safe drinking water coverage rate for rural Uganda is two percentage points higher than in urban areas, rural households do not do as well on other water supply, sanitation, and development indica-

1. Adopted from the 1990 “New Delhi Statement,” prepared by 115 countries at the Global Consultation on Safe Water and Sanitation.

Box 4**2005 UGANDA POVERTY MAPS: INDICATORS**

Human well-being has many dimensions. Sufficient income to obtain adequate food and shelter is certainly important, but other dimensions of well-being are crucial as well. These include good health, security, social acceptance, access to opportunities, and freedom of choice. Poverty is defined as the lack of these dimensions of well-being (MA, 2005).

The poverty indicators produced by the Uganda Bureau of Statistics (UBOS) are based on household consumption and cover some but not all dimensions of poverty. Consumption expenditures include both food and a range of non-food items such as education, transport, health, and rent. Households are defined as poor when their total expenditures fall below Uganda's rural or urban national poverty lines. These lines equate to a basket of goods and services that meets basic monthly requirements (UBOS and ILRI, 2007).

In 2005, the national poverty line (an average of the poverty lines in Uganda's four regions) was 20,789 Uganda Shillings (US\$ 12) per month in rural areas and 22,175 Uganda Shillings (US\$ 13) per month in urban settings. With these poverty lines, the 2005 poverty rate (percentage of the population below the poverty line) was 31.1 percent at the national level, translating to about 8.4 million Ugandans in poverty (UBOS, 2006b). Rural and urban poverty rates differed significantly, at 34.2 percent for rural areas and 13.7 percent for urban areas.

tors. Rural households are, on average, poorer than urban households in Uganda (UBOS, 2006a). Rural areas have, on average, less water available for their basic needs than their urban counterparts (MFPED, 2004). Rural Ugandans also walk greater distances to water sources than Ugandans in cities and towns (UBOS, 2006a).

Household survey data for Uganda and neighboring countries show that access to improved water and sanitation is significantly lower for households in the lowest wealth quintile compared to those in the top quintile (Rutstein and Johnson, 2004; UBOS, 2006a). The richest wealth quintile had to travel less far to reach their primary drinking water source as those in the poorest quintile (World Bank, 2005; Sgobbi and Muramira, 2003).

In addition, household surveys continue to cite ill health as the most common cause of poverty (MFPED, 2004). These personal observations are confirmed by studies and are linked to unhygienic water and sanitation conditions (UBOS and Macro, 2007; Rutstein and Johnson, 2004). Poor sanitation coupled with unsafe water sources increases the risk of waterborne diseases and illnesses due to poor hygiene. This has contributed immensely to the disease burden in Uganda. Households without proper toilet facilities are more exposed to the risk of diseases such as dysentery, diarrhea, and typhoid fever than those with improved sanitation facilities. It is therefore no surprise that communities interviewed as

part of Uganda's participatory poverty assessment listed obtaining a safe drinking water supply as one of their top priorities (MFPED, 2002a).

These links between water, sanitation, and poverty have been recognized in Ugandan national development policies. The overall national framework for poverty eradication, the Poverty Eradication Action Plan (PEAP), acknowledges the multiple dimensions of poverty and highlights the links between water, sanitation, and poverty reduction efforts. It gives prominence to water resource management and water for production (for agriculture, industry, energy, etc.) in the chapter dealing with enhancing production, competitiveness, and incomes. It also highlights water supply and sanitation in the chapter on human development. All of Uganda's sectoral plans, strategies, and policies have been attuned to the PEAP since its conception in 1997.

As a result of the PEAP and the second Uganda Participatory Poverty Assessment Process (UPPAP), the government and its development partners have made large investments in the water sector, with an emphasis on improving safe drinking water supplies. By making higher investments in rural areas—which were underserved and had a higher poverty rate—significant pro-poor benefits were achieved between 1992 and 2002 (Rudaheeranwa et al., 2003; World Bank, 2005).

New Poverty Maps for Better Targeting

Future pro-poor benefits from water and sanitation investments will require more detailed poverty information that goes beyond rural-urban estimates and highly aggregated district-level averages. This is where maps, such as those introduced in this publication, can be helpful to decision-makers. Information on the location of poor communities is especially important, because targeting poor communities with more coordinated water and sanitation investments can greatly improve household health while keeping implementation costs at a reasonable level (World Bank, 2008).

In addition, precision in identifying poor communities needs to improve because of the following factors:

- Unit costs of drinking water investments per person in rural areas have increased significantly over the past five years. (Many investments in easily achievable low-cost options have already been made.) (MWE, 2008).
- Fiscal constraints in the national budget and other funding sources indicate a shortfall in resources to implement the 2001-2015 sector investment plans, hence a need to prioritize investments, for example in areas with the largest potential gain in safe drinking water coverage rates per unit of investment (MFPED, 2004).

- Equity in water and sanitation investments is an important goal: as they strive to meet the national target of 77 percent safe drinking water coverage for rural areas in 2015, decision-makers want to ensure that coverage is evenly distributed among different wealth classes and does not disproportionately favor the better-off households at the expense of the poor.

Until recently, it has been difficult for health and sanitation planners to consider sub-district levels of poverty for small administrative areas in their planning and targeting efforts because reliable statistics from household surveys were only available for regions and districts. To address this lack, the Uganda Bureau of Statistics has produced new poverty maps relying on a statistical estimation technique (small area estimation) that combines information from the national census and household surveys. The first set of maps, for 1999, used detailed poverty data for 320 counties (UBOS and ILRI, 2004). The next set of maps, for 2002, increased the level of spatial resolution to 958 subcounties (UBOS and ILRI, 2007). The latest maps provide data for 2005 and cover all rural subcounties except for those in Kotido, Kaabong, and Abim Districts (UBOS and ILRI, 2008). The 2005 maps were based on the 2002 population and housing census and the 2005/2006 Uganda National Household Survey, which estimated the national poverty rate at 31.1 percent or 8.4 million Ugandans (UBOS, 2006a). Such detailed maps permit more meaningful spatial overlays of poverty metrics and water and sanitation indicators. These spatial comparisons can provide first insights into the relationship between poverty, water supply, and sanitation development in discrete locations—a key to accurate targeting.

Map 1 displays the 2005 poverty rates (defined as the percentage of the population below the poverty line) for rural subcounties. Map 2 shows poverty density (defined as the number of poor persons per square kilometer) for these same subcounties. These two indicators can highlight the geographic distribution of poor communities and the number of poor in a given area. Other measures of poverty, such as the poverty gap (the average distance between expenditures of the poor and the poverty line) and inequality related to household expenditures, are also available at this level of detail but are not presented in this report. (For information on poverty indicators, see Box 4; for a discussion of how poverty rate, poverty density, and the number of poor relate, see Box 5.)

Rural poverty rates in Uganda's subcounties range from less than 15 percent to more than 60 percent of the population. Map 1 shows that subcounties with the highest poverty rates (shaded in dark brown) are located in northern districts such as Amuru, Gulu, Kitgum, Pader, Lira, Moroto, and Nakapiripirit. Low poverty rates (shaded in green) can be found in the southwest and central part of the country (e.g., in parts of Wakiso, Bushenyi, Isingiro, Mbarara, and Kiruhura Districts). The reasons for this spatial pattern are multiple and complex, and include factors such as rainfall and soil quality (which determine an area's agricultural potential), land and labor availability, degree of economic diversification, level of market integration, and issues of security and instability (the latter is especially relevant for the northern parts of Uganda).

As can be seen in Map 2, poverty density often follows a spatial pattern that is distinct from the distribution of poverty rates. In some areas, poverty rates and poverty density

Box 5

MAPPING POVERTY: THE RELATIONSHIP BETWEEN POVERTY RATE, POVERTY DENSITY, AND THE NUMBER OF POOR

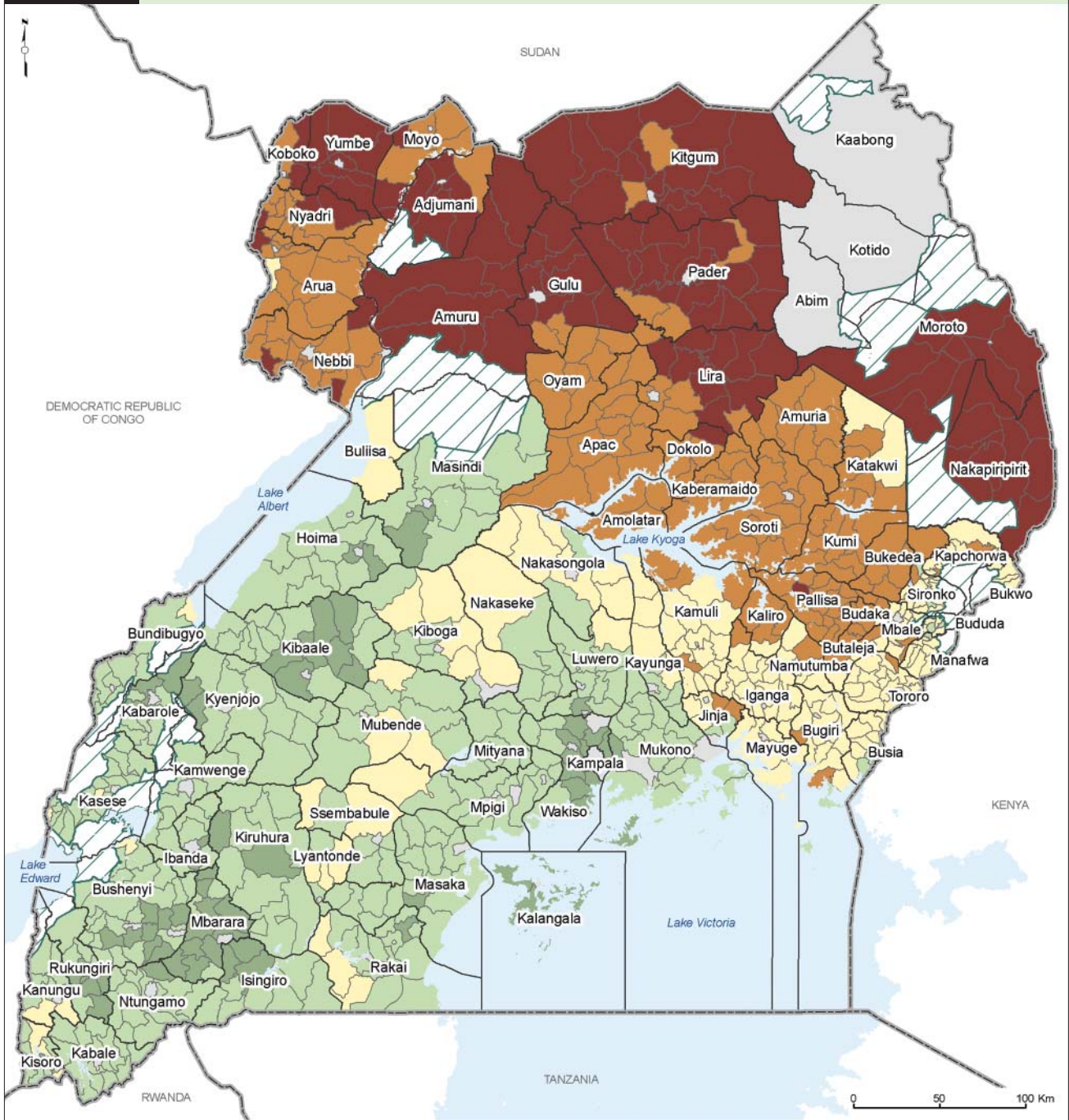
Understanding the complementarity between the poverty rate and poverty density is important for designing and implementing pro-poor water and sanitation interventions. Using either the poverty rate or the poverty density alone will likely be ineffective, either missing many poor people or wasting resources on families that are not poor. For example, targeting only subcounties with the highest poverty rates will not reach all or most of Uganda's poor. In densely settled areas, the proportion of the poor relative to the non-poor may be low, but may still represent a large number of poor people. Relying exclusively on poverty rates for targeting would lead to "undercoverage" of the poor in these densely settled areas. On the other hand, providing resources only to areas with the highest poverty densities will bypass the poor in drier and less densely settled areas.

The total number of the poor in a given area is also an important metric. Poverty rate and poverty density measures alone are not sufficient to identify the most promising subcounties for pro-poor targeting. Subcounties may have high poverty rates or high poverty densities but still differ in their total count of poor persons. Two subcounties, for example, could each have a poverty density of 50 poor persons per square kilometer, but only 5,000 poor persons may be living in the 100 square kilometers of the first subcounty versus 50,000 poor persons inhabiting the 1,000 square kilometers of the second subcounty. Examining the total number of poor per subcounty is necessary because Uganda's subcounties differ greatly in population size (ranging from as few as 2,500 to more than 200,000 inhabitants) and in area.

In this publication, these three metrics were selected to portray the geographic distribution of the poor. While there are other useful poverty indicators, these were chosen as a first approximation to show how poor each subcounty is, and where poor households are spatially concentrated. With this information decision-makers can gain first insights to develop more effective support and services for the poor. In most cases, additional analyses using metrics that capture the depth and severity of poverty (e.g., poverty gap and squared poverty gap) and other dimensions of well-being will be needed to better understand poverty patterns and examine cause-and-effect relationships.

Map 1

POVERTY RATE: PERCENTAGE OF RURAL SUBCOUNTY POPULATION BELOW THE POVERTY LINE, 2005



POVERTY RATE
(percent of the population below the poverty line)

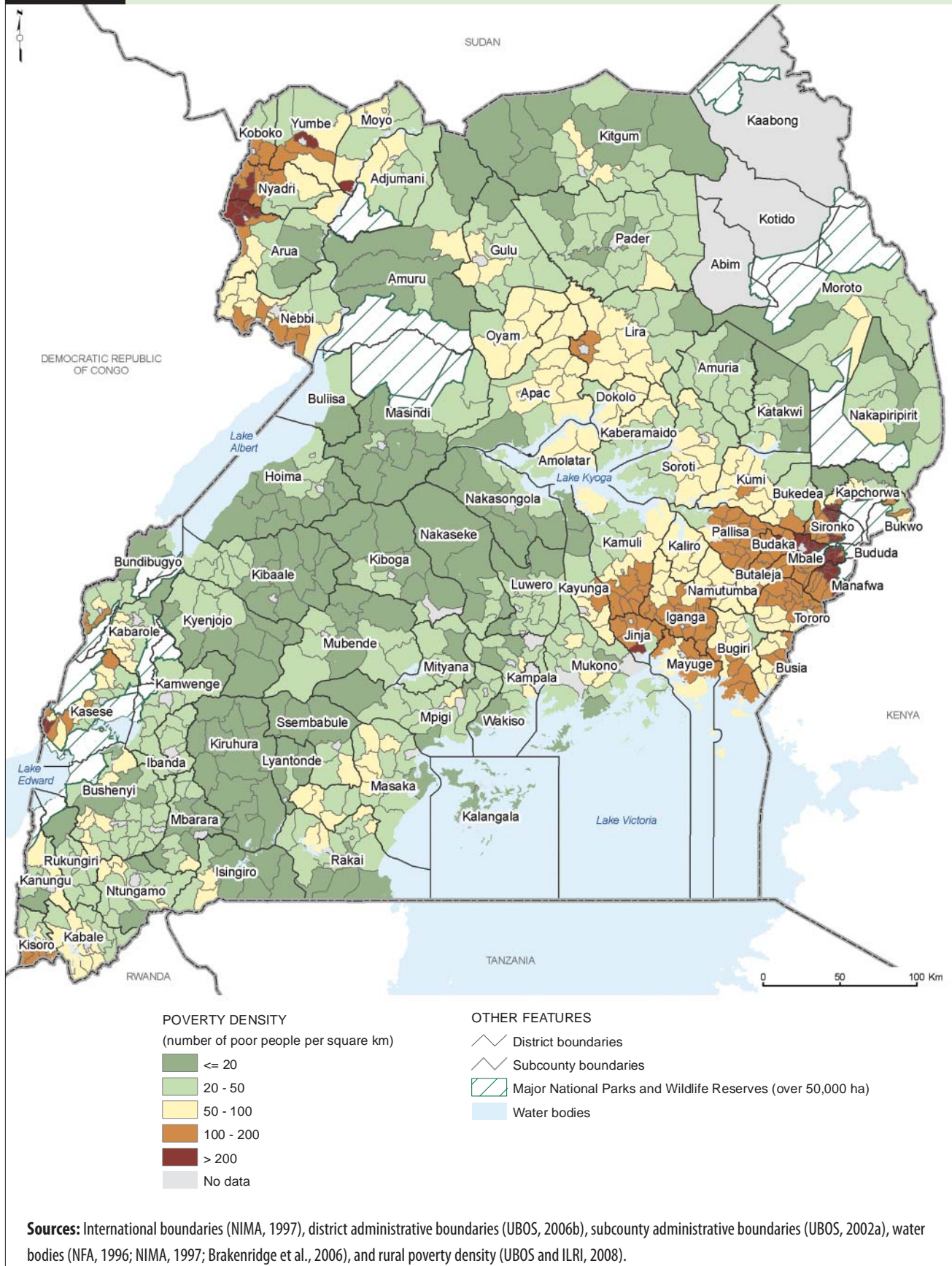
| | |
|-------------|---------|
| Dark Green | ≤ 15 |
| Light Green | 15 - 30 |
| Yellow | 30 - 40 |
| Orange | 40 - 60 |
| Dark Red | > 60 |
| Grey | No data |

OTHER FEATURES

| | |
|-------------------|---|
| Thin black line | District boundaries |
| Thick black line | Subcounty boundaries |
| Blue hatched area | Major National Parks and Wildlife Reserves (over 50,000 ha) |
| Blue area | Water bodies |

Sources: International boundaries (NIMA, 1997), district administrative boundaries (UBOS, 2006b), subcounty administrative boundaries (UBOS, 2002a), water bodies (NFA, 1996; NIMA, 1997; Brakenridge et al., 2006), and rural poverty rate (UBOS and ILRI, 2008).

Map 2

POVERTY DENSITY BY RURAL SUBCOUNTY: NUMBER OF PEOPLE BELOW THE POVERTY LINE PER SQUARE KILOMETER, 2005


increase or decrease in parallel patterns. In other parts of the country they are inversely related.

Poverty density generally is lowest (shaded in dark green) in remote, sparsely populated areas (UBOS, 2007). Many of these areas have drier conditions and lower agroecological endowments. Subcounties with the lowest poverty densities are in the districts of Nakasongola, Nakaseke, Luwero, Kiboga, Sembabule, Rakai, Kiruhura, and Mbarara, which also exhibit generally low poverty rates

in Map 1. Subcounties in parts of Kitgum, Amuru, Pader, and Moroto Districts also show very low numbers of poor per square kilometer, but here poverty rates are among the highest in the country. A selected set of subcounties have both: relatively high poverty rates and high poverty densities (shaded in brown in Map 1 and Map 2). These include subcounties in southeastern Uganda (Pallisa and Budaka Districts) and in northwestern Uganda (Nebbi, Arua, and Nyadri Districts).



Safe Drinking Water Coverage and Poverty

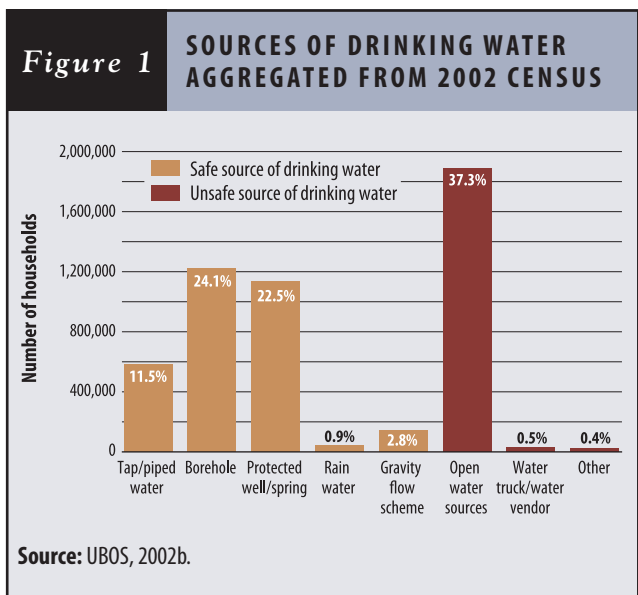
This chapter explores the links between safe drinking water coverage and poverty at the subcounty level. A short introduction defines safe drinking water coverage and summarizes targets and trends for urban and rural coverage at the national level. Maps in this section provide an overview of the national pattern of safe drinking water coverage, highlight the rural areas that have not kept pace with national average progress toward 2015 targets, and examine the poverty rate and density in these lagging subcounties. These overlays are meant to illustrate how poverty maps can help identify geographic areas with a particular set of poverty characteristics—information which can be used to make future investments in safe drinking water infrastructure more pro-poor.

The maps focus on rural areas because map overlays at a national scale can be carried out more meaningfully for rural areas covering large contiguous zones. Overlay analysis of urban areas, in contrast, would require more detailed maps of urban centers such as Kampala and Jinja. In addition, a large number of rural subcounties are still greatly underserved with safe drinking water infrastructure and experience high levels of poverty.

DEFINITION AND TRENDS

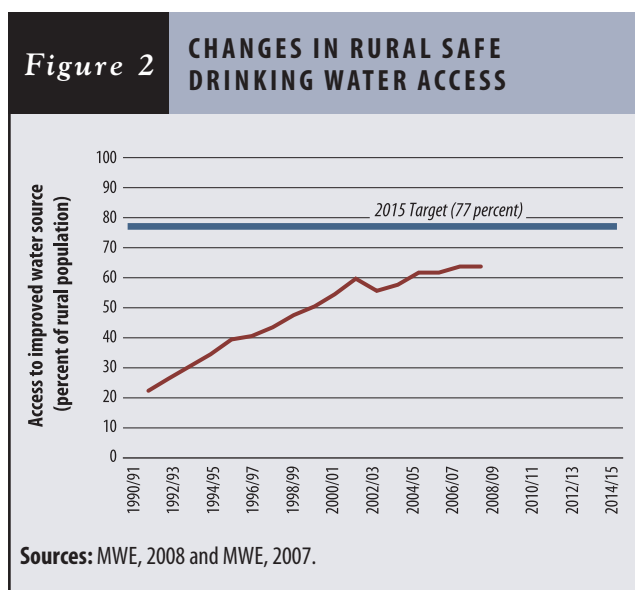
Safe drinking water is water that is free from disease-causing organisms, toxic chemicals, color, smell, and unpleasant taste. In Uganda, safe drinking water is defined as water from a tap and piped water system, borehole, protected well or spring, rain water, or gravity flow schemes. Open water sources including ponds, streams, rivers, lakes, swamps, water holes, unprotected springs, shallow wells, and water trucks are considered unsafe (Figure 1).

As mentioned previously, Uganda has set different 2015 targets for safe drinking water coverage in rural and urban areas. It also applies different distance thresholds to define urban and rural coverage rates. A rural household is considered to have safe drinking water coverage if there is a safe water source within 1.5 kilometers from the household. The distance requirement for an urban household is less than 0.2 kilometers. In addition, the investment costs differ between rural and urban areas. The following section, therefore, presents targets and trends for rural and urban areas separately.



It is the Government's mandate to provide sustainable safe drinking water to the population. In line with this, the country has developed sector investment plans for urban and rural water supply. The supply of most urban water is managed on a commercial basis. The Central Government has established performance contracts with the National Water and Sewerage Corporation (NWSC), a government-owned utility parastatal. NWSC provides water and sewerage services in the largest urban areas such as Kampala. It has established lease and management contracts for private companies to cover a large portion of NWSC's core operations and water supplies in smaller towns (Gutiérrez and Musaaizi, 2003; Richards et al., 2008).

Within the sector investments plans, Central Government has assumed responsibility for most of the costs of rural water supply. Local governments are responsible for implementing these plans and improving rural water supplies. To achieve this, the central government has been allocating funds to enable every district to reach the same level of safe drinking water coverage in 2015 (MWE, 2007; MWE, 2008). Trend data compiled by the Directorate of Water Development (DWD) from District Local Government reports, show that the large investments in water supply infrastructure have translated into dramatic gains in safe drinking water coverage for Uganda's rural areas, from about



25 percent in the early 1990s to 63 percent in 2007/2008 (MWE, 2008) (Figure 2). In recent years, however, the annual construction of new water infrastructure has barely outpaced population growth, slowing down improvements in rural safe drinking water coverage (MWE, 2008). Only if investment levels keep pace with population growth and with the higher unit costs associated with serving the remaining rural households that do not have safe drinking water, can Uganda reach its national goal for 2015.

Uganda's annual water performance report separates safe drinking water access for urban areas into large towns and small towns (MWE, 2008). In 2008, about 4.39 million people lived in 23 large towns and 160 small towns, and 2.69 million Ugandans in these urban areas had access to safe drinking water sources. Coverage differed between large and small towns (see Table 1).

As reported by the National Water and Sewerage Corporation responsible for servicing large towns, the percentage of the population in large towns with access to safe drinking water has increased from 60 percent in 2002 to 72 percent in 2008. Of these large towns, Masindi, Mubende, Soroti, Bushenyi/Ishaka, and Hoima had the lowest 2008 coverage rates, all below 50 percent (MWE, 2008).

Small towns, as reported by District and Town Boards, achieved safe drinking water coverage of 46 percent serving about 0.79 million people in 2008. Of the 160 small towns, 113 have functional piped water supply schemes and 47 are served by other improved water supplies. As a consequence, safe drinking water coverage in Uganda's small towns ranges from as low as zero percent to 95 percent, and is on average higher in towns with a town council (MWE, 2008).

For all urban areas in Uganda, the average access to safe drinking water (61 percent) is ahead of its interim 2008 target of 58 percent (MWE, 2008). Table 1 reveals,

Table 1 URBAN SAFE DRINKING WATER ACCESS

| | 2002 Safe Drinking Water Coverage | | 2008 Safe Drinking Water Coverage | | 2008 Population |
|--------------------------|-----------------------------------|-----------|-----------------------------------|-----------|-----------------|
| | (million) | (percent) | (million) | (percent) | (million) |
| Town Boards | — | — | 0.14 | 36 | 0.40 |
| Town Councils | — | — | 0.65 | 49 | 1.33 |
| <i>Total Small Towns</i> | — | — | 0.79 | 46 | 1.73 |
| <i>Large Towns</i> | — | 60 | 1.90 | 72 | 2.66 |
| Total Urban | — | — | 2.69 | 61 | 4.39 |

Source: MWE, 2008.

however, that this average masks the lack of access to safe drinking water sources in many small towns. Increased attention and resources need to be allocated to smaller urban areas to ensure that intermediate targets are met and Uganda's national target for 2015 is not being jeopardized.

SAFE DRINKING WATER COVERAGE AND POVERTY PATTERNS

Trend data using a national average for safe drinking water coverage mask how individual districts and subcounties are performing. Planners require more location-specific information. At the central government level, they need to know how uniformly national progress is distributed throughout Uganda's districts and which areas have been underserved and need special attention to reach the 2015 target. At local government levels, they need to know the performance differences between subcounties within a district, both to understand how specific investment amounts have translated into safe drinking water coverage rates and how to address distributional equity issues.

Map 3 shows the proportion of the rural subcounty population with safe drinking water coverage. The brown areas in Map 3 represent low percentages of safe drinking water coverage (less than or equal to 20 percent of the rural subcounty population), while subcounties in shades of turquoise have the highest share of safe drinking water coverage.

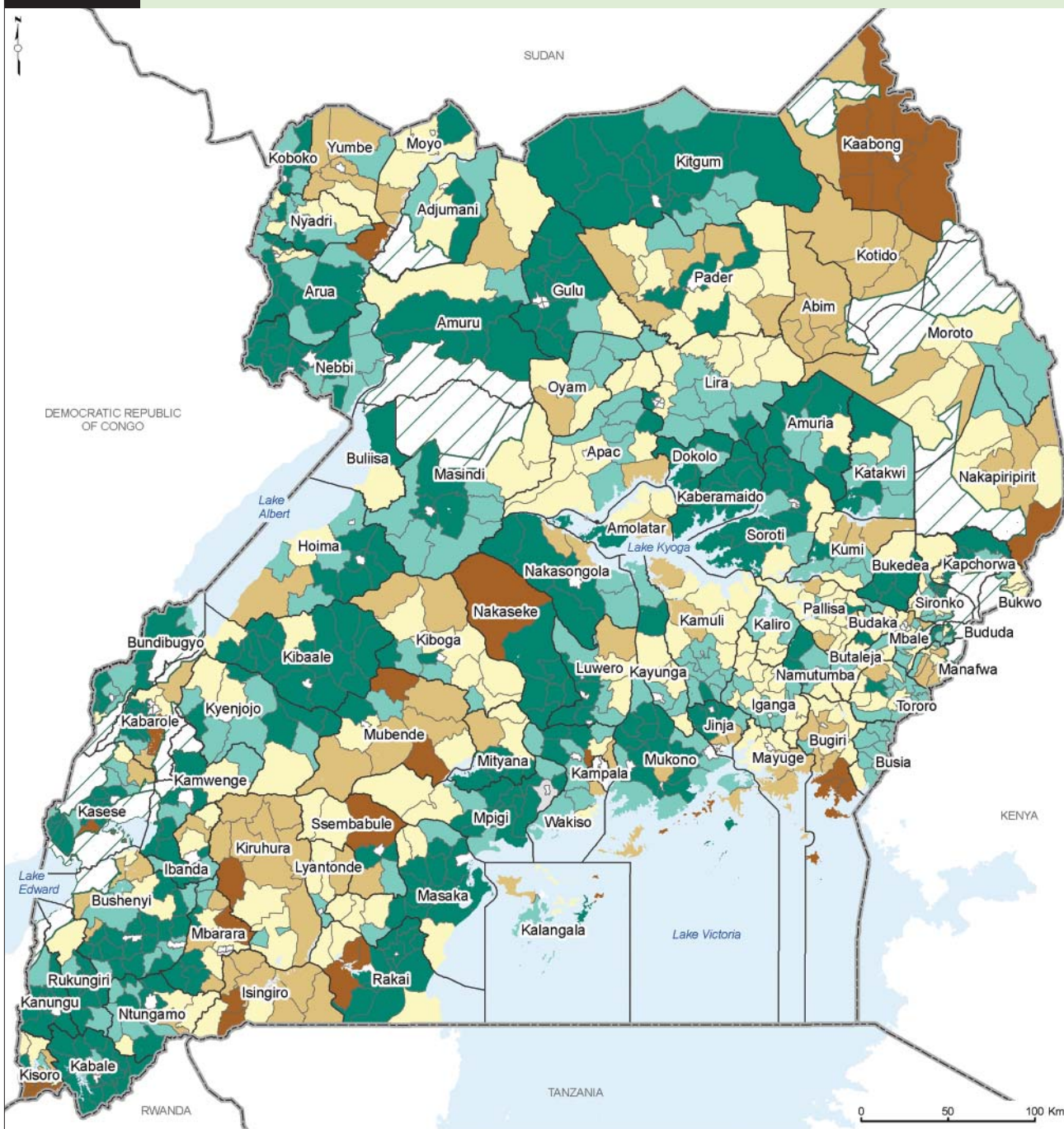
There is no clear spatial pattern in Map 3. For example, there are not consistently low values in the north or very high coverage rates in the central parts of the country.

Nevertheless, a number of observations can be drawn from this map to guide future investments in safe drinking water infrastructure in rural areas.

Subcounties with safe drinking water coverage of 60 to 80 percent are close to the interim national rural target set for 2008 by the Directorate of Water Development and are on track to make the 2015 target, though they still require additional capital investments to boost coverage in the next eight years. Subcounties with safe drinking water coverage of more than 80 percent have already achieved the

Map 3

PROPORTION OF RURAL SUBCOUNTY POPULATION WITH SAFE DRINKING WATER COVERAGE, 2008



SAFE WATER COVERAGE
(percent of rural population with safe water coverage)

- ≤ 20
- 20 - 40
- 40 - 60
- 60 - 80
- 80 - 95
- Urban Subcounties
- No data

OTHER FEATURES

- District boundaries
- Subcounty boundaries
- ▨ Major National Parks and Wildlife Reserves (over 50,000 ha)
- Water bodies

Sources: International boundaries (NIMA, 1997), district administrative boundaries (UBOS, 2006b), subcounty administrative boundaries (UBOS, 2002a), water bodies (NFA, 1996; NIMA, 1997; Brakenridge et al., 2006), and rural safe drinking water coverage rate (DWD, 2008).

Box 6**ESTIMATING ACCESS TO SAFE DRINKING WATER SUPPLIES IN UGANDA**

The Directorate of Water Development (DWD) is using proxy measures to estimate access to safe drinking water supplies in Uganda. The existing data collection and monitoring efforts do not permit DWD to physically measure for the whole country the percentage of people within 1.5 kilometers (rural areas) and 0.2 kilometers (urban areas) of an improved water source.

For rural areas, DWD assumes a fixed number of users per source as follows: protected spring (200 persons), shallow well with hand pump (300 persons), deep borehole with hand pump (300 persons), gravity flow scheme or other piped water supply tap (150 persons), and rain water harvesting tank (3 persons for a tank of less than 10,000 liters and 6 persons for a tank greater than 10,000 liters). DWD relies on an inventory of existing safe drinking water sources (based on a national survey and annual reporting) to calculate for each subcounty the total number of people served by all the improved sources. This number is then divided by the total subcounty population (as projected by the Uganda

Bureau of Statistics) to obtain the share of the subcounty population with access to an improved water source. DWD caps each subcounty share at a maximum coverage rate of 95 percent to ensure that no subcounty is serving more people than its total population. Coverage rates shown in this publication assume that all sources are fully functional.

The calculation for urban areas uses a similar approach assuming a fixed number of users per water source (e.g., house connection, yard taps, public taps, hand pumps, and protected springs). The number of users varies for small, medium, and large towns.

The current method of estimating access to improved rural water supplies at subcounty level—assuming a fixed number of users per source and fully functional sources—results in a best case scenario of safe drinking water access. It is a useful approach to gauge national and district progress, especially when coverage rates are low and improve rapidly from year to year (as was the case in the 1990s). This approach becomes more problematic, however, once administrative areas have achieved higher

coverage rates and planners are in need of more precise information.

For example, although access is capped at 95 percent, the subcounty average may still be an overestimate for parts of a subcounty because well-served areas within a subcounty can compensate for poorly served areas. The results would be more accurate and better reflect the situation on the ground if the analysis were undertaken at parish or even village level. Estimating safe drinking water coverage for these very small administrative areas, however, is costly—it requires a complete inventory of water sources, their exact location, and robust population projections. Making these information investments at more local scales may only be warranted for selected parts of the country, such as subcounties with the highest population or administrative areas that have reached coverage rates of greater than 95 percent, to ensure that the last pockets of underserved households are targeted with greater precision.

Source: MWE, 2008.

2015 target in 2008. These areas will require maintenance funds, but not necessarily resources for new water infrastructure, unless factors such as large population increases arise (e.g., resulting from migration).

Almost all districts had at least one rural subcounty shaded in turquoise (coverage rates of greater than 60 percent), with the exception of Kaabong, Kotido, Abim, Mayuge, and Isingiro Districts. Slightly more than half of the rural subcounties shown in Map 3 have safe drinking water coverage of greater than 60 percent. Southwestern districts of Kabale, Kanungu, and Rukungiri, and the districts of Doko-lo, Kaberamaido, and Nebbi are among the top performers: all of their subcounties have coverage rates above 60 percent. There are several reasons why these areas would be top performers, but one is that many subcounties in the more mountainous region of the south and southwest can rely on protected springs and tap stands fed by small gravity flow schemes—all technologies with low unit costs. This means that a large number of people can be granted access to safe drinking water per shilling invested.

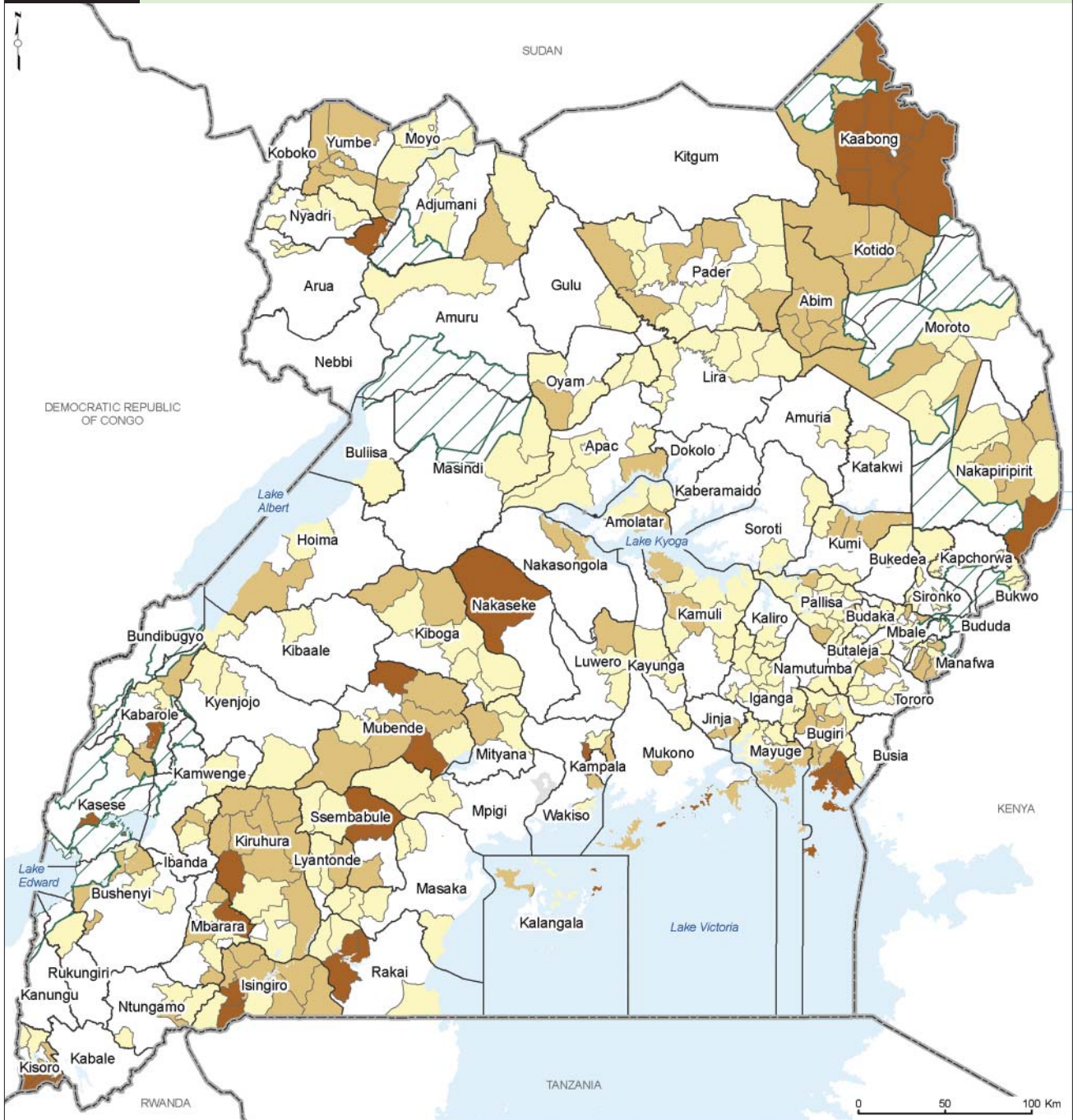
Map 4 highlights the rural subcounties with safe drinking water coverage rates below 60 percent, which means they did not meet the interim national rural target set by the Directorate of Water Development and are not on track to make the 2015 target. All rural subcounties in Kaabong, Kotido, Abim, Mayuge, and Isingiro Districts have

safe drinking water coverage rates below 60 percent. So do almost all rural subcounties in the districts of Yumbe, Pallisa, Bugiri, and Ssembabule Districts, and the majority of rural subcounties in the districts of Mbarara, Kiruhura, Lyantonde, Mubende, and Kiboga Districts. Kampala District borders a few rural subcounties in Wakiso District with very low safe drinking water coverage rates.² All of these areas will require special attention and additional investments to catch up with progress at the national level. In comparison to high-performing regions, many subcounties with the lowest coverage rates (e.g., in Kitgum, Yumbe, Kaabong, and Kotido Districts) are facing two major challenges—greater dependence on costly deep boreholes and generally very poor groundwater potential (MWE, 2007).

2. Current reporting distorts the coverage rates for some peri-urban areas. For example, the Kampala safe drinking water coverage is an overestimate because it includes connections in neighboring rural subcounties of Wakiso District as part of Kampala municipality. Coverage in the same rural subcounties in Wakiso District is an underestimate because it does not consider the piped water supply extending into the District from Kampala (MWE, 2008).

Map 4

LAGGING BEHIND: RURAL SUBCOUNTIES WITH SAFE DRINKING WATER COVERAGE BELOW 60 PERCENT, 2008



SAFE DRINKING WATER COVERAGE
(percent of rural population with safe drinking water coverage)

- <= 20
- 20 - 40
- 40 - 60
- Urban Subcounties or Rural Subcounties where safe drinking water coverage is over 60 percent
- No data

OTHER FEATURES

- District boundaries
- Subcounty boundaries
- Major National Parks and Wildlife Reserves (over 50,000 ha)
- Water bodies

Sources: International boundaries (NIMA, 1997), district administrative boundaries (UBOS, 2006b), subcounty administrative boundaries (UBOS, 2002a), water bodies (NFA, 1996; NIMA, 1997; Brakenridge et al., 2006), and rural safe drinking water coverage rate (DWD, 2008).

Mapping Investment

A critical question for water infrastructure planners is how to prioritize investments over the next eight years: should they invest first in those subcounties with the lowest coverage rates (less than 20 percent) or those with higher coverage rates? If planners only consider a single criterion—the gap between current coverage rate and a target of 77 percent for rural subcounties—then investment would go first to subcounties with the smallest gap, because it would require the least amount of resources to achieve the target. Planners could rely solely on Map 4 and focus on subcounties with safe drinking water coverage of 40 to 60 percent.

However, planners also have to take into consideration other criteria, such as relative unit costs to reach additional households in each subcounty and equity in coverage rates among subcounties. As reflected in the maps, one factor behind varying coverage rates is the varying cost of water resource development across the country. In this case, planners would compare the coverage rates of Map 4 with other maps showing resource allocations, number of safe drinking water points constructed, unit costs, and indicators measuring the equity of coverage rates within districts. (The Directorate of Water Development compiles most of this information in their annual water performance reviews.)

In addition to criteria such as distance to national targets, costs, efficiency, and equity, water infrastructure planners are also facing the challenge of making their investment priorities more pro-poor. This requires further analysis of how water investments would benefit communities with high poverty rates or high poverty density. Table 2 presents a simple demographic and poverty profile for subcounties falling into five different categories of safe drinking water coverage.

Over half of Uganda's rural subcounties and about half of the population living in these areas have achieved safe drinking water coverage rates over 60 percent. In those subcounties where coverage rates are below 60 percent, safe drinking water coverage is not evenly distributed: the majority of subcounties (which in this case also equates to the majority of the population) have coverage between 40 and 60 percent. For the 26 subcounties with the lowest safe drinking water coverage (below 20 percent), investments in facilities that serve approximately 800,000 people are needed to bring these subcounties to a 100 percent level. For subcounties in the next two categories of safe drinking water coverage the number of people requiring new facilities would be more than three to four times as many (2.4 and 3.2 million, respectively) than the number in the bottom category.

Considering data on the number of poor and the poverty rate along with the percentage of access to safe drinking water can help planners focus investments. For example, a look at the total number of poor and the average poverty rate by safe drinking water coverage category in Table 2 reveals that these two indicators have their highest value for subcounties falling into the 40 to 60 percent class.

Table 2 relies on averages derived from a large number of subcounties spread over a broad geographic region. It can provide only some general guidance on which subcounties would result in, on average, greater pro-poor benefits. Poverty rates and poverty densities are not uniformly distributed throughout the five categories of subcounties. Planners need to map individual subcounties and examine the underlying data to more precisely identify locations with greater poverty levels.

The following analysis provides an example of how to identify geographic areas where new investments in water

Table 2

DEMOGRAPHIC AND POVERTY PROFILE FOR RURAL SUBCOUNTIES WITH DIFFERENT SAFE DRINKING WATER COVERAGE

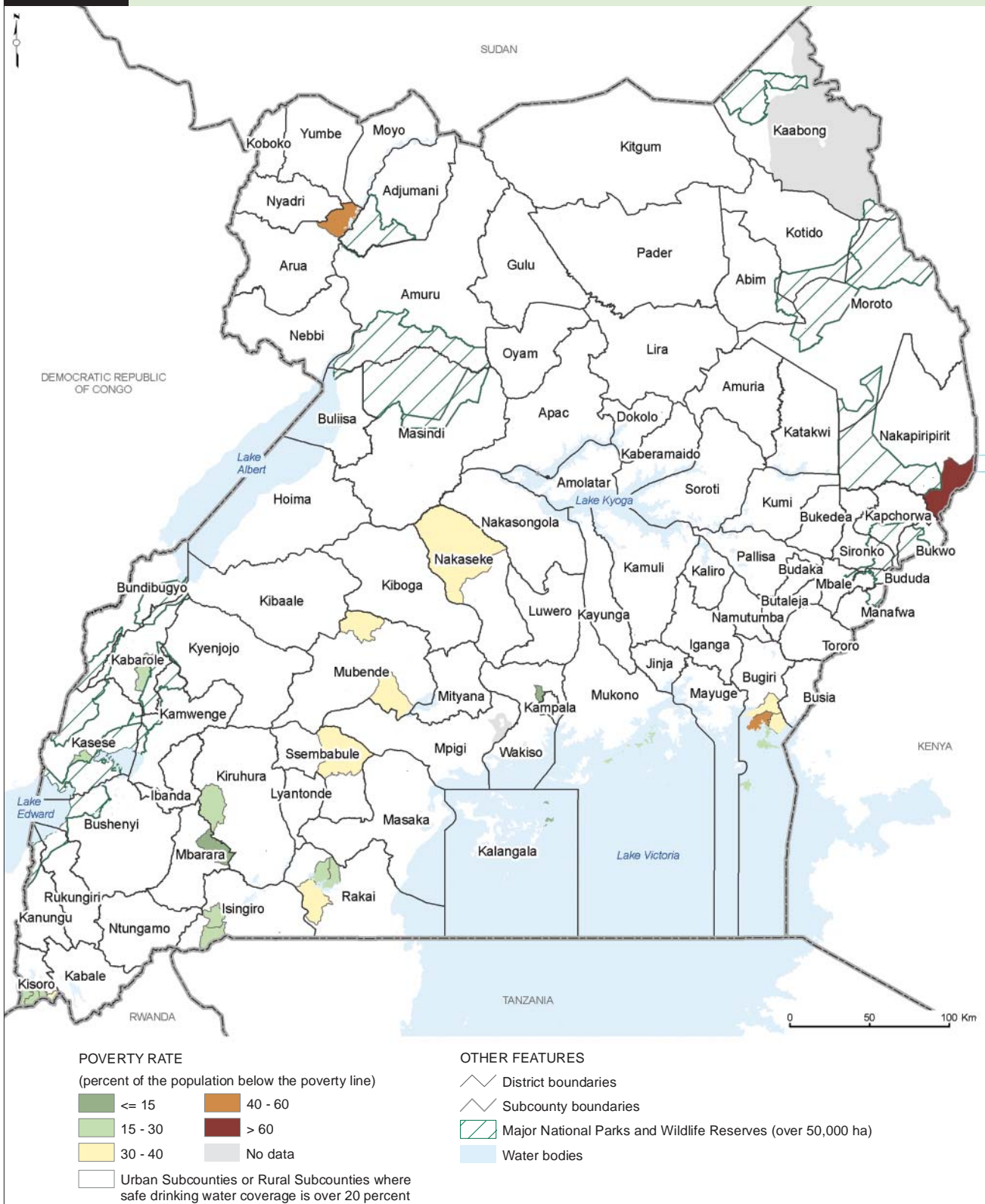
| 2008 Safe Drinking Water Coverage (percent) | Number of Rural Subcounties | Total Settled Area for All Rural Subcounties (square km) | 2008 Total Population in All Rural Subcounties (million) | 2005 Estimated Number of People Requiring Safe Drinking Water (million) | 2005 Average Population Density (number of persons per square km) | 2005 Average Poverty Rate for All Rural Subcounties (percent) | 2005 Total Number of Poor in All Rural Subcounties (million) | 2005 Average Poverty Density for All Rural Subcounties (number of poor per square km) |
|---|-----------------------------|--|--|---|---|---|--|---|
| ≤ 20 | 26 | 6,696 | 0.9 | 0.8 | 113 | 27 | 0.2 | 31 |
| 20 < x ≤ 40 | 92 | 25,650 | 3.5 | 2.4 | 110 | 33 | 0.9 | 37 |
| 40 < x ≤ 60 | 205 | 46,700 | 6.6 | 3.2 | 114 | 39 | 2.1 | 44 |
| 60 < x ≤ 80 | 201 | 36,591 | 6.3 | 1.9 | 140 | 36 | 1.8 | 50 |
| 80 > x ≤ 95 | 305 | 58,492 | 7.8 | 0.6 | 111 | 30 | 1.9 | 33 |
| TOTAL | 829 | 174,129 | 25.1 | 8.9 | 118 | 34 | 7.0 | 40 |

Notes: Only 829 rural subcounties had both poverty and water coverage data. Seven subcounties in Kaabong District, all with safe drinking water coverage below 20 percent, are not included in this table because reliable poverty estimates were not available for 2005. Data are rounded to nearest thousand, million, or percent.

Sources: Authors' calculation based on UBOS and ILRI (2008), and DWD (2008).

Map 5

POVERTY RATE IN RURAL SUBCOUNTIES WITH SAFE DRINKING WATER COVERAGE BELOW 20 PERCENT



Note: Seven subcounties in Kaabong District, all with safe drinking water coverage below 20 percent, are not shown in this map because reliable poverty estimates were not available for 2005.

Sources: International boundaries (NIMA, 1997), district administrative boundaries (UBOS, 2006b), subcounty administrative boundaries (UBOS, 2002a), water bodies (NFA, 1996; NIMA, 1997; Brakenridge et al., 2006), rural safe drinking water coverage rate (DWD, 2008), and rural poverty rate (UBOS and ILRI, 2008).

infrastructure would reach the greatest number of poor. It overlays information from the earlier poverty maps (Maps 1 and 2) with data from Maps 3 and 4. Combining maps permits the creation of new statistics which can help prioritize safe drinking water investments. It focuses on rural subcounties with the lowest safe drinking water coverage—below 20 percent. Similar systematic analyses need to be carried out for other types of subcounties, such as those nearest to the 2006 milestone of safe drinking water coverage (i.e., those with coverage rates of 40 to 60 percent).

Targeting the Poor in Rural Subcounties with the Lowest Safe Drinking Water Coverage

About 200,000 poor persons live in the 26 rural subcounties with the lowest safe drinking water coverage rates. Targeting these subcounties would seek to improve the situation for areas that are having the greatest difficulty in providing safe drinking water to their inhabitants. By focusing on high poverty areas, planners could try to improve the well-being of communities with multiple deprivations: high levels of monetary poverty and high dependence on unsafe drinking water sources. Map 5 and Map 6 display the poverty rate and the poverty density respectively for these subcounties.

Map 5 shows that poverty rates for the 26 subcounties include all five classes of poverty rates, a fact that is masked by the average poverty rate (27 percent) in Table 2. Subcounties with the highest poverty rate (shaded in dark brown) are located in Nakapiripirit, Bugiri, and Arua Districts. Map 6 displays a similarly diverse spread in the poverty density values. Rural subcounties in Bugiri District have high poverty densities (shaded in light brown), as do subcounties in Kisoro District.

Selecting poor subcounties based on Map 5 and Map 6 is not a straightforward choice. Only a few subcounties fall in similar classes such as one subcounty in Bugiri District (high poverty rate and high poverty density) and in Mbarara, Kiruhura, Kabarole, and Kasese Districts (low poverty rates and low poverty densities). Other subcounties have contrasting profiles: in Nakapiripirit District (high poverty rate and low poverty density); in Kisoro District (high poverty density and low poverty rate), and in Arua District (high poverty rate and medium poverty density). Moreover, simply selecting subcounties with the highest poverty rate or highest poverty density may not always be the optimal way to reach a great number of the poor (see example in Box 5).

Mapping Investment

Planners will need to examine the poverty and demographic data behind the two maps to guide their selection process. Three poverty indicators can help them to identify the most promising subcounties where new drinking

water infrastructure would have the greatest potential for pro-poor benefits:

- **Poverty Rate.** Poverty rate determines the precision and cost required to identify and target poor households. If planners seek to maximize the number of poor per new drinking water facility proportional to non-poor households also benefiting, they should target areas with high poverty rates. A new safe drinking water source will enhance the well-being of all community members being served—poor as well as non-poor. Placing a new facility in a subcounty where more than 70 percent of the households are poor requires less precise targeting than placing a facility in an area where only 20 percent are poor.
- **Poverty Density.** Poverty density is of relevance if planners want to minimize the delivery costs of water from the source to a family's home. Low density areas are associated with higher costs to connect dwellings to a piped water system or with greater average distances walked to a single community source.
- **Total Number of Poor.** Poverty rate and poverty density measures alone are not sufficient to identify the most promising subcounties for pro-poor targeting. A subcounty may have a high poverty rate or a high poverty density but still have a low count of poor persons because the subcounty is small and its overall population is comparatively low.

Generally, planners will need to examine all three indicators and decide whether to use one or a combination of all three to determine their priority subcounties. The analysis that follows will examine these poverty metrics for a subset of subcounties whose safe drinking water coverage rates are below 20 percent. The analysis is based on three different rankings in Table 3. Section A lists the 10 subcounties (out of 26 subcounties with safe drinking water coverage rates below 20 percent) with the highest poverty rates. Section B and Section C rank the same 26 subcounties, but this time showing the 10 subcounties with the highest poverty densities and the highest total number of poor, respectively.

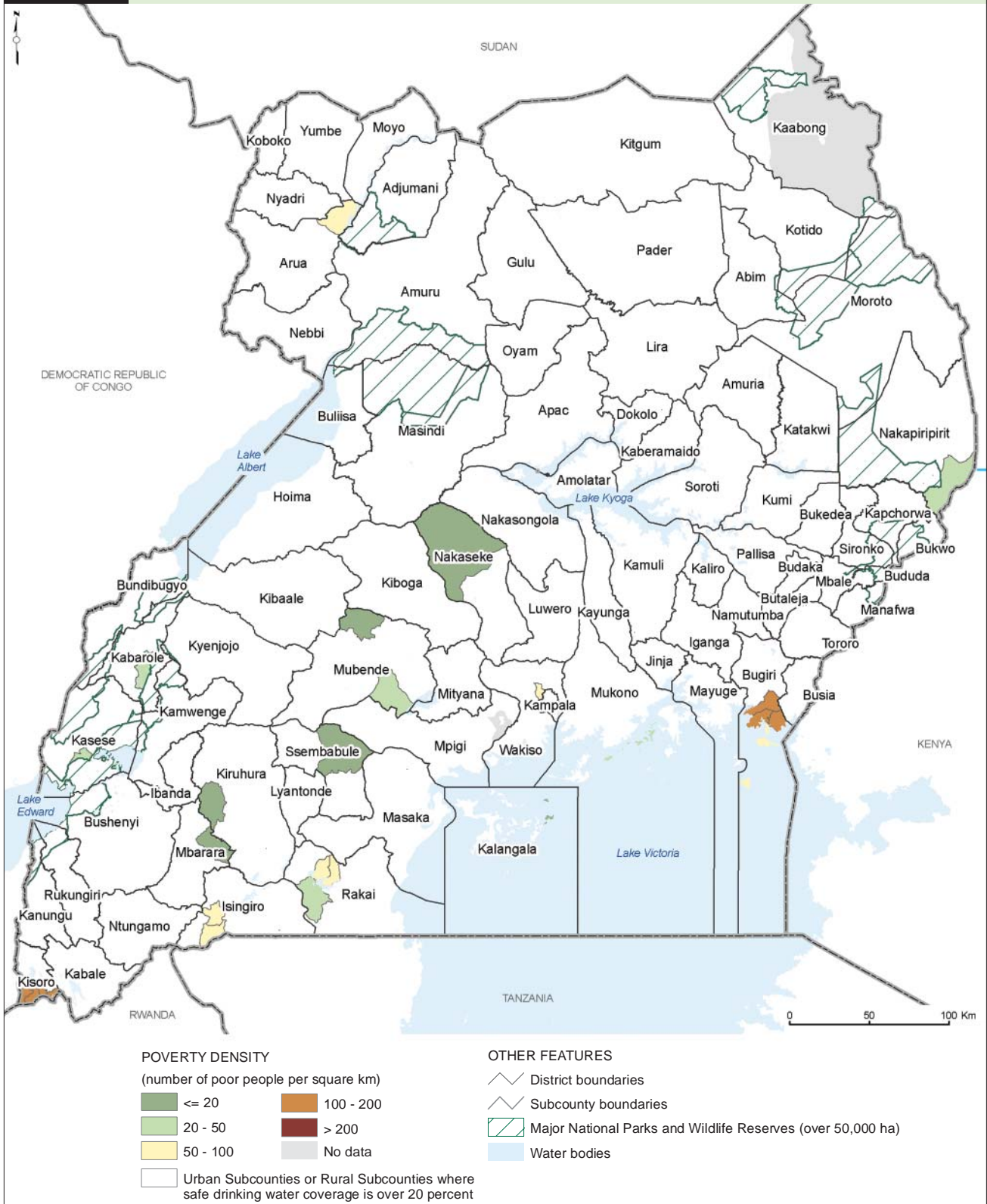
Sample Findings

The three sections reveal that targeting subcounties solely by poverty rate, poverty density, or total number of poor results in a different selection of subcounties. As expected, the average poverty rate, average poverty density, and the pool of poor households that could be reached, differ for the respective ten subcounties:

- The top ten subcounties ranked by poverty rates (Section A) achieve an average poverty rate of 44 percent. In contrast, the average poverty rate is 38 percent for the top ten subcounties ranked by poverty count (Section C) and only 24 percent for the top ten subcounties ranked by poverty density (Section B). Section A includes

Map 6

POVERTY DENSITY IN RURAL SUBCOUNTIES WITH SAFE DRINKING WATER COVERAGE BELOW 20 PERCENT



Note: Seven subcounties in Kaabong District, all with safe drinking water coverage below 20 percent, are not shown in this map because reliable poverty estimates were not available for 2005.

Sources: International boundaries (NIMA, 1997), district administrative boundaries (UBOS, 2006b), subcounty administrative boundaries (UBOS, 2002a), water bodies (NFA, 1996; NIMA, 1997; Brakenridge et al., 2006), rural safe drinking water coverage rate (DWD, 2008), and rural poverty density (UBOS and ILRI, 2008).

Table 3 SUBCOUNTIES WITH LOWEST SAFE DRINKING WATER COVERAGE: RANKING BY POVERTY INDICATOR

| Rank | Subcounty | District | Settled area (square km) | 2005 Total number of people (000) | 2005 Poverty rate (percent) | 2005 Poverty density (number of poor per square km) | 2005 Total number of poor (000) | 2005 Estimated number of people requiring safe drinking water (000) |
|-----------------------------------|-------------------|-------------|--------------------------|-----------------------------------|-----------------------------|---|---------------------------------|---|
| Section A HIGHEST POVERTY RATE | | | | | | | | |
| 1 | KARITA | NAKAPIRIPIT | 571 | 27 | 87 | 41 | 23 | 22 |
| 2 | RIGBO | ARUA | 318 | 28 | 56 | 50 | 16 | 23 |
| 3 | MUTUMBA | BUGIRI | 101 | 29 | 40 | 114 | 11 | 26 |
| 4 | BANDA | BUGIRI | 99 | 32 | 40 | 129 | 13 | 30 |
| 5 | BUTOLOOGO | MUBENDE | 355 | 16 | 38 | 17 | 6 | 13 |
| 6 | NGOMA | NAKASEKE | 1,824 | 17 | 37 | 3 | 6 | 14 |
| 7 | BUYINJA | BUGIRI | 141 | 43 | 36 | 110 | 16 | 35 |
| 8 | LUGUSULU | SSEMBABULE | 738 | 21 | 33 | 9 | 7 | 17 |
| 9 | MURORA | KISORO | 35 | 16 | 32 | 147 | 5 | 14 |
| 10 | KYALULANGIRA | RAKAI | 325 | 28 | 31 | 28 | 9 | 25 |
| TOTAL TOP 10 | | | 4,507 | 257 | 44 | 25 | 112 | 219 |
| Section B HIGHEST POVERTY DENSITY | | | | | | | | |
| 1 | MURORA | KISORO | 35 | 16 | 32 | 147 | 5 | 14 |
| 2 | BANDA | BUGIRI | 99 | 32 | 40 | 129 | 13 | 30 |
| 3 | MURAMBA | KISORO | 62 | 30 | 26 | 126 | 8 | 24 |
| 4 | CHAHI | KISORO | 28 | 15 | 23 | 121 | 3 | 13 |
| 5 | MUTUMBA | BUGIRI | 101 | 29 | 40 | 114 | 11 | 26 |
| 6 | BUYINJA | BUGIRI | 141 | 43 | 36 | 110 | 16 | 35 |
| 7 | NYARUSIZA | KISORO | 57 | 23 | 25 | 101 | 6 | 19 |
| 8 | NABWERU | WAKISO | 41 | 102 | 3 | 87 | 4 | 88 |
| 9 | NYAKITUNDA | ISINGIRO | 129 | 32 | 28 | 69 | 9 | 28 |
| 10 | KAGAMBA (BUYAMBA) | RAKAI | 120 | 28 | 29 | 69 | 8 | 25 |
| TOTAL TOP 10 | | | 814 | 352 | 24 | 102 | 83 | 302 |
| Section C HIGHEST POVERTY NUMBER | | | | | | | | |
| 1 | KARITA | NAKAPIRIPIT | 571 | 27 | 87 | 41 | 23 | 22 |
| 2 | RIGBO | ARUA | 318 | 28 | 56 | 50 | 16 | 23 |
| 3 | BUYINJA | BUGIRI | 141 | 43 | 36 | 110 | 16 | 35 |
| 4 | BANDA | BUGIRI | 99 | 32 | 40 | 129 | 13 | 30 |
| 5 | KIGANDA | MUBENDE | 444 | 39 | 30 | 26 | 12 | 32 |
| 6 | MUTUMBA | BUGIRI | 101 | 29 | 40 | 114 | 11 | 26 |
| 7 | KYALULANGIRA | RAKAI | 325 | 28 | 31 | 28 | 9 | 25 |
| 8 | NYAKITUNDA | ISINGIRO | 129 | 32 | 28 | 69 | 9 | 28 |
| 9 | KIKAGATE | ISINGIRO | 161 | 44 | 20 | 54 | 9 | 37 |
| 10 | KAGAMBA (BUYAMBA) | RAKAI | 120 | 28 | 29 | 69 | 8 | 25 |
| TOTAL TOP 10 | | | 2,410 | 331 | 38 | 52 | 126 | 283 |

Notes: Seven subcounties in Kaabong District, all with safe drinking water coverage below 20 percent, are not included in this table because reliable poverty estimates were not available for 2005. The number of persons requiring safe drinking water sources is an estimate based on 2008 coverage applied to 2005 subcounty population. Subcounties highlighted are ranked among the top ten subcounties for all three indicators.

Source: Authors' calculation based on UBOS and ILRI (2008), and DWD (2008).

the second highest total number of poor. Six out of ten subcounties in Section A have low poverty densities.

- The average poverty density in Section B (subcounties ranked by poverty density) is more than four times the average density for the top ten subcounties with the highest poverty rates (Section A). Targeting poor households in the selected subcounties listed in Section B requires great precision, since these subcounties only have an average poverty rate of 24 percent (ranging from 3 to 40 percent at subcounty level). Overall, the fewest number of poor would be reached with the selection criteria of Section B.
- The top ten subcounties ranked by the total poverty number (Section C) would reach about 126,000 poor persons, which is relatively close in number to the 112,000 poor persons in Section A (subcounties ranked by poverty rates). The average poverty rate in Section C is not quite as high as in Section A (38 versus 44 percent). Average poverty densities in Section C are half that in Section B.

As presented, selecting subcounties by a single poverty indicator results in a trade-off in performance regarding the other two poverty metrics. Depending on whether the targeting of new water infrastructure seeks to reach the highest number of poor, tries to target poor households most efficiently and reduce identification costs, or wants to reach a high density of poor within the perimeter of a water source, decision-makers can pick one of these indicators (and accept a large trade-off) or try to optimize the performance of all three poverty indicators (and accept smaller trade-offs for all three poverty indicators).

They could focus, for example, on subcounties that are ranked among the top ten subcounties for all three indicators. Three subcounties in the presented sections fall into this category. All are in southeastern Uganda in Bugiri District and include the subcounties of Banda, Buyina, and Mutumba. As expected, selecting subcounties based on all three poverty indicators results in different aggregate averages: The average poverty rate for these three subcounties is 38 percent (not quite as high as in Section A, but the same as the average rate in Section C), and their average poverty density of 117 persons per square kilometer is higher than the highest average density in Section B (102 persons per square kilometer). Targeting these three subcounties would represent a compromise. It would reach a very high number of poor within the perimeter of a new water facility but would achieve mid-level performance of reaching poor versus non-poor households.

Spatial Analysis and Safe Water Coverage: Conclusions

Several maps, figures, and data tables were developed throughout this section to illustrate how spatial analysis

can inform Uganda's efforts to promote safe drinking water coverage. Based on the data presented here, the following conclusions can be drawn:

- About 11 million people live in the 323 rural subcounties that have not kept pace with national progress on safe drinking water rates. These subcounties will require special attention in the future to catch up with the remaining 506 subcounties that are leading the country in coverage rates.
- Technology and associated costs are an important factor for explaining low and high safe drinking water coverage rates in selected locations of Uganda. A comparison of poverty levels (poverty rates and poverty densities) with the levels of safe drinking water coverage reveals no strong correlation or clear spatial pattern (e.g., consistently low values in the north, or very high coverage rates in the central part of the country). This means that planners need to examine maps of poverty rates and poverty densities and the underlying data in more detail to identify subcounties for pro-poor targeting.
- Poverty maps can be combined with maps of safe drinking water coverage to identify areas that are most promising for pro-poor geographic targeting. However, pro-poor targeting of subcounties requires careful examination of these maps and the underlying data (poverty rates, poverty densities, and total number of poor) to identify optimal locations.
- In general, subcounties with high poverty rates and a high total number of poor are prime candidates for pro-poor targeting of future drinking water investments. In the example presented, prioritizing subcounties by poverty density resulted in an overall lower pool of poor persons and a low average poverty rate. However, for another subset of subcounties, poverty densities may be a more relevant indicator, especially if delivery costs to provide drinking water are of high importance to decision-makers.

As indicated earlier, this initial analysis is meant to be illustrative and therefore brings to the forefront other issues for research and follow-up analyses:

- While this analysis focused on subcounties with less than 20 percent coverage, a similar systematic analysis for all the other subcounties below safe drinking water coverage rates of 60 percent would be useful.
- For some district planning efforts, a more fine-grained analysis at parish level would also be useful. Such an analysis could, for example, compare maps of safe drinking water coverage rates to maps of human well-being using census data on basic necessities such as clothing, blankets, shoes, soap, and sugar.³

3. UBOS does not provide poverty data at parish level.

■ While maps of safe drinking water coverage rates and poverty can help to identify broad geographic priorities, other factors need to be incorporated in prioritizing future water infrastructure investments—notably costs and equity issues. Follow-up analyses should therefore also include data and maps of government resource allocation (conditional grant allocation to districts), investment amounts in water infrastructure (total and per capita), efficiency of investments (shillings invested

versus gains in coverage rates), and an indicator capturing distributional equity in coverage rates. This would provide national and local planners and representatives of local communities with information to discuss the pros and cons of different prioritization criteria. It would also provide decision-makers with more data to justify their selected priorities for new water infrastructure investments.



Improved Sanitation, Hygiene, and Poverty

Improved sanitation and handwashing are among the most influential factors in reducing morbidity and mortality from diarrheal diseases (WSSCC and WHO, 2005). However, promoting sanitation and hygiene is challenging. Households must make appropriate choices in an arena which is intensely private. Catalyzing such choices requires that all institutional stakeholders collaborate effectively (WSSCC and WHO, 2005).

As mentioned in the introduction, the Uganda government has acknowledged the direct impacts of sanitation and basic hygiene on health, education, and poverty reduction in the Poverty Eradication Action Plan (MFPED, 2004). To boost improved sanitation coverage and hygiene behavior, the government has established national PEAP targets. It has also established an inter-sectoral National Sanitation Working Group to coordinate all sanitation and hygiene promotion efforts, reviewed budget mechanisms and funding flows, and discussed establishing a new national budget line for sanitation and hygiene promotion (MFPED, 2004; MoH, 2004; Arebahona, 2007).

While these efforts have raised the profile of these issues, implementation so far has lagged behind the improvements achieved for safe drinking water coverage (MWE, 2007; MWE, 2008). Reasons for this underperformance include past marginalization in resource allocation and low prioritization given to sanitation and basic hygiene by local governments. Another factor is insufficient time for fundamental changes to take place at the household level—where behavioral changes require long-term and sustained efforts—and at the institutional level, where action is required by multiple actors within and outside government and at local and national scales.

Adding to these challenges is the desire to incorporate broader goals relating to poverty, equity, and efficiency into sanitation and hygiene interventions (MoH, 2004). Allocation of the proposed new earmarked sanitation and hygiene funding under discussion, for example, could target those parts of the country with higher levels of poverty to meet the poverty reduction objective. Or it could support those areas with currently low sanitation coverage to address equity issues, or could target those areas with the greatest potential for improving performance to address concerns about public sector efficiency.

Maps showing location-specific indicators of sanitation coverage and poverty can help guide such allocation discussions. The following chapter—organized into three sections—demonstrates how poverty maps can support planning and targeting of interventions to promote improved sanitation and basic hygiene behavior.

The first section introduces the institutional framework for sanitation and hygiene behavior efforts in Uganda and highlights challenges to improving this behavior. It includes a national map showing the status of improved sanitation coverage in the country.

The second section looks at the relationship between improved sanitation coverage and poverty by first comparing poverty indicators and coverage rates for Uganda's subcounties. It then identifies the rural subcounties that did not achieve the country's target for improved sanitation in Uganda's first Health Sector Strategic Plan (HSSP I).⁴ These subcounties will require special attention to reach Uganda's 2015 target for improved sanitation. The final two maps examine these subcounties that have not achieved HSSP I and highlight the geographic distribution of poverty densities and poverty rates. Taking these geographic factors into consideration when designing and funding sanitation and hygiene programs could result in greater benefits for vulnerable populations in these subcounties.

The third section consists of Box 8, which illustrates how data from the census can be combined to link information on sanitation, drinking water sources, and affordability of soap (the latter a general indicator of poverty, measuring the affordability of basic necessities). This serves as a reminder that data and evidence need to be compiled to design more coordinated interventions that improve water supply, sanitation infrastructure, and hygiene behavior. Together these have greater impact than stand-alone interventions.

4. Uganda has formulated two five-year strategic plans: HSSP I covering 2000/2001 to 2004/2005 and HSSP II covering 2005/06 to 2009/2010. The 2002 improved sanitation map in this publication is compared to the interim target established in HSSP I because of its proximity to the data collection year.

IMPROVED SANITATION: DEFINITION, ISSUES, AND COVERAGE RATES

The main responsibilities for sanitation-related activities in Uganda are shared among the Ministry of Water and Environment (MWE), Ministry of Health (MoH), and the Ministry of Education and Sports (MES). MWE is responsible for planning sewerage services and public sanitation facilities in towns and rural growth centers as well as promoting sanitation around new water points. MoH is responsible for coordinating household hygiene and sanitation efforts and acts as the secretariat to the National Sanitation Working Group. MES has the mandate to construct school latrines and promote hygiene education in schools.

Such an institutional set up requires significant coordination and contributions from all stakeholders to achieve results. In addition to intersectoral collaboration, these three ministries need to collaborate with institutions from national to subcounty level to allocate resources, implement plans, and monitor progress. Past efforts to raise the profile of sanitation and implement a national action plan have had limited impacts (e.g., the National Sanitation Forum in 1997 that produced the Kampala Declaration on Sanitation). However, the new sector-wide approach to planning, in both the health and the water and sanitation sectors, provides an opportunity to scale up sanitation and hygiene efforts by addressing two fundamental barriers: fragmented and limited funding through multiple institutions, and uncoordinated water, sanitation, and hygiene interventions.

In the past, each agency has tended to undertake water and sanitation programs in isolation from the others and has not fully integrated its hygiene promotion campaigns with each other. An international review of best practices in this area (WSSCC and WHO, 2005) found that hygiene improvements and health benefits are most quickly and lastingly achieved when the following conditions are present:

- A program of hygiene promotion, including communication, social mobilization, community participation, social marketing, and advocacy;
- Improved access to the “hardware” for water supply, sanitation, and hygiene, such as water supply systems, improved sanitation facilities, household technologies, and materials such as soap, safe drinking water containers, and effective water treatment; and
- An enabling environment that includes policy improvement, institutional strengthening, community organization, financing and cost recovery, and cross-sectoral and private-public partnerships.

The National Environmental Health Policy (MoH, 2005a) is addressing some of these challenges by emphasizing such government actions as:

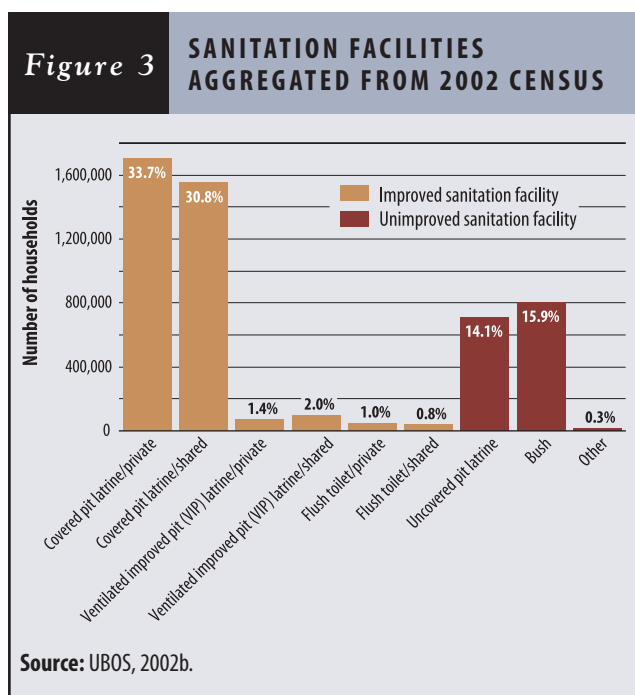
- Adopting a national sanitation and hygiene promotion strategy with clear goals, budgets, and institutional responsibilities;
- Establishing District Water and Sanitation Coordinating Committees that integrate and coordinate existing resources and implement integrated hygiene promotion and sanitation plans; and
- Establishing a dedicated national sanitation team (within MoH) to support the national strategy and provide technical support to towns and districts.

Based on the latest Water and Sanitation Sector Performance Report (MWE, 2008), 62 percent of rural and 74 percent of urban households in Uganda used improved sanitation facilities in 2007/2008. This puts Uganda’s rural average of safe sanitation below the country’s intermediate target of 64 percent for 2007/2008. This means that rural areas have not passed an important milestone to stay on the trajectory for Uganda’s 2015 target of 77 percent safe sanitation coverage. In contrast, urban households have achieved their interim target of 74 percent for 2007/2008 (MWE, 2008).

To produce detailed maps of improved sanitation (and compare them with the 2005 poverty maps), the analysis presented here relies on data from Uganda’s 2002 Population and Housing Census, the only national source of readily available sanitation data at subcounty level.⁵ The Census applies a less stringent definition for safe sanitation facilities than the Ministry of Health (see detailed description in Box 7). Based on these Census data, about 70 percent of all households (urban and rural) had access to improved sanitation facilities in 2002. Approximately 30 percent of the households had to rely on unsafe sanitation (see Figure 3) which included uncovered pit latrines (14.1 percent) and use of the bush (15.9 percent). Many households owned private covered pit latrines (33.7 percent) and an almost equal number of households (30.8 percent) shared covered pit latrines.

Map 7 shows the spatial distribution of the improved sanitation coverage data by subcounty. Rates of improved sanitation are typically higher in urban areas and the

5. The latest Water and Sanitation Sector Performance Report provides some national data on other sanitation indicators (MWE, 2008). According to these data, 21 percent of all Ugandan households (based on a limited study) have access to (and use) handwashing facilities. Data on school sanitation show that 41 percent of all schools have handwashing facilities (2006/2007), with a pupil to latrine/toilet stance ratio of 47:1 in 2007/2008 (compared to the 2015 target of 40:1). The Performance Report also highlights new data collection efforts in Mbarara District that resulted in improved sanitation coverage statistics for its 16 subcounties.



towns of Kampala, Jinja, Kabale, Kitgum, Gulu, Lira, Apac, and Hoima Districts, with the exception of Ssembabule, Katakwi, Moroto, and Nakapiripirit Districts. This could be due to generally improved housing and building regulations that require safe sanitation facilities before any structures are erected in these areas.

There is a distinct northeast-southwest division in the rates of improved sanitation facilities. The map shows low improved sanitation coverage rates in dark and light brown, which almost exclusively occupy the north and northeast, including the districts of Kitgum, Pader, Gulu, Kaberamaido, Amuria, Soroti, Katakwi, Kumi, Moroto, and Nakapiripirit. This may be explained by the settlement patterns in the north, characterized by internally displaced persons camps with inadequate sanitation facilities (UBOS, 2004). In addition, in the northeast (Moroto and Nakapiripirit Districts), the nomadic nature of the population does not encourage latrine construction or use. In contrast, high improved sanitation coverage rates (displayed in shades of turquoise) are more prevalent in central and southwestern Uganda, including Wakiso, Masaka, Mbarara, Ntungamo, Kabale, Bushenyi, Rukungiri, and Kanungu Districts.

Planners can use Map 7 to identify areas of progress as well as underachieving locations. Map 7 can also help to locate areas where the coverage rate of improved sanitation is just below 75 percent, which research indicates may be a sanitation threshold. Areas near this threshold may have the potential for significant improvement in health outcomes with additional sanitation investments. Achieving health impacts such as a reduction in diarrheal disease requires that a high proportion of the people in a community consistently use safe sanitation facilities. Studies show

that this proportion is roughly 75 percent of households⁶. This is due to the fact that unsafe disposal of human waste not only affects the household members directly involved, but can also impact the whole community. If improved sanitation coverage rates fall below 75 percent, such community impacts undermine the benefits that individual households gain from upgrading their sanitation facilities and improving their hygiene practices (Shordt, 2006). Thus, changing behavior at the household level and achieving an adequate sanitation coverage rate at the community level are both needed to maximize the health benefits of sanitation investments.

If a 75 percent improved sanitation coverage rate is applied as a rule of thumb threshold to Map 7, subcounties with coverage rates between 40–60 percent (shown in yellow) would warrant closer examination as potential priority areas for future sanitation and hygiene interventions. However, before this rule is applied indiscriminately, more specific epidemiologic data for Uganda are needed that may suggest a different threshold or a different scale (such as a parish) for such a prioritization effort.

IMPROVED SANITATION AND POVERTY PATTERNS

In the following analysis, Map 7, which shows the proportion of households with improved sanitation facilities, is combined with poverty maps to gain insights into the links between poverty and improved sanitation and to identify geographic clusters of subcounties with similar poverty and sanitation profiles. The analysis focuses on rural subcounties.

This section addresses the following policy-relevant questions, which can be used to design and execute more pro-poor sanitation interventions:

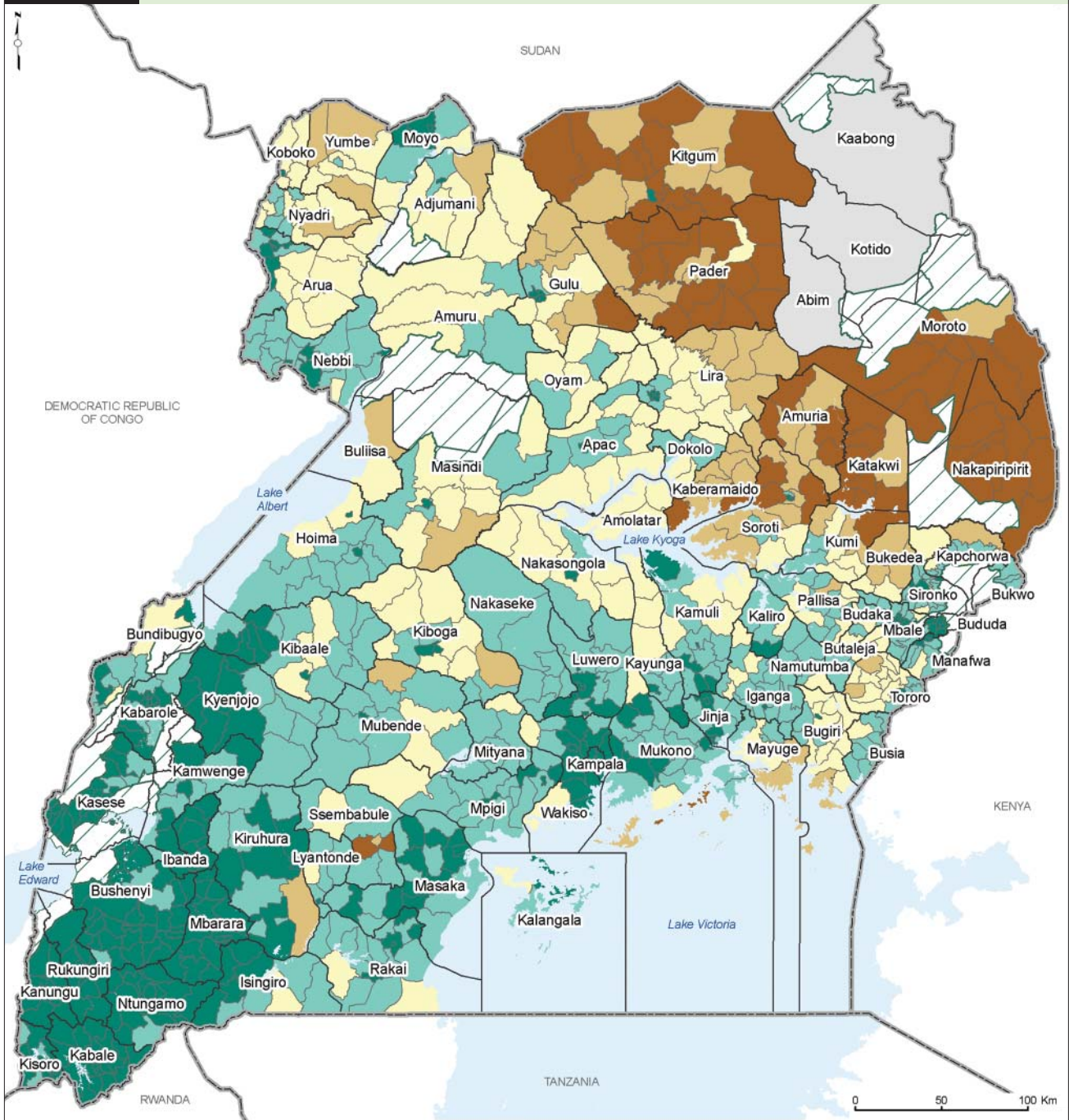
- How can planners target sanitation interventions (e.g., funding for sanitation education and leveraging resources for improved sanitation facilities) to result in greater pro-poor benefits?

This can be addressed by examining the relationship between poverty and improved sanitation at the sub-county level. A high correlation between, for example, low levels of improved sanitation coverage and high levels of poverty could simplify targeting of sanitation efforts, because prioritizing areas with low sanitation coverage would also result in greater pro-poor benefits.

6. This is shown in studies that demonstrate that stunting of children occurred in communities with safe sanitation levels below 75 percent (but less so above that threshold), whether the individual child lived in a home with a latrine or not (Bateman and Smith, 1991; Esrey 1996).

Map 7

PROPORTION OF HOUSEHOLDS WITH IMPROVED SANITATION FACILITIES, 2002



IMPROVED SANITATION FACILITIES
(percent of households with improved sanitation facilities)

- <= 20
- 20 - 40
- 40 - 60
- 60 - 80
- > 80
- No data

OTHER FEATURES

- District boundaries
- Subcounty boundaries
- Major National Parks and Wildlife Reserves (over 50,000 ha)
- Water bodies

Sources: International boundaries (NIMA, 1997), district administrative boundaries (UBOS, 2006b), subcounty administrative boundaries (UBOS, 2002a), water bodies (NFA, 1996; NIMA, 1997; Brakenridge et al., 2006), and subcounty share of households with improved sanitation facilities (UBOS, 2002b).

Box 7

DEFINITIONS OF IMPROVED SANITATION FACILITIES

The 2002 Uganda Population and Housing Census defines improved sanitation coverage only by the type of latrine or toilet facility installed. For the census, a government representative will ask citizens what type of facility they use, but will not personally check the validity of the household's answer. The options available for the citizen are the following three categories of improved sanitation facilities: covered pit latrine, ventilated improved pit (VIP) latrine, and flush toilet. Unsafe sanitation facilities include uncovered pit latrine, bush, and other.

The Ministry of Health (MoH) collects its data differently by inspecting the sanitation facility. While the MoH applies the same definitions as the census, the MoH also includes other criteria to define a safe sanitation facility: latrine pits are required to be at least 15 feet deep; waste has to be three feet below the latrine hole; and adequate privacy has to be provided. Without sufficient privacy, people will be inclined to seek the privacy found in bushes or elsewhere, exacerbating poor sanitation.

District health inspectors compile the MoH data for improved sanitation facilities in an annual exercise called the Health Inspectors Annual Sanitation Survey. The data are obtained from a sample of households (more than 50 percent of the households in a district) and are not readily available at subcounty level (MoH, 2008b). Therefore, this publication uses the 2002 Census data at subcounty level to carry out exploratory overlay analyses with poverty rates and poverty densities, recognizing that the results may overestimate use of improved sanitation facilities relative to 2002 MoH data and underestimate use for selected areas because of sanitation investments since 2002. District level maps of improved sanitation coverage for 2007/2008, however, still show a similar relative picture in coverage rates among northern, central, and southern parts of the country (MoH, 2008a).

■ *How equitable has progress been to date on improved sanitation?*

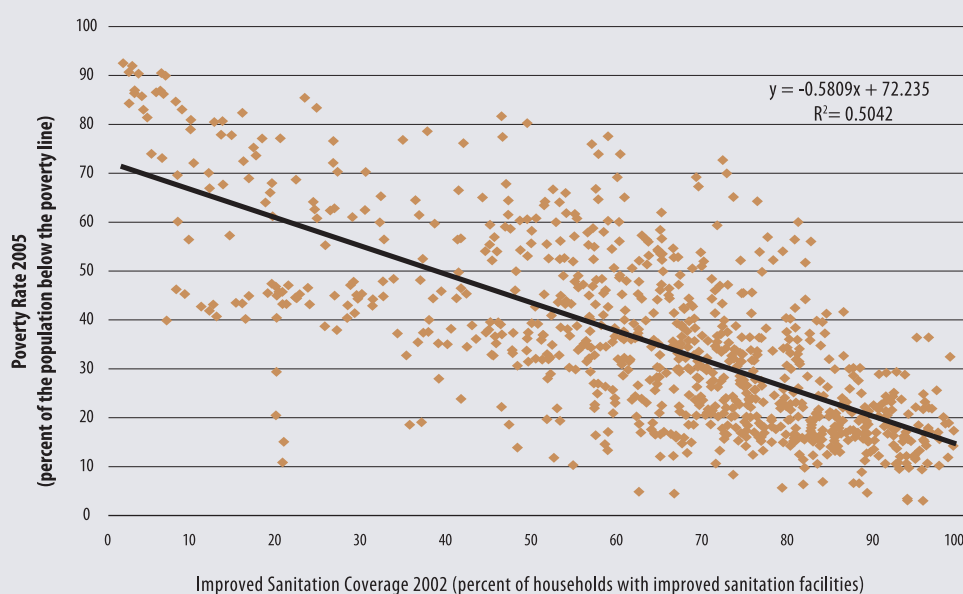
Comparing the performance of subcounties to national progress is of relevance from an equity perspective (that is, the belief that all areas and groups should share equally in the benefits of improved sanitation). Underperforming areas will require increased attention in the future to catch up with their peers. The first Health Sector Strategic Plan (HSSP I) established a national target of 60 percent safe sanitation coverage for 2004/2005 (and a rural target of 58 percent). This is

an important milestone to reach Uganda's 2015 target for safe sanitation.

■ *How should geographically focused sanitation interventions be prioritized?*

By mapping the demographic and poverty characteristics of rural subcounties that have fallen behind the HSSP I target and determining the spatial pattern of poverty rates, poverty densities, and sanitation coverage rates in these subcounties, one can derive the foundation for geographically focused sanitation interventions.

Figure 4 POVERTY RATE VERSUS IMPROVED SANITATION COVERAGE BY RURAL SUBCOUNTY



Sources: UBOS and ILRI (2008), and UBOS (2002b).

A comparison of poverty rates and improved sanitation coverage rates reveals that the two variables are negatively correlated; that is, in broad terms, subcounties with high poverty rates also have low levels of improved sanitation (see Figure 4). The trend line supports the argument that poorer households lack the resources to invest in improved sanitation, which is also a reflection of government policy to provide no public funds toward the cost of household sanitation facilities (MoH 2005).

However, Figure 4 shows a large variation of values from the trend line (r squared⁷ of 0.504). Some better-off subcounties have low sanitation coverage rates, and some subcounties with high poverty rates have high sanitation coverage rates. This suggests that the relationship between poverty rate and sanitation coverage rate is not straightforward. Other factors beside poverty rate determine whether households invest in safe sanitation, such as hygiene awareness, culture, or geological obstacles to construct latrines. Recent household surveys indicate a general lack of interest and demand for improved household sanitation and reveal that more affluent households often lack improved sanitation facilities even though they could afford to install them (MFPED, 2003). They also show that during the 1990s, households spent their increasing household incomes on other parts of their dwelling (roofs, floor, and walls) and not on improved sanitation (MFPED, 2002b; MFPED, 2003).

Mapping Subcounties that have Underperformed

Beyond the general insights of Figure 4, decision-makers need more specific information, especially on how well subcounties have performed in relationship to national targets and where underperforming areas are located. Map 8 highlights the rural subcounties that had not attained the interim national rural target of 58 percent of improved sanitation coverage (HSSP I) in 2002, the year

the sanitation data were collected. Areas in white had achieved the target.

Map 8 indicates that generally the northern region of the country and parts of eastern Uganda are underperforming in sanitation improvements. Almost all subcounties in these areas, apart from several subcounties in Apac, Lira, Moyo, and Nebbi Districts, had not attained the 58 percent target. Conversely, most subcounties in central, south, and southwestern Uganda had attained the HSSP I target.

The clear implication of Map 8 for decision-making and resource allocation is that priority should be given to the north and northeastern areas for programs to promote hygiene behavior and construction of improved sanitation facilities. This is especially appropriate given that most internally displaced persons from the IDP camps are returning to their villages. One possible requirement could be to have an improved sanitation facility—constructed with government support—at each homestead, where possible, especially in high-poverty areas. In the south and southwestern region, districts should work toward 100 percent coverage. This can be achieved partly through consistent health education, combined with enforcement of the 1964 Public Health Act and systematic implementation of the National Environmental Health Policy.

Creating a Demographic and Poverty Profile

Sanitation coverage data for the 831 rural subcounties can be combined with maps of poverty and population distribution to create a demographic and poverty profile for the subcounties that have not achieved the HSSP I target and for those that have already surpassed the target. Table 4 provides such a profile.

Table 4 reveals noteworthy differences between the subcounties that are ahead of or lag behind the HSSP I target. Approximately one third of Uganda's rural subcounties (278), representing almost a third of the rural population (6.2 million people), had not reached the rural HSSP I target by 2002. In comparison, almost twice as many (559) rural subcounties, with a population of 14.4 million, had

7. In statistical analysis, r squared measures how well the “line of best fit” approximates the various data points. If the line perfectly fits each data point, then r squared will equal 1.

Table 4

DEMOGRAPHIC AND POVERTY PROFILE FOR RURAL SUBCOUNTIES WITH DIFFERENT IMPROVED SANITATION COVERAGE RATES

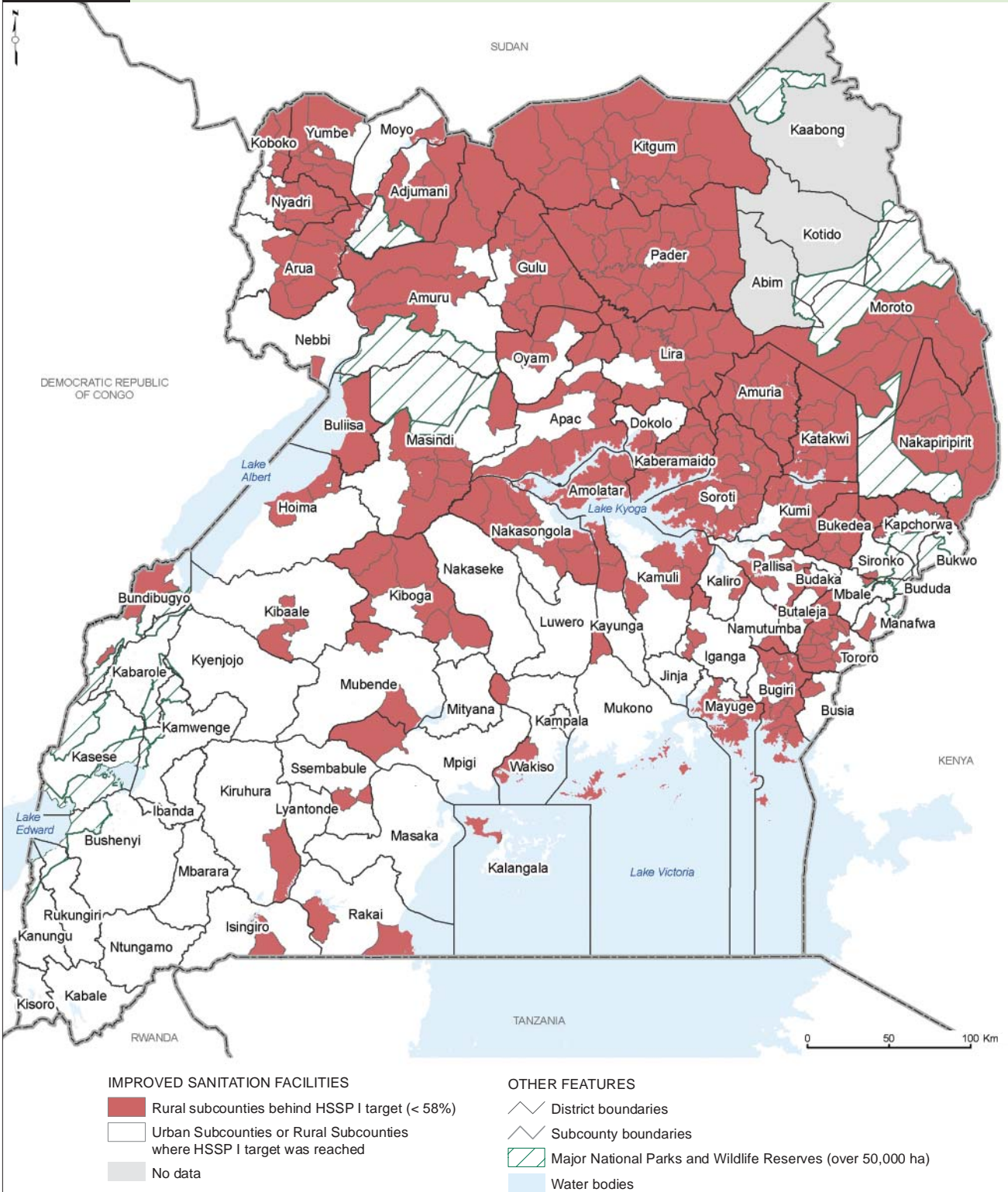
| 2002 Improved Sanitation Coverage (percent) | Number of Rural Subcounties | Total Settled Area for All Rural Subcounties (square km) | 2005 Total Population in All Rural Subcounties (million) | 2005 Average Population Density (number of persons per square km) | 2005 Average Poverty Rate for All Rural Subcounties (percent) | 2005 Total Number of Poor in All Rural Subcounties (million) | 2005 Average Poverty Density for All Rural Subcounties (number of poor per square km) |
|---|-----------------------------|--|--|---|---|--|---|
| Behind HSSP I ($x < 58$) | 278 | 86,213 | 6.2 | 72 | 50 | 3.1 | 36 |
| Ahead of HSSP I ($x \geq 58$) | 553 | 88,090 | 14.4 | 163 | 27 | 3.9 | 44 |
| TOTAL | 831 | 174,304 | 20.5 | 118 | 34 | 7.0 | 40 |

Note: Only 831 rural subcounties had both poverty and improved sanitation coverage data.

Sources: Authors' calculation based on UBOS (2002b), and UBOS and ILRI (2008).

Map 8

LAGGING BEHIND: RURAL SUBCOUNTIES THAT FAILED TO REACH HSSP I TARGET FOR IMPROVED SANITATION FACILITIES IN 2002



Note: HSSP I is Uganda's first Health Sector Strategic Plan covering 2000/2001 to 2004/2005.

Sources: International boundaries (NIMA, 1997), district administrative boundaries (UBOS, 2006b), subcounty administrative boundaries (UBOS, 2002a), water bodies (NFA, 1996; NIMA, 1997; Brakenridge et al., 2006), and subcounties with share of improved sanitation facilities below 58 percent of the population (UBOS, 2002b).

passed that target. About 3.1 million poor live in subcounties that did not achieve HSSP I, and the average poverty rate in these areas is 23 percentage points higher than in subcounties that had passed the target. Rural subcounties that had attained the HSSP I target had a higher average population density (163 versus 72 people per square kilometer) and a higher average poverty density (44 versus 36 persons per square kilometer) than subcounties that had not attained the target.

In conclusion, more densely settled and better-off rural subcounties (reflecting to some degree the positive correlation between higher population density and better agricultural endowment) were the first to achieve the HSSP I target and generally have higher average coverage rates of improved sanitation. Focusing future sanitation and hygiene interventions on subcounties that have fallen behind HSSP I will provide two benefits: it will reduce inequities in access to improved sanitation and contribute to Uganda's poverty reduction goal.

Identifying Geographic Similarities

One question that would be useful for planners of hygiene and sanitation interventions to answer is whether poverty patterns occur uniformly throughout the 278 rural subcounties that have fallen behind HSSP I. If so, planners can use such patterns to identify specific subcounties for more pro-poor targeting. Maps 9 and 10 display the poverty rate and poverty density for subcounties that had not achieved the HSSP I target in 2002.

The brown areas in Map 9 show higher poverty rates, while the green areas represent low poverty rates. The majority of subcounties behind on the HSSP I target have poverty rates above 40 percent with a large number having rates greater than 60 percent.

The majority of subcounties not reaching the 2002 target, as highlighted in Map 10, have low poverty densities (out of 278 subcounties, 58 have less than 20 poor persons per square kilometer and 107 have 20-50 poor persons per square kilometer). This is largely related to the lower population densities of northern Uganda. However, a number of subcounties in southeastern Uganda—in Mayuge, Bugiri, Tororo, and Pallisa Districts—have high numbers of poor per square kilometer.

Information from Map 9 and Map 10 can be combined and compared with data on improved sanitation coverage (Map 7) to identify geographic clusters of subcounties that are similar in their poverty and sanitation patterns. Pro-poor sanitation interventions can then be targeted at these types of subcounties.

Common Poverty and Poor Sanitation Profiles

The following three profiles of subcounties across Maps 7, 9, and 10 are the most common:

- *High poverty rate, low poverty density, and low improved sanitation coverage.* Subcounties in Adjumani District, and parts of Gulu, Kitgum, Pader, Moroto, Nakapiripirit, and Katakwi Districts all have high poverty rates and low poverty densities. These areas also have some of the lowest sanitation coverage rates in Uganda, with the majority of subcounties ranging between 20–40 percent and a large number of subcounties with rates below 20 percent.

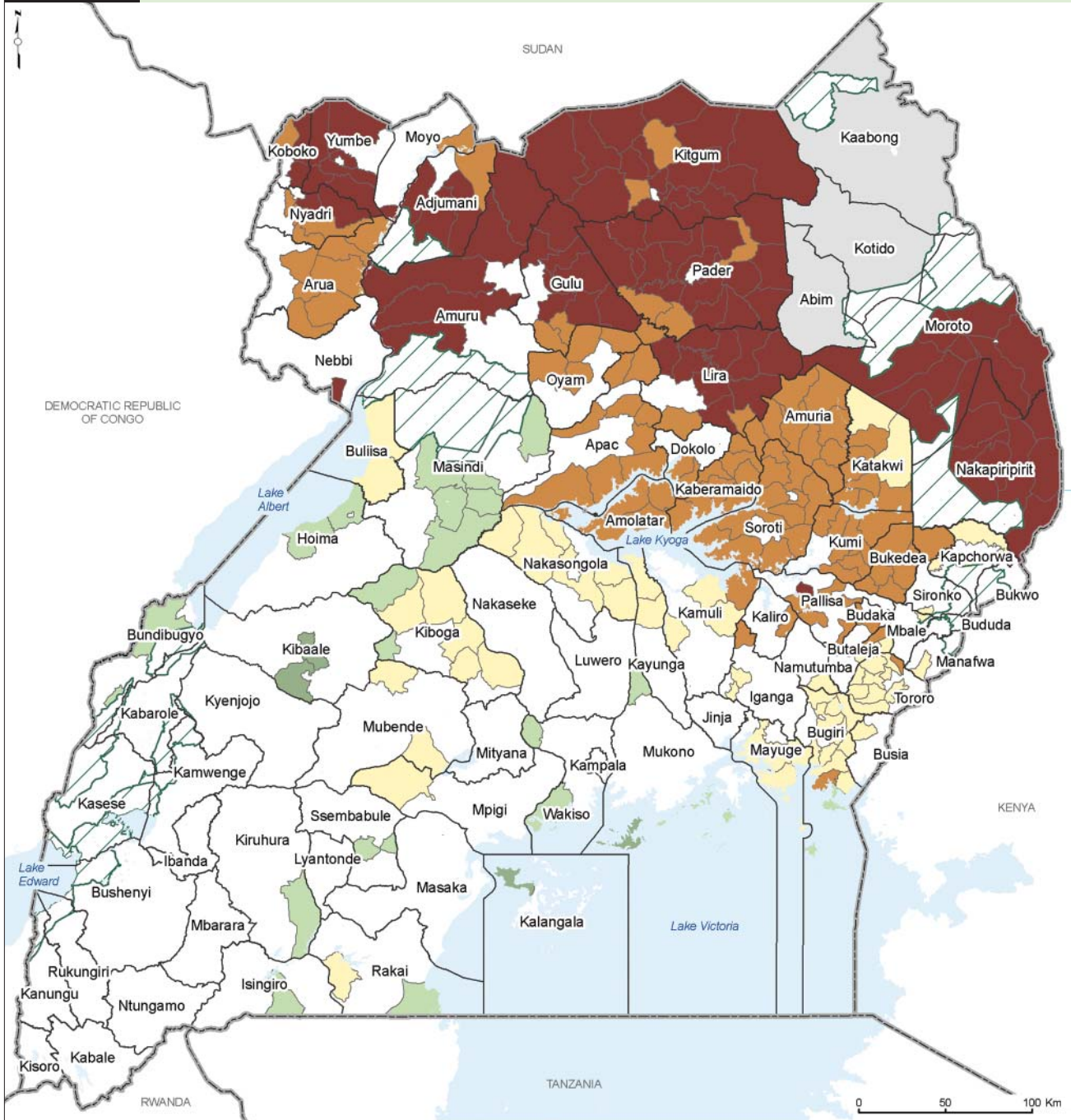
In these areas, future sanitation and hygiene interventions have to overcome low demand for improved sanitation coverage, which will require multiple-year education efforts to encourage changes in behavior at the household level. At the same time, high poverty levels make leveraging contributions for investment in improved sanitation hardware from communities and households a challenge. Promotion of low-cost sanitation technologies and precisely targeted subsidies could help these disadvantaged communities. Efforts that go hand in hand with resettling internally displaced persons and (re)establishing communities could provide the opening for well-targeted hygiene and sanitation interventions.

- *High poverty rate, high poverty density, and medium improved sanitation coverage.* The majority of subcounties with this profile are located in the southeast including Bugiri, Tororo, Pallisa, and Kumi Districts. A number of subcounties with these characteristics are also in northwestern Uganda, for example in Yumbe, Nyadri, and Koboko Districts. Most of these subcounties are more densely settled, resulting in higher poverty densities. Improved sanitation coverage rates range between 40–60 percent.

Leveraging resources from households and communities in these areas will encounter the same challenges as the subcounties with high poverty rates and low poverty densities shown above. What is different, however, is that households are spatially concentrated and current demand for improved sanitation facilities is closer to a critical threshold that could bring more widespread health benefits at the community level. Geographically targeted campaigns that try to 'back fill' underperforming subcounties in these areas could boost coverage rates to 75 percent or higher. Pallisa District, in which the majority of subcounties have surpassed the HSSP I target with coverage rates between 60 to 80 percent, appears to be a prime candidate for such an approach.

Map 9

POVERTY RATE IN RURAL SUBCOUNTIES THAT FAILED HSSP I TARGET FOR IMPROVED SANITATION FACILITIES



POVERTY RATE
(percent of the population below the poverty line)

| | |
|---|--|
| <= 15 | 40 - 60 |
| 15 - 30 | > 60 |
| 30 - 40 | No data |
| Urban Subcounties or Rural Subcounties where HSSP I target was reached | |

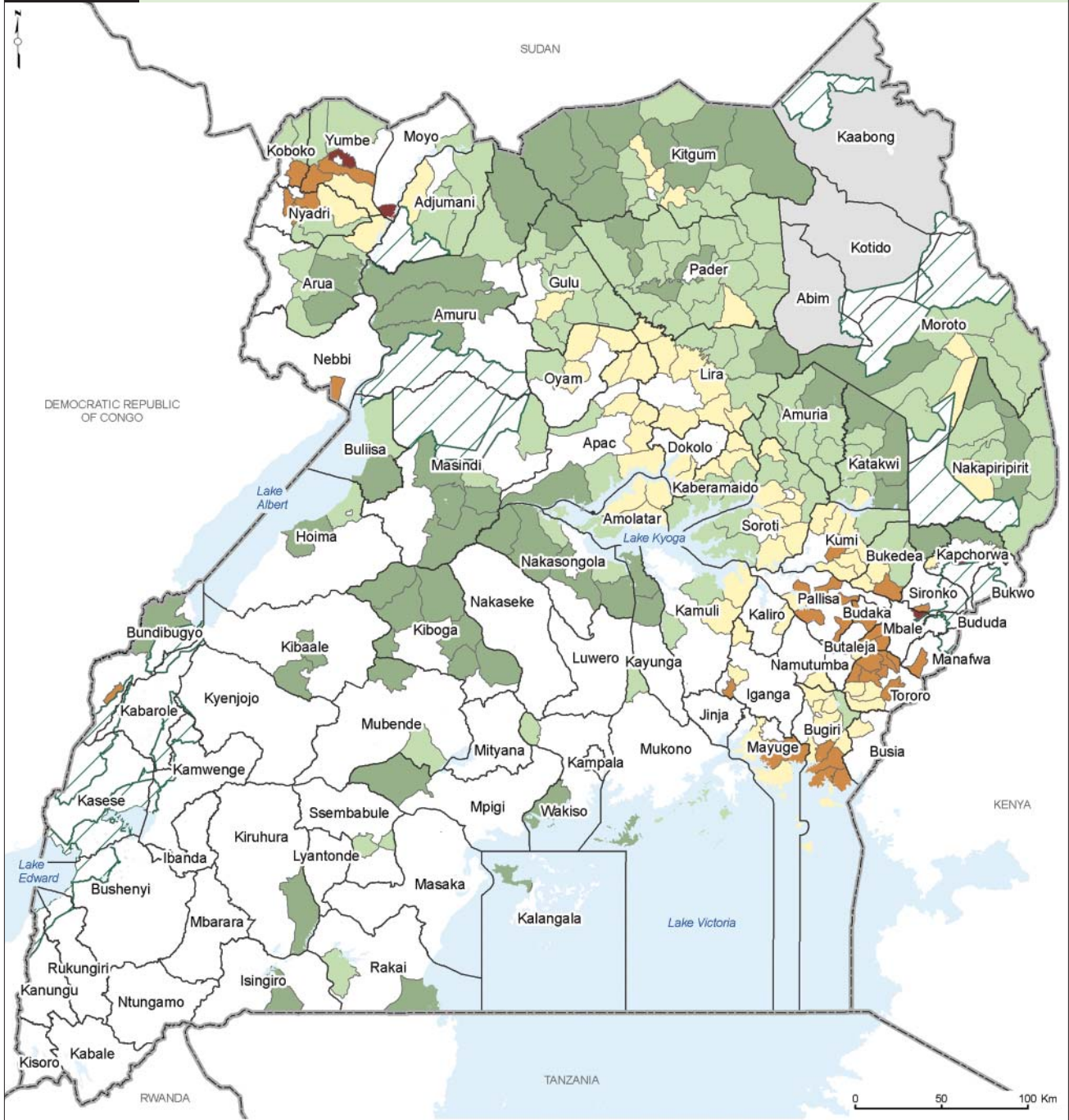
OTHER FEATURES

- District boundaries
- Subcounty boundaries
- Major National Parks and Wildlife Reserves (over 50,000 ha)
- Water bodies

Note: HSSP I is Uganda’s first Health Sector Strategic Plan covering 2000/2001 to 2004/2005.
Sources: International boundaries (NIMA, 1997), district administrative boundaries (UBOS, 2006b), subcounty administrative boundaries (UBOS, 2002a), water bodies (NFA, 1996; NIMA, 1997; Brakenridge et al., 2006), households with improved sanitation facilities (UBOS, 2002b), and rural poverty rate (UBOS and ILRI, 2008).

Map 10

POVERTY DENSITY IN RURAL SUBCOUNTIES THAT FAILED HSSP I TARGET FOR IMPROVED SANITATION FACILITIES



POVERTY DENSITY
(number of poor people per square km)

| | |
|---|--|
| <= 20 | 100 - 200 |
| 20 - 50 | > 200 |
| 50 - 100 | No data |
| Urban Subcounties or Rural Subcounties where HSSP I target was reached | |

OTHER FEATURES

- District boundaries
- Subcounty boundaries
- Major National Parks and Wildlife Reserves (over 50,000 ha)
- Water bodies

Note: HSSP I is Uganda's first Health Sector Strategic Plan covering 2000/2001 to 2004/2005.

Sources: International boundaries (NIMA, 1997), district administrative boundaries (UBOS, 2006b), subcounty administrative boundaries (UBOS, 2002a), water bodies (NFA, 1996; NIMA, 1997; Brakenridge et al., 2006), households with improved sanitation facilities (UBOS, 2002b), and rural poverty density (UBOS and ILRI, 2008).

- *Low poverty rate, low poverty density, and medium improved sanitation coverage.* The districts of Nakason-gola, Masindi, and Kiboga have the greatest number of subcounties with this profile. Poverty rates are between 15–40 percent, and the number of people and poor persons per square kilometer is relatively low. Improved sanitation coverage rates range between 40–60 percent.

Promotion of hygiene and improved sanitation can build on an established demand by a critical share of households with safe sanitation facilities. These subcounties have greater potential to leverage household and community resources for upgrading sanitation facilities.

Other types of poverty and sanitation profiles can be derived from overlays between Maps 7, 9, and 10. However, these profiles are less common and are only relevant for a dozen subcounties.

The above examples demonstrate that distinct geographic patterns of poverty rate, poverty density, and sanitation coverage can provide guidance on designing more pro-poor hygiene and sanitation interventions. The planning and targeting of sanitation and hygiene efforts could be further enhanced with additional information. Analysts could locate areas with rocky ground, sandy soils, or a high water table, for example—all factors that make it difficult to build and maintain latrines. Other useful maps could show the level of hygiene awareness or handwashing practices if these data were regularly collected and incorporated in the District Health Monitoring Systems (MoH, 2005). Based on the analysis of these maps, planners could then decide on the right mix and level of interventions, whether these be stimulating the demand for improved sanitation and hygiene or using carefully targeted subsidies to construct sanitation facilities. The pros and cons of the latter are widely debated by sanitation and hygiene experts, especially regarding how to support more disadvantaged and marginalized areas and groups (see for example Shordt, 2006; WSP, 2004; WSSCC and WHO, 2005; MoH, 2005).

Box 8

MAPPING CASE STUDY: USING CENSUS DATA TO GUIDE HYGIENE BEHAVIOR INTERVENTIONS

The 2002 Population and Housing Census data can be used to identify areas at greater risk of waterborne diseases and to help plan handwashing campaigns. To illustrate, three variables are presented in three separate maps:

- The density of households in an area without improved sanitation (Map 11).
- The percentage of households relying on open sources of drinking water, such as lakes, streams, etc. (Map 12).
- The percentage of households that cannot afford to use soap (Map 13), a measure from the census showing the lack of basic necessities.

Map 11 shows the densities of households without access to improved sanitation in each subcounty. The more darkly shaded areas have the highest density of households without adequate sanitation, and are therefore at higher risk of disease. The pattern displayed largely follows the patterns of population density (arc around Lake Victoria, near Mount Elgon, north of Lake Kyoga, and around Arua, Nebbi, and Bundibugyo Districts). The southwestern subcounties, which also

have high population densities, are an exception to this pattern.

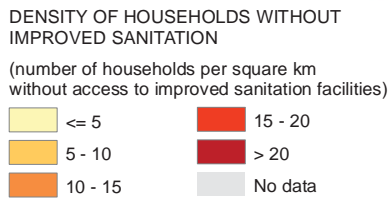
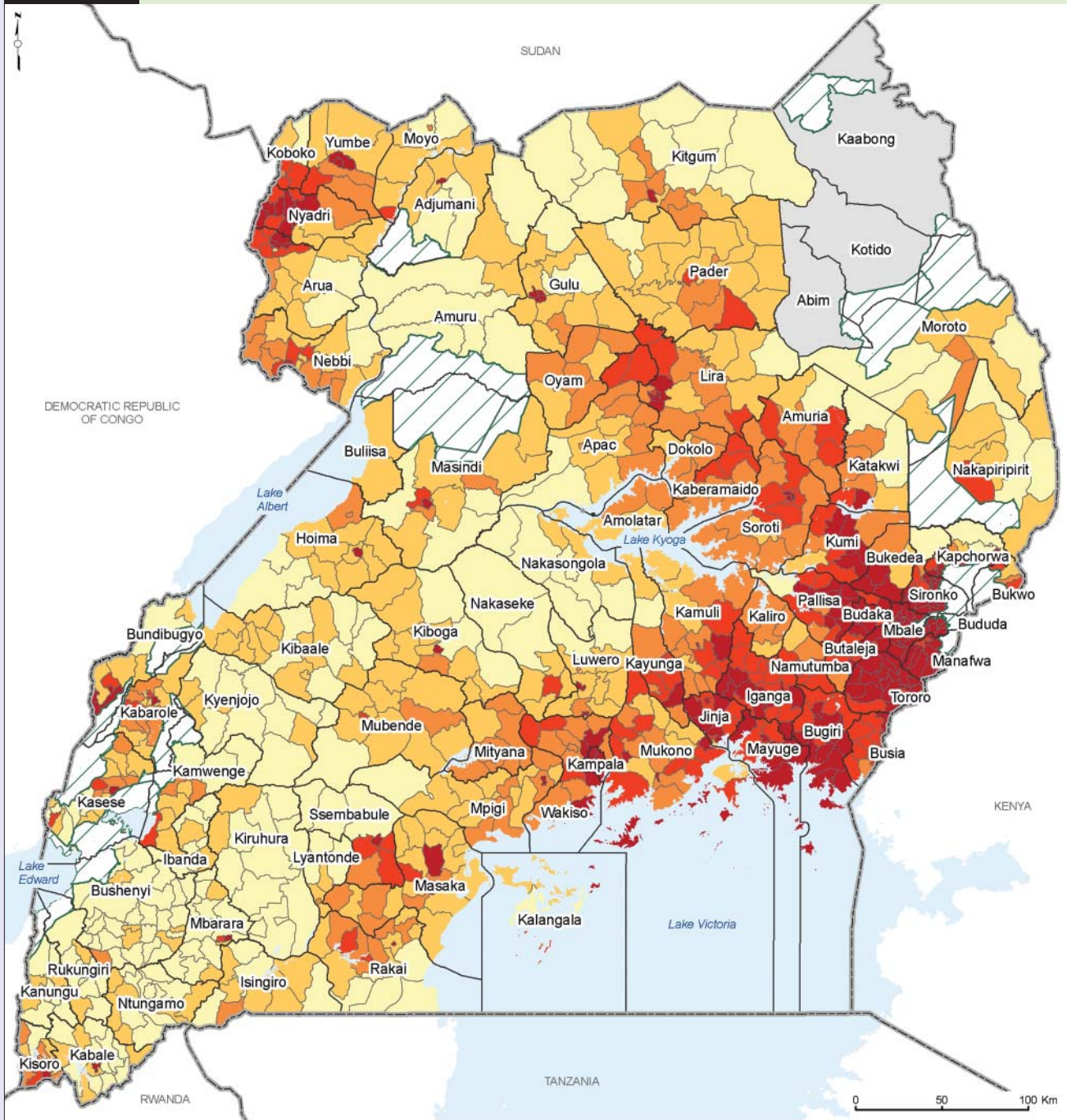
Map 12 displays percentages of households relying on open sources for drinking water and therefore at risk of waterborne diseases attributed to unsafe sources. The pattern here differs from Map 11 in that it is now the subcounties in the districts of Mubende, Kyenjojo, Kiruhura, Ssembabule, and Rakai, and in the northern region that have the highest risk.

Map 13, which presents the spatial distribution of households that cannot afford soap, closely resembles the earlier map of improved sanitation coverage (Map 7), with higher rates found in the northern subcounties. Households which are too poor to obtain soap will benefit less from hygiene awareness efforts, such as the government-sponsored Sanitation Awareness Week (MoH, 2007). In addition to education, households will need help to obtain soap on a regular basis, either through free distribution of soap bars or other subsidies.

Maps 11, 12, and 13 can be combined into a single map to create an index of risk for waterborne diseases. Areas at highest risk for example

would have a high density of households per square kilometer without improved sanitation, a high proportion of the community relying on open sources of drinking water, and high percentage of households not being able to afford soap. Other variables from the census or the poverty maps could be incorporated in this index, such as poverty rate (often associated with outbreaks of cholera) or the number of livestock per square kilometer (which may be associated with higher loads of waterborne pathogens). Maps could also be developed with indicators for sanitation and hygiene promotion, such as the percentage of households with access to (and using) handwashing facilities with water and soap (or soap substitutes), and the percentage of households maintaining a safe drinking water chain (MoH, 2005).

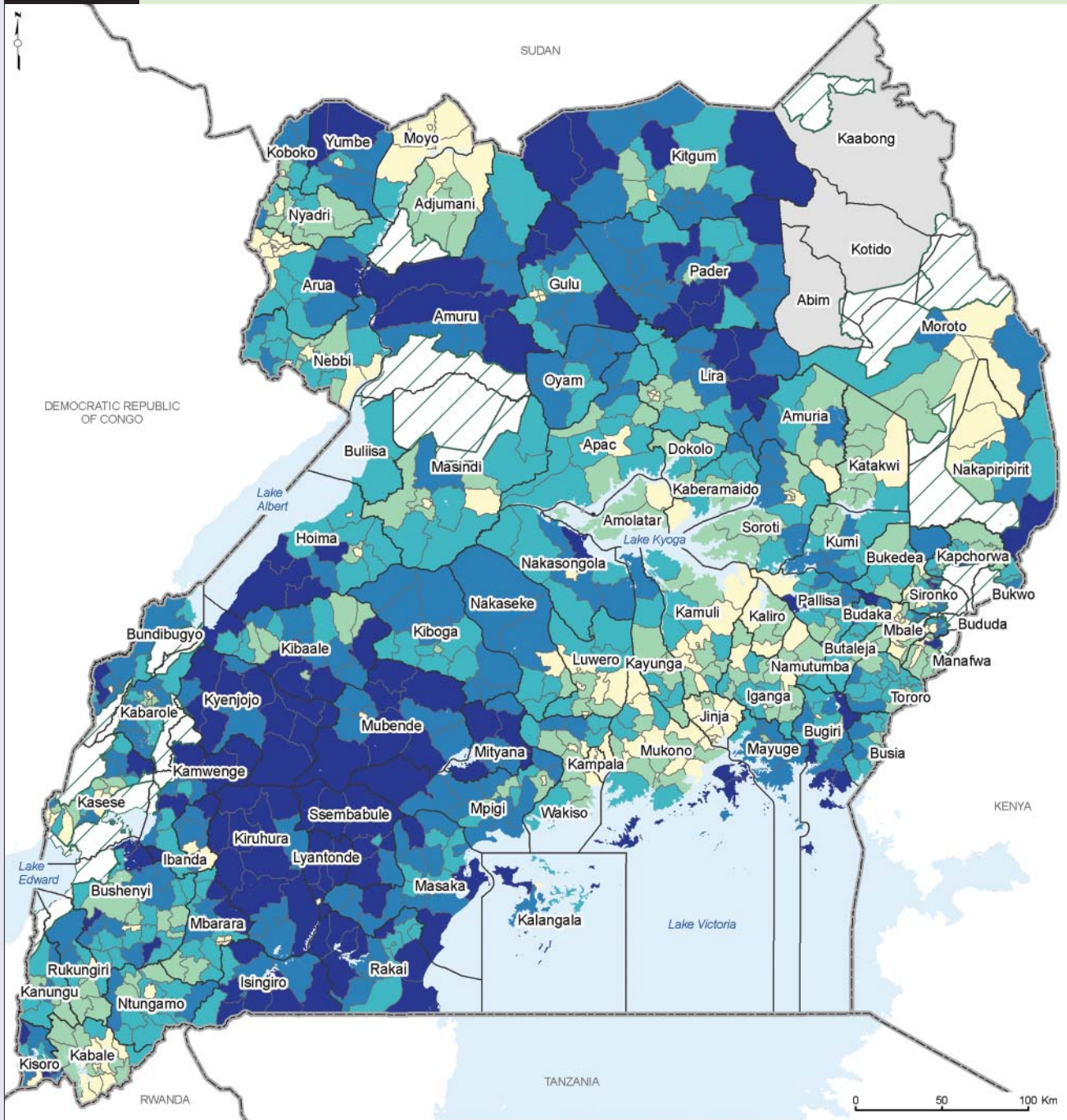
Even though this type of study can be performed with information from the Population and Housing Census, future analyses could be significantly improved by relying on more precise sanitation data from the Ministry of Health, ideally aggregated at the parish level.



Sources: International boundaries (NIMA, 1997), district administrative boundaries (UBOS, 2006b), subcounty administrative boundaries (UBOS, 2002a), water bodies (NFA, 1996; NIMA, 1997; Brakenridge et al., 2006), and households without improved sanitation facilities (UBOS, 2002b).

Map 12

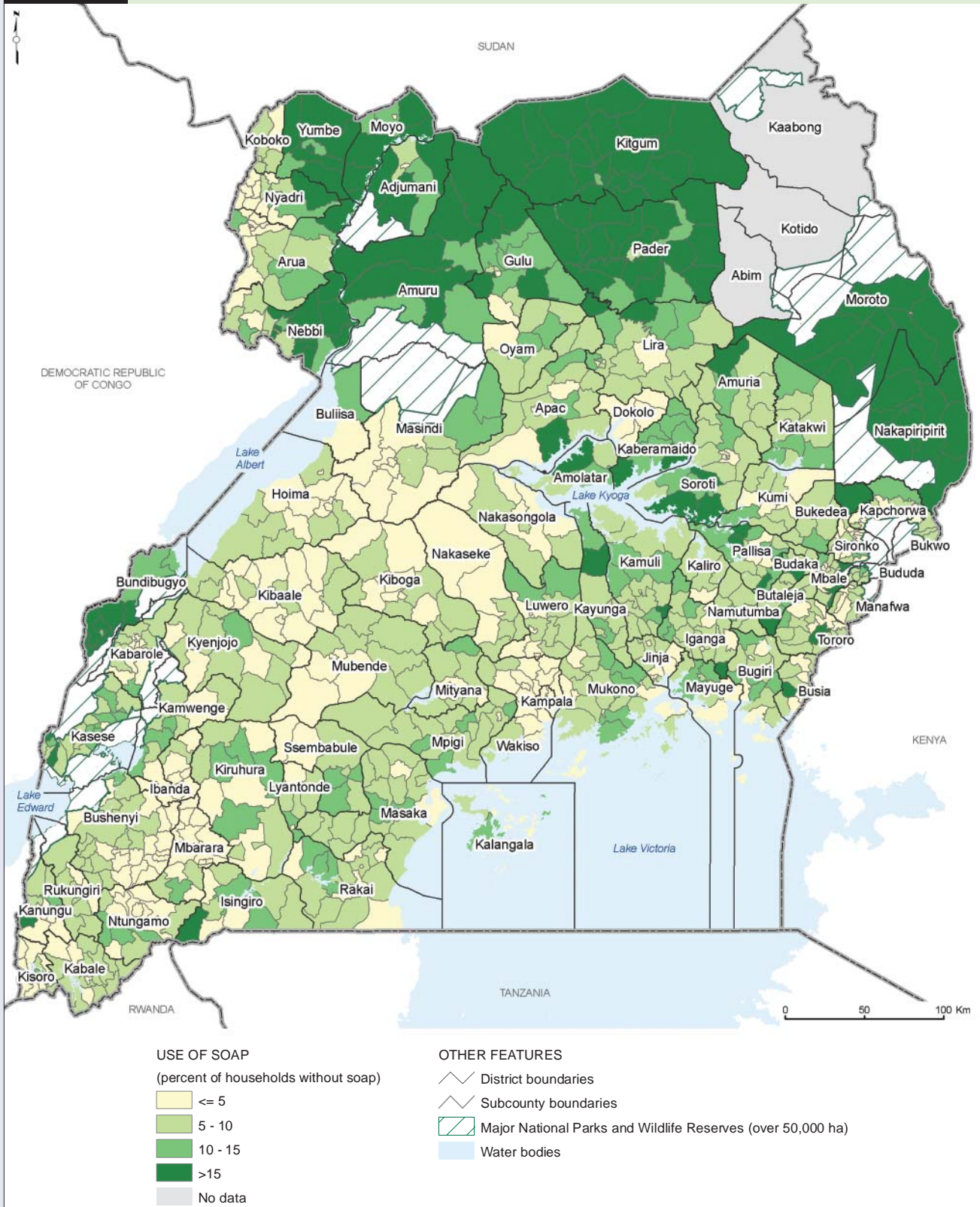
PERCENTAGE OF HOUSEHOLDS RELYING ON OPEN SOURCES OF DRINKING WATER, 2002



| SOURCE OF DRINKING WATER (percent of households relying on open sources for drinking water) | |
|---|---------|
| | <= 15 |
| | 15 - 30 |
| | 30 - 50 |
| | 50 - 70 |
| | > 70 |
| | No data |

| OTHER FEATURES | |
|----------------|---|
| | District boundaries |
| | Subcounty boundaries |
| | Major National Parks and Wildlife Reserves (over 50,000 ha) |
| | Water bodies |

Sources: International boundaries (NIMA, 1997), district administrative boundaries (UBOS, 2006b), subcounty administrative boundaries (UBOS, 2002a), water bodies (NFA, 1996; NIMA, 1997; Brakenridge et al., 2006), and percentage of households relying on open sources of drinking water (UBOS, 2002b).



Sources: International boundaries (NIMA, 1997), district administrative boundaries (UBOS, 2006b), subcounty administrative boundaries (UBOS, 2002a), water bodies (NFA, 1996; NIMA, 1997; Brakenridge et al., 2006), and percentage of households that cannot afford soap (UBOS, 2002b).

Conclusions and Recommendations

Mapping a Healthier Future: How Spatial Analysis Can Guide Pro-Poor Water and Sanitation Planning in Uganda explores how poverty, water, and sanitation maps can be combined to create new indicators and maps that can inform future investments. Analysis of this information can help to identify regions and communities with greater needs and thereby help to design more pro-poor interventions.

Such analyses are only possible because of the substantial efforts by government agencies to collect relevant data. The Directorate of Water Development at the Ministry of Water and Environment has consistently monitored investments in the drinking water infrastructure allowing them to provide suitable indicators for small administrative areas such as subcounties or parishes. At the same time, the Uganda Bureau of Statistics has been expanding its technical expertise to produce poverty maps for small administrative areas, which requires regular investments in high-quality and geographically referenced censuses and household surveys. The census is a valuable source of data on water, sanitation, and basic necessities (such as clothing, blankets, shoes, soap, and sugar) at subcounty and even parish level.

By integrating and conducting spatial analyses on these data, Ugandan analysts can strengthen water and sanitation investments and poverty reduction efforts. Similarly, given that analysts have the data available to conduct such work, Ugandan decision-makers can demand additional analytical returns for their data investments. The examples presented here illustrate how examination of spatial relationships between poverty, safe drinking water, improved sanitation, and better hygiene behavior can provide new information to help craft more effective—and more evidence-based—investments and poverty reduction efforts.

CONCLUSIONS

The main purpose of this publication is to encourage readers to carry out their own examination of poverty, water, and sanitation maps using the approaches and data sources described here. The process of compiling the data, producing the maps, and analyzing the map overlays has shown that:

- Analysts working with the Uganda Bureau of Statistics, Directorate of Water Development (Ministry of Water and Environment), and Health Planning Department

(Ministry of Health) can combine poverty maps with maps showing water, sanitation, and hygiene data (at subcounty level).

- From these map overlays, analysts can create new indicators and maps juxtaposing levels of poverty with levels of water and sanitation coverage.
- Analysts can use these indicators and maps to select geographic areas with specific poverty, water, and sanitation profiles for pro-poor targeting.
- Decision-makers can use these new indicators and maps to make more informed and transparent choices when prioritizing investments in water and sanitation efforts.

While the maps and analyses in this report are primarily illustrative in nature, they support the following conclusions:

Maps showing water and sanitation indicators at the subcounty level can highlight geographic differences in the achievement of national targets. This information is useful for planners at the district and national levels to identify disadvantaged areas and examine equity issues.

- ***Rural safe drinking water coverage:*** The performance of subcounties in achieving safe drinking water coverage is mixed, without any clear spatial patterns. About 11 million people live in the 323 subcounties that have not kept pace with the progress made at the national level.
- ***Improved sanitation coverage:*** There are strong geographic patterns, with lower coverage in northern and eastern Uganda, and higher coverage in central and southwestern parts of the country. Approximately one third of Uganda's rural subcounties (278), representing 6.2 million people or one quarter of the rural population, had not reached the rural target established for the first Health Sector Strategic Plan (HSSP I) by 2002.

Combining map-based census data related to water, sanitation, and hygiene can guide more integrated campaigns to decrease the incidence of waterborne diseases.

There is valuable information in the census that can be combined to gain insights and plan more integrated safe drinking water, sanitation, and hygiene efforts.

Poverty maps and maps of water and sanitation indicators can provide insights into the relationship between poverty, water, and sanitation.

- *Rural safe water coverage versus poverty levels:* There is no clear spatial relationship between levels of water coverage and poverty for the rural subcounties examined in this publication.
- *Improved sanitation coverage versus poverty levels:* Rural subcounties with higher poverty levels are associated with lower sanitation coverage rates. About half of the variance between these two variables can be explained by poverty rates. Other factors (not examined specifically in this publication), such as hygiene awareness, interest, and geology most likely contribute to the association as well.

The overlay analyses of poverty, water, and sanitation maps presented are most useful for identifying subcounties with similar poverty, water, and sanitation characteristics to guide geographic targeting.

- *Pro-poor targeting to improve rural safe drinking water coverage rates:* To identify rural subcounties optimal for pro-poor targeting requires careful examination of three poverty metrics: poverty rates, poverty densities, and the total number of poor people. In general, rural subcounties with high poverty rates and a high total number of poor are prime candidates for pro-poor targeting of drinking water investments.
- *Pro-poor targeting to boost rural improved sanitation coverage rates:* More densely settled and better-off rural subcounties were the first to achieve the HSSP I target and generally have higher average coverage rates of improved sanitation. Focusing future sanitation and hygiene interventions on rural subcounties that have fallen behind national milestones will provide two benefits: it will reduce inequities in access to improved sanitation and will contribute to Uganda's poverty reduction goal. The map overlays presented here identified three major types of rural subcounties reflecting similar poverty rates, poverty densities, and improved sanitation coverage levels. These three profiles could be used to tailor efforts to stimulate demand for improved sanitation and hygiene and target subsidies to construct sanitation facilities.

RECOMMENDATIONS

The primary objective of this publication is to highlight ideas on how census and poverty maps can be combined with water and sanitation data to produce new indicators and maps. But it also seeks to catalyze new and improved analyses and greater use of the resulting information in decision-making. Central and local government agencies can increase the likelihood of this by intervening on the supply side to make available more and better information,

and on the demand side to increase the use of these maps and analyses in government planning.

Strengthening the supply of high-quality data and analytical capacity will provide broad returns to future planning and prioritization of water, sanitation, and poverty reduction efforts. Priority actions to achieve this include:

- **Fill data gaps on sanitation and hygiene indicators; regularly update water, sanitation, and hygiene data; and continue supply of poverty data for small administrative areas.**

Future planning could be improved with the more precise sanitation data from the Ministry of Health, especially if they are available for small administrative areas and updated regularly. The proposed new key indicators for sanitation and hygiene promotion outlined in the National Environmental Health Policy will fill an important data gap and enhance planning and annual performance reviews. The regular update of detailed poverty maps is essential for tracking progress of poverty reduction efforts and to continue pro-poor targeting of resources, both for central and local government institutions.

- **Strengthen data integration, mapping, and analysis.**

Compared to the financial resources spent on data collection, fewer resources have been earmarked to analyze and communicate the data from the various sources explored in this publication. The in-house technical and analytical capacity within the Ministry of Health, Ministry of Water and Environment, and other government institutions to extract, map, interpret, and communicate these data requires strengthening through regular and focused training.

Promoting the demand for such indicators and spatial analyses will require leadership from several government agencies. Actions in the following four areas carry the promise of linking the supply of new maps and analyses with specific decision-making opportunities:

- **Incorporate poverty information in water, sanitation, and hygiene interventions and in regular performance reporting for the water and sanitation sector.**
 - This publication provides examples of how poverty maps can enrich analyses for the water and sanitation sector and lead to more precise geographic targeting. Follow-up analyses by the Directorate of Water Development (Ministry of Water and Environment) and the Health Planning Department at the Ministry of Health can build on these examples and include other variables (reflecting costs, efficiency, equity, etc.) that are relevant to prioritizing water, sanitation, and hygiene interventions. This would increase the likelihood that efforts to reach Uganda's 2015 water and sanitation targets continue to be pro-poor.

- Institutions in the water and sanitation sector should work closely with the Uganda Bureau of Statistics and the Ministry of Finance, Planning and Economic Development to discuss the pros and cons of different prioritization criteria assuming they have continued to build a solid information base (for national and local planners and representatives of local communities).
- Performance reporting for the water and sanitation sector would provide more comprehensive and decision-relevant information if data from the new poverty maps were incorporated. Future reports, for example, could include a poverty profile for the communities reporting changes in water and sanitation coverage rates.

■ ***Incorporate water, sanitation, and hygiene behavior information into poverty reduction efforts.***

Improved sanitation, safe drinking water supplies, and better hygiene behavior all affect well-being, livelihoods, and economic development. Strategic investments to improve environmental health could provide broad benefits reaching far beyond the water and sanitation sector. The Ministry of Finance, Planning and Economic Development could collaborate with the institutions in the water and sanitation sector to identify communities that are near a critical threshold where additional investment could bring widespread health benefits at the community level. Such a threshold could be defined by the community's current level of improved sanitation and other community indicators reflecting drinking water sources and hygiene behavior. Based on such an assessment, district and local communities could then work with the Central Government to lobby for changes in recurrent and development budgets (both from the Central Government and District Local Government). These new funds could be used to design geographically targeted campaigns to boost coverage rates and improve hygiene behavior in priority communities.

■ ***Promote more integrated planning and implementation of water, sanitation, and hygiene interventions.***

The short example in Box 8 demonstrates how combining water, sanitation, and hygiene indicators could result in new map overlays and more comprehensive analyses. Similar analyses incorporating data from various sectors should become a regular tool to plan more integrated interventions. Such an approach could help to make more efficient use of government and community resources and achieve greater health and well-being impacts. Districts in southeastern Uganda—because of their poverty, water supply, and sanitation characteristics—would be ideal for testing such an integrated approach.

■ ***Incorporate poverty maps and maps of water, sanitation, and hygiene indicators into local decision-making.***

The underlying data and maps discussed in the previous section are in most cases detailed enough to be useful in local decision-making. However, many local decision-makers still have difficulty accessing these data, conducting such analyses, and applying the findings to planning exercises. Initially, the Health Planning Department at the Ministry of Health, the MIS/GIS Unit at the Directorate of Water Development at the Ministry of Water and Environment, and the GIS unit at the Uganda Bureau of Statistics could provide technical and analytical support to a few pilot districts and incorporate poverty information into the design of future water, sanitation, and hygiene interventions. Later, such support could be given to all districts through ongoing and planned local government capacity building programs. In the same breath, it is recommended that the Ministry of Health integrates spatial analysis in the Health Management Information System (HMIS). The system should permit mapping of parish, subcounty, and county data (for analysis within a district) as well as mapping of district and regional data (for analysis at the national level).



References

- AREBAHONA, I. 2007. *Sustainable Financing for Water Supply and Sanitation: Ugandan Experience*, Presentation to 2nd OECD Water Task Team Meeting, Paris, 23rd October, 2007. Paris, France: OECD. (Online at <http://www.oecd.org/dataoecd/37/26/39541934.pdf>, last access 03/31/09)
- ASINGWIRE, N. AND D. MUHANGI. 2001. *Primary School Sanitation Research of GoU/UNICEF Sanitation Programme*. Kampala, Uganda: Government of Uganda.
- BATEMAN, O.M., AND S. SMITH. 1991. *A Comparison of the Health Effects of Water Supply and Sanitation in Urban and Rural Guatemala*. WASH Field Report No. 352. (Online at http://pdf.usaid.gov/pdf_docs/PNABK608.pdf; last access 03/31/09).
- BRAKENRIDGE, G.R., E. ANDERSON AND S. CAQUARAD. 2006. *Global Active Archive of Large Flood Events*. Data selected for Lake Victoria. Hanover, New Hampshire, USA: Dartmouth Flood Observatory. (Online at <http://www.dartmouth.edu/~floods>, last access 07/22/08)
- CHECKLEY, W., R. GILMAN, R. BLACK, L. EPSTEIN, L. CABRERA, C. STERLING, AND L. MOULTON. 1991. "Effect of water and sanitation on childhood health in a poor Peruvian peri-urban community." *The Lancet* 363 (9403), 112–118.
- CHECKLEY, W., L.D. EPSTEIN, R.H. GILMAN, L. CABRERA AND R.E. BLACK. 2003. "Effects of Acute Diarrhea on Linear Growth in Peruvian Children." *American Journal of Epidemiology* 157, 166–175.
- DIRECTORATE OF WATER DEVELOPMENT (DWD), MINISTRY OF WATER AND ENVIRONMENT. 2006. *Five Year Water and Sanitation Development Plan 2006–2011*. Kampala, Uganda: Government of Uganda, DWD.
- DIRECTORATE OF WATER DEVELOPMENT (DWD), MINISTRY OF WATER AND ENVIRONMENT. 2008. *Safe Drinking Water Coverage Rate Data for Rural Subcounties 2008*. Kampala, Uganda: Government of Uganda, DWD.
- ESREY, S.A. 1996. "Water, waste and well-being: a multi-country study." *American Journal of Epidemiology* 143(6), 608–623.
- ESREY, S.A., J.B. POTASH, L. ROBERTS, AND C. SCHIFF. 1991. "Effects of improved water supply and sanitation on ascariasis, diarrhoea, dracunculiasis, hookworm infection, schistosomiasis and trachoma." *Bulletin of the World Health Organization*, 69(5), 609–621.
- GUTIERREZ, E. AND Y. MUSAAZI. 2003. *The Changing Meaning of Reforms in Uganda: Grappling with Privatisation as Public Water Services Improve*. WaterAid Discussion Paper. London, United Kingdom: WaterAid. (Online at http://www.wateraid.org/documents/plugin_documents/waterprivatisationuganda.pdf, last access 06/11/09)
- HUTLEY, S.R., S.S. MORRISS, AND V. PISANI. 1997. "Prevention of Diarrhea in Young Children in Developing Countries." *Bulletin of the World Health Organization* 75(2): 165–74.
- JORGENSEN, P. 2005. *Poverty Targeting in Kenya Water and Sanitation Programme*. Presentation to Danida Water Sector Workshop in Accra, Ghana 1st Feb. (Online at www.danidadevforum.um.dk/NR/rdonlyres/98EDA6E8-0CA7-4C85-9885-A67924C3B25F/0/2006WP_PovertyKenya.doc, last access 03/31/09)
- MILLENNIUM ECOSYSTEM ASSESSMENT (MA). 2005. *Ecosystems and Human Well-Being: Wetlands and Water, Synthesis*. Washington, DC, USA: World Resources Institute. (Online at <http://www.maweb.org/en/Synthesis.aspx>, last access 07/21/08)
- MINISTRY OF FINANCE, PLANNING AND ECONOMIC DEVELOPMENT (MFPED). 2002a. *Uganda Participatory Poverty Assessment Process, Second Participatory Poverty Assessment Report, Deepening the understanding of poverty — national report*. Kampala, Uganda: Government of Uganda, MFPED. (Online at <http://www.finance.go.ug/uppap/docs/NationalRpt.pdf>, last access 06/10/09)
- MINISTRY OF FINANCE, PLANNING AND ECONOMIC DEVELOPMENT (MFPED). 2002b. *Poverty Indicators in Uganda*, Discussion Paper 4. Kampala, Uganda: Government of Uganda, MFPED.
- MINISTRY OF FINANCE, PLANNING AND ECONOMIC DEVELOPMENT (MFPED). 2003. *Uganda's Progress in Attaining the PEAP Targets in the Context of the Millennium Development Goals*, Background Paper for the Consultative Group Meeting Kampala, 14–16 May 2003. Kampala, Uganda: Government of Uganda, MFPED. (Online at http://siteresources.worldbank.org/UGANDAEXTN/Resources/CG_2003_GoU_PEAP_targets.pdf, last access at 06/06/09)
- MINISTRY OF FINANCE, PLANNING AND ECONOMIC DEVELOPMENT (MFPED). 2004. *Poverty Eradication Action Plan (2004/05–2007/08)*. Kampala, Uganda: Government of Uganda, MFPED. (Online at <http://www.finance.go.ug/docs/PEAP%202005%20Apr.pdf>, last access 02/11/08)
- MINISTRY OF HEALTH (MoH). 2004. *Strengthening Budget Mechanisms for Sanitation in Uganda, Sector Finance Working Paper*. Kampala, Uganda: Government of Uganda, MoH.
- MINISTRY OF HEALTH (MoH). 2005a. *National Environmental Health Policy*. Kampala, Uganda: Government of Uganda, MoH.
- MINISTRY OF HEALTH (MoH). 2005b. *Annual Health Sector Performance Report Financial Year 2004/2005*. Kampala, Uganda: Government of Uganda, MoH.
- MINISTRY OF HEALTH (MoH). 2008a. *Annual Health Sector Performance Report Financial Year 2007/2008*. Kampala, Uganda: Government of Uganda, MoH.
- MINISTRY OF HEALTH (MoH). 2008b. Personal communication, Environment Health Division. Kampala, Uganda: Government of Uganda, MoH.
- MINISTRY OF WATER AND ENVIRONMENT (MWE). 2006. *Water and Sanitation Sector Performance Report 2006*. Kampala, Uganda: Government of Uganda, MWE.
- MINISTRY OF WATER AND ENVIRONMENT (MWE). 2007. *Water and Sanitation Sector Performance Report 2007*. Kampala, Uganda: Government of Uganda, MWE. (Online at <http://www.watsanuganda.watsan.net/content/download/572/6603/file/WSSDPG%20Ug%20FINAL%20PROOF%20SPR%202007%20small.pdf>, last access 07/21/08)

- MINISTRY OF WATER AND ENVIRONMENT (MWE). 2008. *Water and Sanitation Sector Performance Report 2008*. Kampala: Government of Uganda, MWE. (Online at <http://www.irc.nl/docsearch/title/162521>, last access 03/31/09)
- MINISTRY OF WATER, LANDS AND ENVIRONMENT (MWLE). 1999. *The National Water Policy*. Kampala, Uganda: Government of Uganda, MWLE.
- NATIONAL FOREST AUTHORITY (NFA). 1996. *Land Cover GIS Database*. Kampala, Uganda: Government of Uganda, NFA.
- NATIONAL FOREST AUTHORITY (NFA). 2007. *Gazetted Areas GIS Database*. Kampala, Uganda: Government of Uganda, NFA.
- NATIONAL IMAGERY AND MAPPING AGENCY (NIMA). 1997. *Vector Map Level 0 (Digital Chart of the World)*, 3rd Edition. Fairfax, Virginia: NIMA.
- RICHARDS, T., E. DOERING, A. D'SOUZA, H. LANG, H. PLUMM, D. SCHAEFER, AND R. WERCHOTA. 2008. *Water Supply and Sanitation Sector Reforms in Kenya, Tanzania, Uganda and Zambia*. Dar es Salaam, Tanzania: Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH. (Online at <http://www2.gtz.de/dokumente/bib/gtz2008-0361en-water-supply-sanitation.pdf>, last access 06/11/09)
- RUDAHERANWA, N., L. BATEGA, AND M. BANGA. 2003. *Beneficiaries of Water Service Delivery in Uganda*. Kampala, Uganda: Economic Policy Research Centre (EPRC).
- RUTSTEIN, S. AND K. JOHNSON. 2004. *The DHS Wealth Index*. Calverton, MD, USA: ORC Macro.
- SGOBBI A. AND T.E. MURAMIRA. 2003. *Poverty Relevant Environmental Indicators. Status Report for Uganda, 2002*. Kampala, Uganda: Government of Uganda, Ministry of Finance, Planning and Economic (MFPED), Poverty Monitoring and Analysis Unit (PMAU).
- SHORDT, K. 2006. *Review of Safe Disposal of Feces*. The Hague, Netherlands: International Water and Sanitation Centre (Online at <http://www.irc.nl/content/download/28340/298243/file/Sanitation%20AED%20draft%208Jan06.pdf>, last access at 03/31/09).
- UGANDA BUREAU OF STATISTICS (UBOS). 2002a. *Uganda Administrative Boundaries GIS Database*. Kampala, Uganda: Government of Uganda, UBOS.
- UGANDA BUREAU OF STATISTICS (UBOS). 2002b. *2002 Uganda Population and Housing Census GIS Database*. Kampala, Uganda: Government of Uganda, UBOS.
- UGANDA BUREAU OF STATISTICS (UBOS). 2004. *Report on the Northern Uganda Baseline Survey 2004*. Kampala, Uganda: Government of Uganda, UBOS.
- UGANDA BUREAU OF STATISTICS (UBOS). 2006a. *Uganda National Household Survey 2005/2006, Report on the Socio-Economic Module*. Kampala, Uganda: Government of Uganda, UBOS. (Online at <http://www.ubos.org/index.php?st=pagerelations2&id=32&p=related%20pages%202:National%20Household%20Surveys>, last access 06/11/09)
- UGANDA BUREAU OF STATISTICS (UBOS). 2006b. *Uganda Administrative Boundaries GIS Database*. Kampala, Uganda: Government of Uganda, UBOS.
- UGANDA BUREAU OF STATISTICS (UBOS). 2007. *2002 Uganda Population and Housing Census, Census Atlas. Mapping Socio-Economic Indicators for National Development*. Kampala, Uganda: Government of Uganda, UBOS.
- UGANDA BUREAU OF STATISTICS (UBOS) AND INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE (ILRI). 2004. *Where are the Poor? Mapping Patterns of Well-Being in Uganda*. Kampala, Uganda: UBOS and ILRI. (Online at <http://www.ilri.org/ILRIPubAware/ShowDetail.asp?CategoryID=TS&ProductReferenceNo=TS%5F051101%5F002>, last access 02/11/08)
- UGANDA BUREAU OF STATISTICS (UBOS) AND INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE (ILRI). 2007. *Nature, Distribution and Evolution of Poverty and Inequality in Uganda*. Kampala, Uganda: UBOS and ILRI. (Online at http://www.ilri.org/ILRIPubAware/ShowDetail.asp?CategoryID=TS&ProductReferenceNo=TS_071224_001, last access 02/11/08)
- UGANDA BUREAU OF STATISTICS (UBOS) AND INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE (ILRI). 2008. *2005 Poverty GIS Database*. Kampala, Uganda: Government of Uganda, UBOS and ILRI.
- UGANDA BUREAU OF STATISTICS (UBOS) AND ORC MACRO. 2001. *Uganda Demographic and Health Survey 2000–2001*. Calverton, Maryland, USA: UBOS and ORC Macro.
- UGANDA BUREAU OF STATISTICS (UBOS) AND MACRO INTERNATIONAL INC. 2007. *Uganda Demographic and Health Survey 2006*. Calverton, Maryland, USA: UBOS and Macro International Inc.
- UN-WORLD WATER ASSESSMENT PROGRAMME (UN-WWAP) AND DIRECTORATE OF WATER DEVELOPMENT (DWD), UGANDA. 2005. *National Water Development Report: Uganda*, Second UN World Water Development Report. Paris, France: United Nations Educational, Scientific, and Cultural Organization. (Online at <http://unesdoc.unesco.org/images/0014/001467/146760e.pdf>, last access 06/10/09)
- WATER SUPPLY AND SANITATION COLLABORATIVE COUNCIL (WSSCC) AND WORLD HEALTH ORGANIZATION (WHO). 2005. *Sanitation and Hygiene Promotion: Programming Guidance*. Geneva, Switzerland: WSSCC and WHO. (Online at http://www.who.int/water_sanitation_health/hygiene/sanhygpromo.pdf, last access 03/31/09)
- WORLD BANK. 2005. *Uganda, Poverty Assessment Report (mimeo)*. No City: World Bank.
- WORLD BANK. 2008. *Overview. Poverty and the Environment, Understanding Linkages at the Household Level*. Washington, DC: 2008.
- WORLD HEALTH ORGANIZATION (WHO). 2001. *Macroeconomics and Health: Investing in Health for Economic Development*. Geneva, Switzerland: WHO. (Online at <http://libdoc.who.int/publications/2001/924154550X.pdf>, last access 03/31/09)
- WORLD HEALTH ORGANIZATION (WHO), COUNTRY OFFICE FOR UGANDA. 2001–2004. *IDS/Health Information Bulletin, No. 1 to No. 10*. (Online at <http://www.cdc.gov/idsr/bulletin-uganda.htm#uganda>, last access 03/31/09)
- WORLD HEALTH ORGANIZATION (WHO), REGIONAL OFFICE FOR AFRICA. 2006. *Country Health System Fact Sheet 2006 – Uganda*. (Online at http://www.afro.who.int/home/countries/fact_sheets/uganda.pdf, last access 03/28/09)

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