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# Seasonal Water Insecurity in Urban Philippines: Examining the Role of Gender, Resources, and Context

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# Seasonal Water Insecurity in Urban Philippines: Examining the Role of Gender, Resources, and Context

by

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**Acknowledgements**

It has long been part of my story that I spent six months as a young child in the Philippines, that my earliest memories in life begin there. It was the realization of a dream to spend time in the Philippines as an adult, further experience the heritage of my mother and our family, and share this with my own daughter as she crafts her identity and sense of the world we live in. There are so many to thank for helping bring this dream and this dissertation to life.

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**Abstract of the Dissertation**

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by

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Doctor of Philosophy in Social Work

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Professor Michael Sherraden, Chairperson

Seasonal water insecurity is a complex problem of growing concern in many urban areas, due in part to urbanization, population growth, and environmental change. Using multiple research methods, this study documents the extent and nature of seasonal water insecurity among and within households in an urban neighborhood in Baguio City, the Philippines. This study also examines how individual and household factors—gender and financial, physical, and social resources—and contextual factors may relate to water insecurity by season. Data collection methods include archival research, informal interviews, randomly-sampled household surveys (N=396), randomly-sampled individual subsurveys (N=291), and in-depth interviews (N=18).

This study conceptualizes and measures water insecurity along three dimensions: quantity, quality, and accessibility of water for everyday household and individual use. Key findings are that water insecurity varies widely among households in the study neighborhood, and to some extent, within households. These differences are more pronounced in the dry than rainy season. Household financial and physical resources are associated with some dimensions of water insecurity, also with seasonal variation. In general, quantitative methods in this study find

few associations between water insecurity and gender or household social resources; relationships among these variables are found, however, using qualitative methods. Neighborhood and municipal factors such as geography, water utility characteristics, and population and environment trends are discussed.

This study contributes an important documentation of the heterogeneities in water insecurity that exist among a population and which are often masked by municipal, regional, and national statistics. Study findings also have implications for programs and policies designed to bolster the factors associated with reduced water insecurity by season—in urban areas of the Philippines, and in other countries expecting to experience seasonal water insecurity for the first time or to a greater extent than in the past.

## I. Introduction

Environmental change results from human and non-human activity, and is always occurring. Seasonal rains vary, trees are planted or cut down, and soil quality improves or erodes. Since the 1980s, scientists and the public have become increasingly aware of the global scale of some environmental changes, such as biodiversity loss, freshwater decline, and climate change (Hempel, 2006; Leichenko & O'Brien, 2008). These changes threaten people's ability to secure basic needs of food, clean water, and adequate shelter, and have broader implications for social development, economic development, social justice, and human rights (Humphreys, 2009; United Nations Development Programme, 2007).

In many urban areas, environmental change coupled with urbanization and population growth have contributed to seasonal water insecurity—a problem of growing concern worldwide (Kjellstrom & Mercado, 2008; Kundzewicz et al., 2007; Vairavamoorthy, Gorantiwar, & Pathirana, 2008). A conservative estimate of the 2000 global urban population affected by seasonal water shortage alone was 312 million people. By 2050, this number is projected to reach 1.3 billion (McDonald et al., 2011). The consequences of water insecurity are well-known and include increased morbidity, mortality, emotional distress, financial loss, and social and political conflict (Aiga & Umenai, 2002; Allouche, 2011; Howard & Bartram, 2003; United Nations Development Programme, 2006; Wutich & Ragsdale, 2008).

Despite the scope and projections for seasonal water insecurity in urban areas, we know surprisingly little about the social dimensions of this problem. The extent and nature of dry versus rainy season insecurity among households and individuals, and multi-scale analysis of the individual, household, and contextual factors associated with each have been little studied in urban water research to date (Cheng, 2013; Hadjer et al., 2005; Wutich and Ragsdale 2008).

To advance this understanding, this study uses multiple methods to document seasonal water insecurity in an urban neighborhood in Baguio City, the Philippines. This documentation is important because municipal, regional, and national statistics may mask heterogeneities in water insecurity that exist among a population (Cheng, 2013; Satterthwaite, 2003). This study also examines how specific individual and household factors, and broader contextual factors, relate to water insecurity by season. Such examination can inform programs and policies designed to address the most salient factors that emerge (Moser & Satterthwaite, 2010; Ribot, 2010).

Combining data collection methods of archival research, informal interviews, randomly-sampled household surveys (N=396), randomly-sampled individual subsurveys (N=291), and in-depth interviews (N=18), this study addresses the questions:

Q1. How do the extent and nature of household water insecurity compare during the dry and rainy seasons?

Q2. Within households, how do the extent and nature of individual water insecurity and individual water-related behaviors compare during the dry and rainy seasons?

Q3. How are individual and household factors—specifically, gender and financial, physical, and social resources—associated with:

   a. Household water insecurity during the dry season?

   b. Household water insecurity during the rainy season?

Q4. In what ways do neighborhood or municipal contextual factors relate to household water insecurity during the dry and rainy seasons?

Q5. How do individuals and households acquire and use resources to mitigate water insecurity, within the given neighborhood and municipal context? Is this acquisition and use gendered in ways that matter for program and policy development?

This study takes place in a particular locale—an urban neighborhood in Baguio City, the Philippines. Findings, however, may help inform future research and program and policy development in other urban areas of the Philippines, other developing countries, and also developed countries that are expected to experience seasonal water insecurity for the first time or to a greater extent than in the past. Indeed, one motivation for this study is to generate knowledge from a developing country that can be compared to and potentially applied to problems in more developed countries. This motivation stems from the standpoint that the production and flow of knowledge about environmental change should go in multiple directions.

This study is organized as follows. In Section II, I summarize the background literature on water security and theoretical frameworks relevant to this study. I then describe the Philippines and Baguio City in Section III. In Section IV, I describe my research methods, from gaining neighborhood entry through analysis of each data source collected. Section V describes the study neighborhood, Pinget. Section VI presents results for research questions Q1-Q2, followed by results for Q3-Q5 in Sections VII-IX, respectively. Finally, I discuss implications and conclusions of the study in Section X.

## II. Background

### Water Insecurity

*Definition and Measurement*

This study examines water insecurity along three dimensions: quantity, quality, and accessibility of water for everyday household and individual use. More explicitly, water insecurity can be defined as the lack of access "by all people, at all times, to adequate water for an active and healthy lifestyle," (Wutich & Ragsdale, 2008, p. 2117; see also Bickel, Nord, Price, Hamilton, & Cook, 2000). This definition includes water for basic needs—drinking, cooking, personal hygiene, and sanitation—and other needs such as laundry, household cleaning, and backyard gardening. This definition also recognizes the dimensions of water insecurity—quantity, quality, and accessibility—which can and should be measured through both objective and subjective means (Ennis-McMillan 2001; Gleick, 1998; Hadley & Wutich, 2009; Satterthwaite, 2003). By objective means, I refer to quantifiable measures that can be compared to some standard (e.g., 50 liters per capita per day as a basic water requirement; Gleick, 1998). By subjective means, I refer to perceptual or experiential measures of water insufficiency, inadequacy, or hardship. Indeed, one contribution of this study is its use of multiple measures of water insecurity, across dimensions and measurement types. This multi-dimensional, multi-method approach to measuring water insecurity is rare in the literature, but is needed to provide a more comprehensive understanding of the extent and nature of the problem (Hadley & Wutich, 2009).

*Seasonal Aspects*

Seasonal aspects of water insecurity have been little addressed in urban water research to date. Seasonality, however, is of increasing importance given anticipated environmental changes

of more intense rainy seasons and prolonged dry seasons in many areas (Cruz et al., 2007; Muller, 2007; Schneider et al., 2007; Yusuf & Francisco, 2009). During rainy seasons, increased precipitation can provide a valuable source of rainwater for households or communities when harvested. Increased flooding and landslides, however, may adversely affect water quality and accessibility (Hamdan, 2009; Islam, Chou, Kabir, & Liaw, 2010; Kundzewicz et al., 2007; Pajuelas, 2000; Rodrigo, Sinclair, Forbes, Cunliffe, & Leder, 2011). During dry seasons, rationing of municipal water may become more severe, and competition over other sources such as privately delivered water, bottled water, and urban springs may increase (Rosenberg, Talozi, and Lund, 2008; Vairavamoorthy, Gorantiwar, & Pathirana, 2008).

Research conducted in places like this study—Baguio City, the Philippines, where seasonal water insecurity has existed for many years—can inform policies and programs locally and in places expected to experience seasonal water insecurity in the near future (Adger et al., 2007; Kundzewicz et al., 2007; Rola & Francisco, 2004). To advance such knowledge, this study draws on environmental change, social vulnerability, and gender and development scholarship to guide its examination of seasonal water insecurity. Together, these bodies of literature point to the importance of studying social and environmental problems like water insecurity with a multi-scale lens that includes individual, household, and contextual factors (Turner et al., 2003; Ribot, 2010), analogous to the systems perspective in social work research (Coates, 2003).

**Individual and Household Factors**

It is widely recognized that the consequences of environmental change are not and will not be experienced equally among or within populations (Mearns & Norton, 2010; Schneider et al., 2007; United Nations Development Programme, 2007). At the individual and household level, gender and resources are theorized to matter for vulnerability and adaptation to a range of

environmental change outcomes, including seasonal water insecurity as examined in this study (Denton, 2002; Mearns & Norton, 2010; Prowse & Scott, 2008).

*Gender*

Gender refers to "socially produced differences between being feminine and masculine," (Holmes, 2007, p.2). Women and female-headed households are often considered more vulnerable to environmental change outcomes than men and male-headed households, and gender roles and relations are increasingly studied as explanatory factors (Demetriades & Esplen, 2010; Denton, 2002; MacGregor, 2009).

On gender and water, we know that gender roles and relations are important for understanding water access, needs, and use in urban and rural societies worldwide (Loftus, 2007; Ray, 2007; Sultana, 2009; Wallace & Coles, 2005). In many areas, women serve as household water managers and primary water users—due to gendered responsibilities of cooking, childcare, and cleaning—and draw on complex preferences and strategies to conserve water when necessary or prescribed (Cleaver 1998; Crow & Odaba 2010; Crow & Sultana 2002). In some contexts, however, men may also serve as household water managers or play important roles in water collection (Hawkins & Seager, 2010; Mason, 2012).

Water-related conditions, politics, and governance can also shape gender norms, and may exacerbate or reduce gender inequalities (Franks & Cleaver, 2007; Truelove, 2011). Women may lose income more often than men, for example, due to greater time spent collecting or waiting for water (Wutich, 2009). Alternatively, women as primary household water managers may become more engaged in political struggles with local officials and water agencies, leading to "alternative freedom projects" for women, as described by Loftus (2007, p. 41).

An important note from the gender and development literature is that we still know little about how gender may interact with other key characteristics—such as age, ethnicity, and resources—to produce "intersecting inequalities" that may matter for understanding heterogeneities of outcomes or conditions (Dankelman, 2002; Demetriades, & Esplen, 2010, p. 140). Lorber's (2010) argument that the concept of *intersectionality* should be *a priori* incorporated into research designs informs this study's focus on how gender and resources may intersect, as relevant for understanding seasonal water insecurity in the study setting.

*Resources*

Resources are the personal characteristics, material objects, and social relationships that people use to progress toward goals (Diener & Fuijita, 1995). In the broader development literature, and increasingly in scholarship on vulnerability and adaptation to environmental change, a subset of resources are often examined; namely, assets—the stocks of financial, physical, human, social, and natural capital that people use to buffer crisis and advance well-being, particularly across generations (Moser, 2007; Sherraden, 1991). In this study, however, I use the broader category of resources because (1) the resources needed to mitigate water insecurity may be a combination of flows (e.g., income) and stocks (e.g., savings), and (2) water insecurity may be conceived more as a problem of everyday, immediate well-being, rather than long-term transformation or development across generations.

From the broader literatures on vulnerability, development, and environmental change, we know that different types of resources can protect people from environment- and non-environment-related problems of various kinds (Blaikie et al. 1994; Drèze & Sen 1989; Moser & Satterthwaite, 2010; Prowse & Scott 2008). Financial resources like income provide a means to secure basic necessities of food, water, and shelter under typical conditions, and in the context of

environmental change (United Nations Development Programme, 2007). Investment in physical resources like climate-resilient homes may lower the risk of loss during extreme weather events (Molua, 2009). Social resources such as reciprocal child care networks can provide households with more time and opportunity to work and earn income (Cruz-Torres, 2001). Also, resources may be used for short-term coping or long-term adaptation (Prowse & Scott, 2008).

*Study Contributions: Individual and Household Factors*

Studies that examine how specific individual and household factors—such as gender and particular resources—relate to environmental change are increasing in number. To date, however, few studies have focused on specific environmental change outcomes, and just two have examined water insecurity in urban areas (Wutich 2009; Wutich & Ragsdale, 2008). Instead, most examine broad environmental change phenomena such as flooding, drought, climate variability, or disasters generally. To be most useful to policymakers, new research should focus on particular outcomes and test theoretically-driven predictors of such outcomes (Moser & Satterthwaite, 2010; Prowse & Scott, 2008; Ribot, 2010).

This study furthers the literature in this area by (1) focusing on the particular outcome of seasonal water insecurity, (2) testing how the gender of the household water manager and specific financial, physical, and social resources are associated with water insecurity by season, and (3) examining how gender may interact with resource acquisition and use to mitigate seasonal water insecurity. The selection of specific resources examined in this study is informed by the pilot study for this dissertation (Mason, 2012) and the few studies that have included some explicit analysis of resource types and urban water insecurity to date (Crow & Odaba, 2010; Wutich & Ragsdale, 2008). Thus, financial resources examined in this study are income and savings, which may be used to pay for water, storage containers, or piped connections to the

municipal water supply. Physical resources are the materials and objects used to store or access water—tanks, drums, piped connections, and homes. Social resources are the relationship networks that people may use to obtain water, or obtain the financial or physical resources needed to obtain water.

**Contextual Factors**

Contextual studies of water insecurity in urban areas suggest that water supply and access are often related to socioeconomic conditions and political structures in complex ways (Fisher, 2008; Chng, 2008). Recent research has also examined how individual and household water-related decisions—intended to mitigate insecurity at a micro level—may increase water insecurity at a higher level like municipality (Srinivasan, Seto, Emerson, & Gorelick, 2013).

Ideally, social and environmental problems such as seasonal water insecurity should be examined in a series of nested scales, with causal factors identified and examined at all scales, from local to global, and including social, economic, political, and environmental factors (Cutter, 2006; Turner et al., 2003). This approach resonates with social work's systems perspective (Coates, 2003). As Turner et al. (2003, p. 8076) note, however:

> This ideal…is unrealistic. Real-world data and other constraints invariably necessitate a "reduced" vulnerability assessment. Nevertheless, analysts must remain aware that vulnerability rests in a multifaceted coupled system with connections operating at different spatiotemporal scales …

Researchers must thus delineate boundaries for which scales will be examined in a particular study, with the goal of better understanding why certain people or groups are more likely to experience a particular outcome than others (Adger, 2006; Ribot, 2010).

*Study Contributions: Contextual Factors*

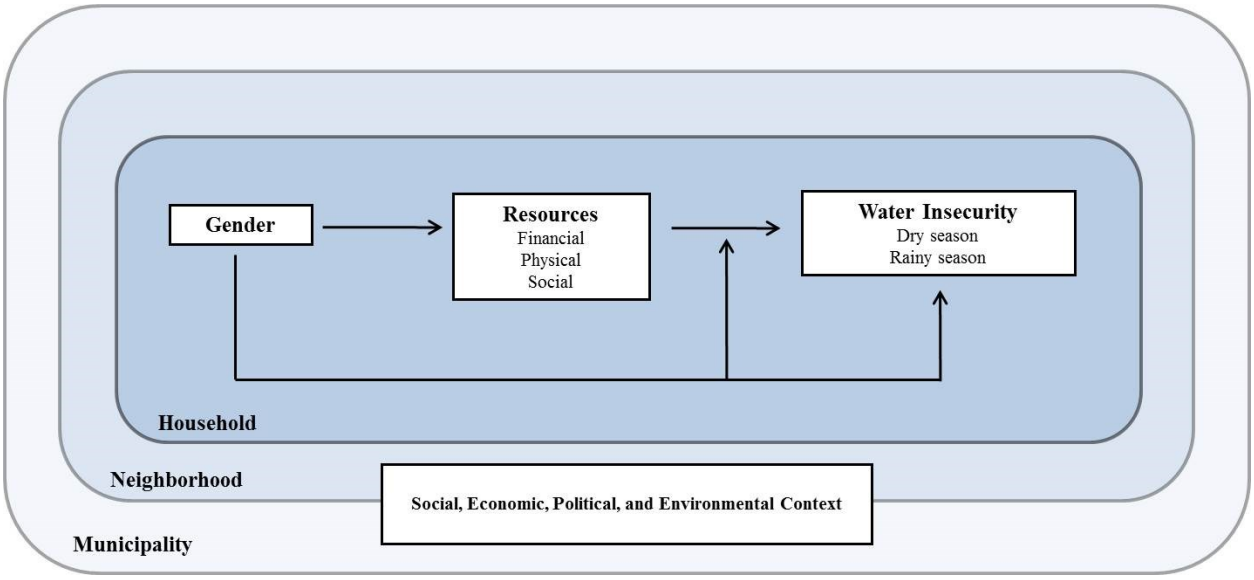
This study's main contribution to understanding how contextual factors relate to seasonal water insecurity stems from the choice of study setting—Baguio City, the Philippines. Urban water scholarship has often focused on cities with populations of 10 million people or more. Medium and smaller sized cities though, like Baguio City, are growing rapidly and already house over 50% of the global urban population (Biswas, 2006; United Nations Population Division, 2010). Research in areas like Baguio City can be innovative and productive for understanding how context matters in non-megacities that nonetheless are experiencing significant population growth during the 21st century. For additional background on Baguio City, see Section III.

Another contribution of this study is its explicit analysis of household, neighborhood, and municipal scales in understanding seasonal water insecurity. In many environmental change, vulnerability, or adaptation studies, the "local" scale is the neighborhood or community. This study, meanwhile, places emphasis on household and within household heterogeneities of experience, and attempts to understand these heterogeneities given household gender and resource characteristics, plus household nesting in higher scales. This kind of multi-scale analysis is surprisingly rare in research on the social aspects of environmental change to date (Ribot, 2010; Srinivasan, Seto, Emerson, & Gorelick, 2013).

**Conceptual Framework**

Drawing on the above scholarship, this study uses the conceptual framework in Figure 1 to examine seasonal water insecurity in urban Philippines. This framework suggests that the gender of the household water manager and household resources are associated with water

**Figure 1. Conceptual Framework**




insecurity, with the potential for relationships to vary by season. The framework also indicates that households are nested within the study neighborhood and municipality, each of which has contextual aspects that must be considered in order to understand the heterogeneities in seasonal water insecurity that may emerge, and the possible differences in how gender and resources matter for water insecurity by season. Of note, implicit in the framework is that *gender* reflects the interaction of sex (being a woman or man) with formal laws and informal norms to produce female or male conditions, behaviors, and rights (Deere & Doss, 2006; Lorber, 2010). Given the above conceptual framework, hypotheses for each research question, when appropriate, are presented in Section IV.

## III. Study Setting

### The Philippines

*Brief History*

The Philippines is an archipelago of over 7,000 islands in Southeast Asia, first inhabited by migrants from present day Australia, Indonesia, China, and Taiwan (Francia, 2010). Until the 16th century, the Philippines consisted mostly of dispersed villages or *barangays* ranging from a few dozen to a few hundred households in size. The Philippines was culturally and linguistically diverse, with over 170 languages spoken by different ethnic groups (Francia, 2010; Tyler, 2009).

Beginning in the 16th century, the Philippines experienced almost 400 years of colonial rule. From 1565 to 1898, the Philippines was colonized by Spain. Catholic institutions spread across much of the country, and a ruling class of Spanish and Filipino elite emerged (Francia, 2010). Following Philippine nationalism in the late 19th century and the Spanish-American War, the Philippines gained independence from Spain in 1898, only to become a colony of the United States. Although Filipinos resisted further imperialism, U.S. sovereignty was established by 1902 and persisted through World War II. In 1946, the United States relinquished control of the Philippines and national independence was secured (Abinales & Amoroso, 2005).

*Current Status*

Today, the Philippines is a rapidly growing and urbanizing nation. The total population of 95 million people is projected to reach 126 million people by 2030. Almost 50% of the population is urban (United Nations Development Programme, 2011). By 2050, the Philippines is expected to rank 10th in total urban population worldwide and 20th in urban population percentage (United Nations Population Division, 2010).

Per the United Nations' Human Development Index, the country has a medium level of human development that varies across and within regions (Philippine Human Development Network 2009; United Nations Development Programme, 2011). Literacy rates are high: 82.5% at the secondary level and 28.7% at the tertiary level. About 27% of the population, though, lives below the national poverty line, and the income gap between rich and poor is large. The Philippines' most recent Gini coefficient was 44.0, higher than the U.S. value of 40.8 (United Nations Development Programme, 2011).

*Natural Environment*

The Philippines is a tropical nation with an abundance of natural resources. These resources traditionally supported livelihoods such as small scale fishing and farming. Increasingly, however, foreign and domestic corporations have "plundered" these resources through industries such as fruit plantations, gold mining, and commercial fishing (Broad & Cavanagh, 1993). Environmental degradation is common throughout the Philippines, and there is poor environmental quality in many urban areas (Lagarde, 2006).

The Philippines is also a "hot spot" for natural hazards. The country experiences several tropical cyclones (i.e., tropic depressions, tropical storms, and typhoons) each year, and is affected by the El Niño Southern Oscillation (ENSO) phenomenon. Climate change and its consequences are of growing concern to policymakers and the public (Pajuelas, 2000; Cruz et al., 2007; Philippine Institute for Development Studies, 2009). Since 2004, the Philippines has experienced several years of either extreme rainfall or prolonged dry periods, although direct links between human induced climate change and these particular events are not assumed (Yumul, Cruz, Servando, & Dimalanta, 2011).

*Water Access and Governance*

In the global water literature, access to an improved source of water is a common proxy for water security or progress toward water-related development goals (UNICEF and World Health Organization, 2012). In the Philippines, national estimates are 70 to 85% of the population has such access. This measure likely overstates water security, however, because water from improved sources may be of poor quality, inaccessible on a regular basis, supplied in insufficient volumes, or require excessive collection times (Bradley, 2004; Gleick, 2009; Hadley & Wutich, 2009; National Statistics Office and ICF Macro 2009; Satterthwaite, 2003). Also, seasonal rainfall variation, population growth, and urbanization mean than people in many areas of the Philippines routinely experience water insecurity on a seasonal basis or even year round (Cheng, 2013; Fisher, 2008; Rola & Francisco, 2004).

At the national level, water utilities are regulated by the National Water Resources Board (NWRB). The NWRB and related water institutions in the Philippines are generally considered fragmented and weak (Fisher, 2008). The NWRB oversees municipal water utilities and issues water-related permits such as for private deep well construction. The Department of Environment and Natural Resources (DENR), another national agency but with regional and provincial offices, oversees watershed lands with the goals of aquifer recharge and groundwater protection, among other responsibilities (Fisher, 2008).

*Gender and Household Dynamics*

Philippine gender roles and relations are often described as more egalitarian and complementary than in many other developing countries, and measures of women's status are often relatively high (Angeles 2001; Chant, 2007; Eder 2006). Women have higher life expectancy, literacy rates, and education enrollment ratios than men (United Nations

Development Programme 2009). The Philippines has also scored relatively well on the Gender-Related Development Index and the more recent Gender Inequality Index (Philippine Human Development Network 2009; United Nations Development Programme 2011).

Some of these broad gender characteristics have roots in Philippine pre-colonial culture. Contrary to many assumptions about non-Western societies, Philippine women experienced an elevated status and near equality with men prior to Spanish colonization (Anderson, Reed, & Sardalla, 1996; Jayawardena, 1986; Mananzan, 1989; Santiago, 1995). With the arrival of Spain, the status of Filipina women changed significantly. Spanish rule introduced patriarchal ideas about gender roles, based in Roman Catholic doctrine, and imposed a new Civil Code that eliminated women's rights to bequeath property, pursue economic activity without spousal consent, and engage in public office (Jayawardena, 1986; Santiago, 1995). When colonial power shifted from Spain to the U.S., some improvement in women's status was observed, particularly through the spread of free, public education for both sexes and the Philippine women's suffrage movement (Anderson, Reed, & Sardalla, 1996; Maranan, 1989; Santiago, 1995).

Today, gender and household dynamics in the Philippines seem to have both patriarchal and egalitarian aspects. Typically, a Filipino male is considered the head of household and is expected to provide for and protect his family (Rubio & Green, 2011). Filipina women are still responsible for most domestic tasks and childrearing, often in addition to informal or formal employment outside the home (Chant, 2007; Illo & Pineda Ofreneo, 1999). Gender divisions in employment are common, and the ratio of female-to-male earned income is 0.61 (United Nations Development Programme 2007). Whereas feminine characteristics of efficiently managing the household and maintaining strong family ties are expected of women, masculine characteristics of spending time and money outside the home (a so-called "vice allowance") are admired among

men (Chant, 2007; Eviota 1992; Angeles 2001). At the same time, however, married men are expected to share decision-making or defer to their wives in household affairs, particularly in women's management of the household budget (Chant, 2007; Rubio & Green, 2011).

## Baguio City

### *Brief History*

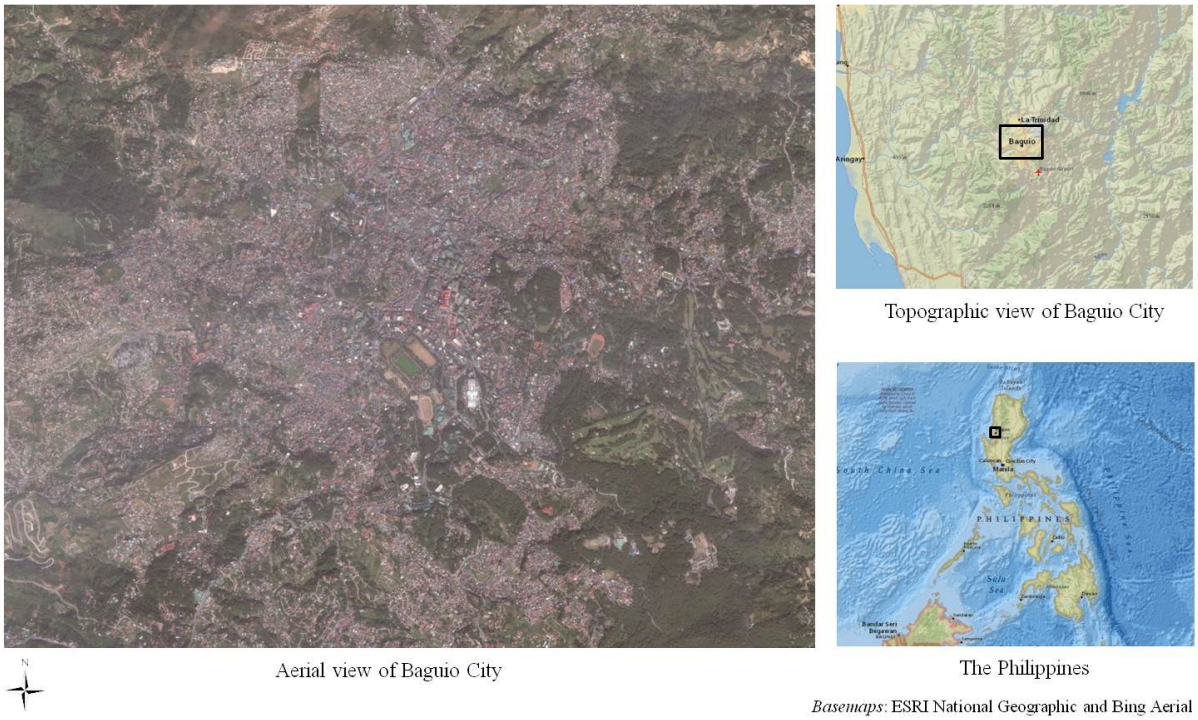
Baguio City is located in the mountainous Cordillera Administrative Region (CAR) in northern Philippines (Figure 2). The area's first settlers were indigenous Ibaloi families who raised small livestock and planted subsistence crops. In 1909, during U.S. occupation of the Philippines, Baguio City became a chartered city with land area of 49 square kilometers. Designed for 25,000 residents, the city initially grew as a summer resort for the Filipino elite and U.S. officials and military personnel (Cruz et al., 1993; Finin, 2005).

During World War II, Baguio City was destroyed. Post-war reconstruction led to rapid population growth of formal and informal settlers as the city grew into a hub for vegetable trading, export-oriented manufacturing, and higher education. Mining communities were also established nearby (Castro-Palaganas, 2010; Cruz et al., 1993). Baguio City quickly outgrew its planned capacity of 25,000 residents, and most development was unplanned. Tensions between formal and informal settlers often arose. Government response to the "squatter problem" ranged from demolition of houses and prosecution of squatters, to relocation of squatters to lands authorized by national law or local ordinance (Bennett & Hamada, 2009; Cruz et al., 1993).

### *Current Status*

Today, Baguio City is a densely populated, highly urbanized city with a population of over 300,000 people (National Statistics Office, 2007). The city is organized into 129 administrative *barangays* or neighborhoods. Baguio City's social fabric is diverse and includes

**Figure 2. Baguio City, the Philippines**




Aerial view of Baguio City

Topographic view of Baguio City

The Philippines

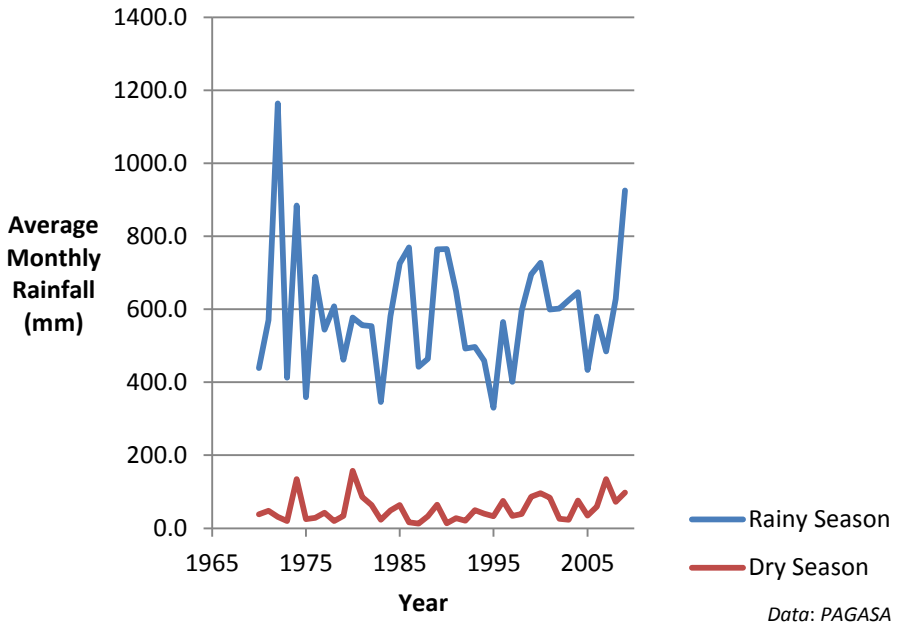
*Basemaps*: ESRI National Geographic and Bing Aerial

"old-timer" Filipino elites, indigenous ethnic migrants, formal and informal settlers, college students, and families of all income levels. The city continues to experience high population growth, attracting migrants from indigenous ethnic CAR communities and, increasingly, from other parts of the Philippines (Cruz et al., 1993; Finin, 2005).

*Natural Environment*

Baguio City is at an elevation of 1500 meters. The area has a cool climate (average annual temperature is 18° C/65° F) and two seasons: dry from November to April, and wet from May to October (Yumul, Cruz, Servando, & Dimalanta, 2011). From 1970-2009, average rainfall was 590 mm per rainy season month and 52.8 mm per dry season month (Figure 3). On average, five tropical cyclones pass through Baguio City each year (Salvidar-Sali & Einstein, 2007).

**Figure 3. Baguio City Average Monthly Rainfall, by Season (1970-2009)**




Baguio City's natural environment has undergone substantial change, as many forested and open spaces have been built up with residences and commercial buildings, including on slopes as steep as 31-50% grade (Estoque & Murayama, 2012; Salvidar-Sali & Einstein, 2007). Due to geologic characteristics, high rainfall, and population and land use trends, Baguio City is highly vulnerable to landslides that threaten lives and property (Salvidar-Sali & Einstein, 2007). National laws and local ordinances have been passed to protect and rehabilitate remaining forested areas and watersheds. Enforcement of these regulations, however, is often limited or difficult (Estoque & Murayama, 2012; Resurrection, 1978).

*Municipal, Commercial, and Other Water Sources*

The Baguio Water District (BWD) is a quasi-governmental corporation authorized by the national Provincial Water Utilities Act of 1973 to provide municipal water service in Baguio City. As of December 2011, BWD provided service to an estimated 206,500 people through

approximately 34,400 metered connections. BWD operates over 40 deep wells which pump water from underground aquifers, taps water from three natural springs, and harvests rainwater in a municipal rain basin. Production is an estimated 50,000 cubic meters of water per day, with system loss of 40% (BWD 2011 annual report).

BWD water is chlorinated and distributed to metered connections though motorized pumps and gravity-driven systems. Distribution is intermittent. During the rainy season, a sample water supply schedule to a residential area might be three days per week, four hours per day. During the dry season, this schedule is often interrupted in unpredictable ways. El Niño related drought also affects BWD water distribution. In 2003 and 2010, BWD implemented more stringent water rationing earlier in the year, due to insufficient recharge of underground aquifers. BWD anticipates that tighter rationing may become more frequent given climate change projections for Baguio City (Royeca personal communication, 2012).

Although BWD water is considered an improved source, quality at point-of-use is suspect. Aging infrastructure and intermittent supply may allow contaminants to enter distribution pipes when supply is turned off. Most households do not drink BWD water, preferring instead to buy purified water in 5-gallon jugs from commercial water vendors. Also, households that do not have access to BWD, or who do not receive enough supply from BWD, may purchase water from private water delivery companies. These companies transport water via tanker trucks, selling water to households on a per drum basis. Natural springs, community deep wells, urban streams, and rainwater are additional water sources available to some households. Many households manage water portfolios with different water sources allocated to different household needs (Mason, 2012).

BWD estimates that average water demand in Baguio City is 100 liters per person, per day. Due to continued urbanization, population growth, and changing consumption patterns, water demand is projected to double by 2026 (Muni & Peñalba, 2011). BWD's perceived challenges to meeting this demand include BWD production capability, system loss, informal settlement on urban watersheds, the proliferation of unregistered deep wells (i.e., privately owned deep wells that have not been registered with the NWRB), and climate change (Muni & Peñalba, 2011).

## IV. Research Methods

This study uses quantitative and qualitative methods to examine seasonal water insecurity in one Baguio City neighborhood. Data collection methods included archival research, informal interviews, randomly-sampled household surveys (N=396), randomly-sampled individual subsurveys (N=291), and in-depth interviews (N=18). My research team (myself and eight local research assistants) collected data from November 2011 to April 2012. Table 1 summarizes the methods used to address each research question. Washington University's Institutional Review Board (IRB) reviewed and approved this study.[1]

### Neighborhood Selection and Entry

To select the study neighborhood, I asked key informants to identify possible "lower income neighborhoods" or neighborhoods with "water problems." For each neighborhood mentioned, I reviewed available information in the Baguio City Planning Office (BCPO). This information was typically a 30-page neighborhood profile written by the Barangay Council within the past few years. Pinget was mentioned by multiple respondents who described it as an "urban poor" settlement with a variety of water sources used by residents. The neighborhood was also adjacent to the Buyog Watershed, one of the few remaining forested areas in Baguio City, which had intrigued me during a driving tour of Baguio with a key informant.

The point about having a variety of water sources used by residents met a criterion for neighborhood selection that I had identified during a March 2011 pilot study. Through the pilot, I found that neighborhood-level access to water could vary widely in Baguio City (Mason, 2012). While some neighborhoods have excellent BWD coverage, others have poor access to BWD's

[1] At the time of study implementation, no process or requirement for in-country institutional review existed.

**Table 1. Summary of Research Questions and Methods**

| Research Question | Data Collection Method | Analyses |
|---|---|---|
| Q1. How do the extent and nature of household water insecurity compare during the dry and rainy seasons? | Household surveys | Descriptive statistics<br>Bivariate analyses |
| | In-depth interviews | Qualitative text analysis |
| Q2. Within households, how do the extent and nature of individual water insecurity and individual water-related behaviors compare during the dry and rainy seasons? | Individual subsurveys | Descriptive statistics<br>Bivariate analyses |
| | In-depth interviews | Qualitative text analysis |
| Q3. How are individual and household factors—specifically, gender and financial, physical, and social resources—associated with:<br>a. Household water insecurity during the dry season?<br>b. Household water insecurity during the rainy season? | Household surveys | Multiple regression |
| Q4. In what ways do neighborhood or municipal contextual factors relate to household water insecurity in the dry and rainy seasons? | Archival research | Document review |
| | Informal interviews | Qualitative text analysis |
| | Individual subsurveys | Qualitative text analysis |
| | In-depth interviews | Qualitative text analysis |
| Q5. How do individuals and households acquire and use resources to mitigate water insecurity, within the given neighborhood and municipal context? Is this acquisition and use gendered in ways that matter for program and policy development? | In-depth interviews | Qualitative text analysis |

main pipelines. Similarly, some neighborhoods have springs used regularly by most households, while others have no springs. This variation led me to seek a neighborhood for this study that would capture some of the Baguio-wide variability within a single neighborhood's boundaries. Although selecting one neighborhood would hinder generalizing the study findings to the greater Baguio City area, it would facilitate my random sampling design and strengthen generalizability to at least the study neighborhood, with potential to inform discussion about each of the major water sources available in Baguio City.

Also, while many had described Pinget as "urban poor," I learned quickly that households of all income and wealth levels resided in Pinget, a characteristic like many other Baguio City neighborhoods. Having this range of household economic conditions in one neighborhood would provide variation for my examination of how resources relate to water insecurity by season, although again not generalizable to Baguio City as a whole.

After reviewing available city data for Pinget and other potential neighborhoods, and discussing possibilities with key informants and local academic experts, I visited Pinget to meet with the Barangay Captain. The Captain was receptive to the research, offered to share the neighborhood household list to facilitate my sampling, and invited me to present the study at the Council's upcoming meeting.

Having found a neighborhood that met my criteria, I presented the study to the Barangay Council, and began spending time in the neighborhood to become acquainted with the community—attending meetings, passing time at the local *jeepney* stand (where people wait for public transportation), and walking through the neighborhood to meet residents. I recorded my activities and reflections on this process, and on the other data collection methods below, via handwritten and electronic field notes.

## Archival Research

I conducted archival research at several Baguio City offices including the BWD, BCPO, City Environment Parks and Management Office (CEPMO), Department of Environment and Natural Resources-Cordillera Administrative Region (DENR-CAR), and Baguio City Health Office (BCHO). Archival research was iterative. As I spent more time in Pinget, and as more surveys and interviews were completed, new questions arose, leading to new archival data needs. My research team and I retrieved most archival data in the form of hard copies and electronic files. When copies or files could not be removed, we recorded notes on site.

## Informal Interviews

I conducted several informal interviews with Pinget residents, Pinget leaders, and Baguio City leaders and agency officials. Interviews focused on the history and status of water, climate, and development in Pinget and/or Baguio City. Like archival research, this process was iterative. Most interviews were conducted in English; interviews in Ilocano, Tagalog, or another language were completed with a translator. Some informal interviews were audiotaped and transcribed. Most were recorded through note taking, given the informal nature and scope of this method.

## Household Surveys

### *Sampling*

I constructed the household survey sampling frame by obtaining a copy of the neighborhood household list from the Barangay Captain. The household list was created during a 2009 neighborhood census and updated with handwritten notes in 2010. Although the list lacked housing units built since 2009, and included few boarding units (e.g., rentals), it provided the most viable starting point among other options: a health center list which included only families with young children, an incomplete Department of Social Welfare and Development list from

recent poverty mapping, and a National Statistics Office dataset that was not yet publicly available.

To update the list, two members of my research team canvassed Pinget's 12 *puroks* (districts) on foot over a one-month period. Their objective was to update the list to include any new permanent units and overlooked permanent and boarding units, and to exclude any vacant units. We did not update the names associated with every unit on the list. Rather, we aimed to create as complete a list of housing units as possible for the sampling frame. In cases where multiple housing units were located in the same compound (e.g., boarders with separate apartments in the same boarding house), each housing unit was included in the sampling frame. To account for shared variance among units within the same compound, each compound was assigned a unique cluster number for use in statistical analysis.

The final sampling frame consisted of 1,793 housing units: 1,255 permanent (70.0%), and 538 boarder (30.0%). I stratified the sampling frame by purok, and within each purok stratified by permanent or boarder status, for a total of 24 strata. I used survey selection procedures with SAS 9.2 to randomly select 25% of cases from each strata, for a total of 454 cases.[2] The decision to draw 25% of cases assumed a conservative 75% response rate, or 340 completed household surveys, and was informed by power analyses for multiple regression in this study.

*Instrument*

The household survey measured demographics; water security by season; and financial, physical, and social resources of the household. A research assistant and I pilot tested an initial version of the survey with six respondents (five female, one male) from non-study neighborhoods in December 2011. During pilot testing, we probed about items that seemed

[2] The 454 cases are 25.32% of all cases on the list, due to rounding for some strata during the random draw.

unclear, error prone, or burdensome. The survey was revised and resubmitted to Washington University's IRB for approval. The final survey instrument is available in Appendix B.

*Dependent variables.* The survey measured water quantity, quality, and accessibility by asking respondents about a "typical dry season week" and "typical rainy season week" for their household, for each water security item. Quantity was operationalized as (1) reported household consumption from all water sources, scaled to liters per capita per day (LPCPD);[3] (2) perceived sufficiency of water overall (whether in a typical week the household *always has enough*, *sometimes does not have enough*, or *often does not have enough* water to meet its needs); and (3) experienced insufficiency of water (whether in a typical week there are times that the household does not have enough water for each of seven specific household needs: drinking, cooking, bathing, washing dishes, laundry, household cleaning, and sanitation).

For multiple regression, the following transformations were used: (1) natural log transformation of LPCPD due to positive skew and kurtosis of the original variable; (2) collapse of perceived sufficiency of water into two categories: *always has enough* and *sometimes or often does not have enough*; and (3) reverse coding and collapse of experienced insufficiency of water items into an overall binary measure of experienced sufficiency of water, where experienced sufficiency means that the household reports always having enough water for each specific need in a typical week.

Quality was operationalized as the survey respondent's perception of water cleanliness overall and for each specific household need. To rate cleanliness, respondents chose a number

[3] Respondents estimated separate volumes of household water consumed per month for any BWD water if used, and per week for each of the following sources if used: delivery truck, purified, spring, rainwater, recycled, any other source. Volumes were transformed to the same time scale (liters per day), summed for total volume per day, then divided by household size to obtain LPCPD.

on an 11-point phrase completion item where 0=Not clean at all, and 10=Completely clean. For multiple regression, I ran a principal component analysis (PCA) of the items measuring perceived cleanliness of water for cooking, bathing, washing dishes, laundry, and household cleaning, with separate PCAs run by season (Kolenikov & Angeles, 2009; Vyas & Kumaranayake, 2006). Each PCA yielded one principal component which accounted for over 86% of the variability among items. Since only one component was extracted in each analysis, rotation was not performed. Scores for the principal components (one dry, one rainy) were extracted and used as dependent variable values in multiple regression, with higher scores indicating higher perceived cleanliness of water.

Accessibility was operationalized as (1) perceived ease of obtaining water overall (11-point phrase completion item with 0=Not easy at all, and 10=Extremely easy); and (2) water expenses, scaled to pesos per month, and then converted into affordability of those expenses as measured by water expenses as a percentage of household income.

For multiple regression, the following transformations were used: (1) perceived ease was dichotomized into Extremely easy=1 for raw values of 8, 9, and 10, and Not extremely easy=0 for raw values of 7 or less; due to the distribution of the data and violations of linear regression assumptions when continuous versions of the measure were used (including numerically transformed versions); and (2) expenses as a percentage of household income was categorized into 10% or less=1, and greater than 10%=0; due to extreme skew and kurtosis of the non-transformed variable, and violations of linear regression assumptions when transformed versions were used (e.g., raising to the -1/2 power).

Finally, PCAs were run on 25 water security items by season, to explore if aggregate, multi-dimensional measures of water insecurity would emerge. Each PCA included: log-

transformed-LPCPD, perceived sufficiency, experienced insufficiency (separate items for drinking, cooking, bathing, washing dishes, laundry, household cleaning, and sanitation), perceived cleanliness (separate items for cooking, bathing, washing dishes, laundry, household cleaning, and overall), perceived ease, whether the household has ever borrowed water, whether the household has ever borrowed money to pay for water, whether the household has to choose between spending for water versus food, and whether the household uses particular water sources (BWD, delivery truck, spring, rainwater, recycled, any other source).[4]

Using an eigenvalue criterion of 1.0, minimum factor loadings of 0.40, and an oblique rotation method to allow correlation among components, the dry season PCA yielded six component measures of water insecurity. The first two components corresponded to reduced forms of the perceived cleanliness and experienced insufficiency items, respectively. Among remaining components, the third emerged as a potential multi-dimensional measure of water insecurity in this study—designated as dry season water hardship—with positive loadings from the following: whether the household has ever borrowed water (0.60), whether the household has ever borrowed money to pay for water (0.58), whether the household has to choose between spending for water versus food (0.55), and whether the household uses rainwater (0.66).

Using the same procedure as for the dry season, the rainy season PCA yielded seven component measures of water insecurity. The first two components again corresponded to perceived cleanliness and experienced insufficiency. Among the remaining components, a meaningful multi-dimensional measure of rainy season water insecurity did not emerge, based on the loadings and combinations of items on different components.

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[4] The PCA initially included a measure of water expenses. This item loaded on more than one component, however, and was removed from the analysis.

*Independent variables.* Key independent variables are gender of the survey respondent and household resources. Gender is whether the survey respondent is female or not. Financial resources are: (1) monthly household income from all sources, by season; and (2) savings, categorized as none, informal, and formal. Physical resources are: (1) tank and drum water storage capacity (liters); (2) access to a BWD metered connection, categorized as none, shared/some other way, and private; and (3) homeownership. Social resources are the number of households in the respondent household's (1) water borrowing network; and (2) money borrowing network to pay for water.

For multiple regression, the following transformations were used: (1) natural log transformation of monthly income, (2) natural log transformation of tank and drum storage capacity, (3) categorization of water borrowing network size into zero, one, or two or more households, and (4) categorization of money borrowing network size into zero, one, or two or more households.

Independent control variables used for analysis are other demographic characteristics of the survey respondent and household size. Other demographic characteristics are education, marital status, age, and Cordilleran ethnic indigenous identity (full or part, based on binary coding of responses to a question about ethnic group membership) of the survey respondent. Household size is the number of people who typically reside in the home most days of the week.

*Implementation*

Research assistants conducted household surveys during February and March 2012. Prior to data collection, research assistants completed human subjects training, attended a study and survey protocols training, and completed mock surveys.

To collect survey data, research assistants visited assigned housing units and invited the *household water manager* (i.e., the person most responsible for ensuring the household has the water that it needs for everyday use) to participate in the survey. The household water manager is thus the survey respondent. This person may or may not be considered the household head. Surveys were administered in Ilocano, Tagalog, or the respondent's preferred language, and took about 45 minutes to complete. Research assistants recorded responses on a hard copy of the survey. I reviewed surveys within 1-3 days of completion to assess survey completeness and accuracy. When necessary, I returned surveys to research assistants, asking them to clarify a response with the household. Upon return to the United States, I entered survey data into an Access database designed for this study, with built-in data quality checks, and cleaned and prepared the data for analysis. Survey respondents received a small incentive of dry goods such as coffee, sugar, or powdered milk (valued at ₱45 or about $1) to thank them for their time.

*Survey Participation and Respondent Characteristics*

The household survey had a high participation rate; 87.2% of all sampled cases and 95.2% of eligible cases completed the survey (Table 2). Completion by eligible permanent and boarder cases (95.8 versus 93.9%) did not differ in a statistically significant way ($\chi^2 = 0.71$, df=1, p=.40). Ineligible cases were vacant and duplicate units, totaling 8.4% of all cases. The survey status categories and calculations in Table 2 are based on recognized survey research standards (American Association for Public Opinion Research, 2009).

Survey respondent characteristics are summarized in Table 3. Among respondents, 79.8% were female, and 29.1% were college graduates. Regarding marital status, 18.7% of respondents were single, 13.9% had a spouse or partner living elsewhere (e.g., employment-related), and

**Table 2. Overall Survey Participation**

| Status | N | Percentage of All Cases (N=454) | Percentage of Eligible Cases (N=416) |
|---|---|---|---|
| Completed | 396 | 87.2 | 95.2 |
| Incomplete | 5 | 1.1 | 1.2 |
| Refused | 8 | 1.8 | 1.9 |
| Not located | 7 | 1.5 | 1.7 |
| Ineligible/vacant | 38 | 8.4 | -- |
| Total | 454 | | |

**Table 3. Survey Respondent Characteristics (N=396)**

| Characteristic | Percent | Mean (SD) |
|---|---|---|
| Gender, female | 79.8 | |
| Education | | |
| Less than a HS diploma | 25.1 | |
| HS diploma/some post-secondary | 45.8 | |
| College graduate or more | 29.1 | |
| Marital status | | |
| Single | 18.7 | |
| Married/has partner, lives elsewhere | 13.9 | |
| Married/has partner, lives at home | 55.3 | |
| Separated | 3.3 | |
| Widowed | 8.8 | |
| Age | | 39.7 (14.6) |
| Ethnicity, Cordilleran indigenous | 63.3 | |
| Years in Pinget | | 15.3 (12.0) |

*Note:* HS=high school.

55.3% had a spouse or partner living in the home. Respondent age ranged from 18 to 90 years, with an average of 39.7. Almost two-thirds (63.3%) of respondents identified their ethnicity in a way that was coded as fully or partially of Cordilleran indigenous ethnicity (e.g., Ibaloi, Kankanaey, Bontoc-Tagalog, etc.). Respondents had, on average, lived in Pinget for 15.3 years, with a range of one month to 52 years.

*Missing Data*

Missing data rates for dependent and independent variables in this study range from 0.0 to 13.1% (Tables 4-5). Reasons for missing data include enumerator error, respondent refusal or indication of unknown response, and respondent being a new arrival to Pinget and only able to answer dry season and non-seasonal questions (not rainy season questions). In lieu of complete case analysis for multiple regression tests of association, which may reduce statistical power and bias estimates and standard errors, I address missing data by using multiple imputation (MI) with fully conditional specification (FCS) in SAS 9.3 to create 10 imputed datasets (Lee & Carlin, 2010; van Buuren, 2012). These datasets can be analyzed with standard statistical procedures, and results pooled using software to calculate valid parameter estimates and standard errors for statistical inference (Allison, 2002; Rubin, 1987).

FCS permits imputation of both continuous and categorical data through a series of chained equations (van Buuren, 2012). In the imputation model, I deliberately selected several auxiliary variables from the raw data for inclusion, to strengthen the assumption that the data are missing at random after conditioning on auxiliaries. In the chained equations, I specified the regression method for normally distributed continuous variables, regression with predictive mean matching for non-normal continuous and discrete variables (e.g., items scaled from 0 to 10), the discriminant method for nominal variables with three or more categories, and logistic regression for binary variables (Lee & Carlin, 2010; van Buuren, 2012). I assessed the imputed datasets by examining trends in the trace plots of the imputed means from the first through the last imputation. I also compared raw frequency percentages, means, and standard deviations between the raw and imputed data (Tables 4-5). Variables with notable difference between raw and imputed datasets are in expected directions. The mean for income, for example, is expected to

increase given that households with higher income may have been more likely to refuse to respond. Indeed, the mean for the dry season increases from ₱15,174 to ₱15,487, and for the rainy season from ₱14,092 to ₱14,338.

**Table 4. Missing Data and Multiple Imputation for Dependent Variables**

| Variable | N (%) Missing | Raw: % or Mean (SD) | Imputed: % or Mean (SD) |
|---|---|---|---|
| *Dry Season* | | | |
| All consumption (LPCPD) | 12 (3.0) | 68.5 (60.2) | 68.1 (59.7) |
| Perceived sufficiency of water, overall | 0 (0.0) | | |
| Always enough | | 48.2 | 48.2 |
| Sometimes not enough | | 45.7 | 45.7 |
| Often not enough | | 6.1 | 6.1 |
| Experienced insufficiency for 1+ need | 0 (0.0) | 26.0 | 26.0 |
| Perceived cleanliness of water, overall | 1 (0.3) | 7.5 (1.7) | 7.5 (1.7) |
| Perceived ease of getting water, overall | 1 (0.3) | 6.9 (2.2) | 6.9 (2.2) |
| Monthly water expense (₱) | 10 (2.5) | 787 (757) | 789 (755) |
| | | | |
| *Rainy Season* | | | |
| All consumption (LPCPD) | 23 (5.8) | 66.3 (57.8) | 65.1 (56.9) |
| Perceived sufficiency of water, overall | 14 (3.5) | | |
| Always enough | | 90.5 | 90.5 |
| Sometimes not enough | | 9.4 | 9.6 |
| Often not enough | | 0.0 | 0.0 |
| Experienced insufficiency for 1+ need | 14 (3.5) | 3.9 | 4.3 |
| Perceived cleanliness of water, overall | 15 (3.8) | 6.9 (1.9) | 6.8 (1.9) |
| Perceived ease of getting water, overall | 15 (3.8) | 8.6 (1.7) | 8.6 (1.7) |
| Monthly water expenses (₱) | 26 (6.6) | 638 (680) | 627 (667) |

*Note:* LPCPD=liters per capita, per day. ₱=Philippine pesos.

**Table 5. Missing Data and Multiple Imputation for Independent Variables**

| Variable | N (%) Missing | Raw: % or Mean (SD) | Imputed: % or Mean (SD) |
|---|---|---|---|
| Gender, female | 0 (0.0) | 79.8 | 79.8 |
| Education | 1 (0.3) | | |
| Less than a HS diploma | | 25.1 | 25.0 |
| HS diploma/some post-secondary | | 45.8 | 45.9 |
| College graduate or more | | 29.1 | 29.1 |
| Marital status | 0 (0.0) | | |
| Not married/no partner | | 30.8 | 30.8 |
| Married/partner, lives elsewhere | | 13.9 | 13.9 |
| Married/partner, lives in home | | 55.3 | 55.3 |
| Age (years) | 0 (0.0) | 39.7 (14.6) | 39.7 (14.6) |
| Ethnicity, Cordilleran indigenous | 1 (0.3) | 63.3 | 63.3 |
| HH size (people) | 0 (0.0) | 4.4 (2.1) | 4.4 (2.1) |
| Monthly income, dry season (₱) | 49 (12.4) | 15,174 (10,963) | 15,487 (10,939) |
| Monthly income, rainy season (₱) | 52 (13.1) | 14,092 (10,519) | 14,338 (10,505) |
| Savings | 5 (1.3) | | |
| None | | 44.5 | 44.4 |
| Informal | | 10.5 | 10.4 |
| Formal | | 45.0 | 45.2 |
| Tank/drum storage capacity (L) | 4 (1.0) | 1,934.1 (1,640.2) | 1,935.4 (1,634.7) |
| BWD connection | 0 (0.0) | | |
| Private | | 43.2 | 43.2 |
| Shared/other way | | 31.1 | 31.1 |
| None | | 25.8 | 25.8 |
| Homeownership | 1 (0.3) | 55.4 | 55.5 |
| Water borrowing network | 5 (1.3) | | |
| 0 HHs | | 14.6 | 15.0 |
| 1 HH | | 52.4 | 52.3 |
| 2+ HHs | | 33.0 | 32.8 |
| Money borrowing network | 8 (2.0) | | |
| 0 HHs | | 16.8 | 17.4 |
| 1 HH | | 46.9 | 46.5 |
| 2+ HHs | | 36.3 | 36.1 |

*Note:* HS=high school. HH=household. ₱=Philippine pesos. L=liters. BWD=Baguio Water District.

*Hypotheses and Analysis*

Household surveys were analyzed to address research questions Q1 and Q3 (see Table 1). Descriptive statistics and bivariate analyses, using raw data and unless otherwise specified, were used to answer Q1. This question aims to describe and document heterogeneities of household water insecurity that may exist in the study neighborhood. Hypotheses for bivariate analysis of seasonal difference are that in the dry season, compared to the rainy season: (1) households will report lower water consumption (LPCPD); (2) a lower percentage of households will report that they *always have enough* water; (3) a higher percentage of households will experience insufficiency of water; (4) mean ratings for perceived cleanliness will be higher; (5) mean ratings for perceived ease will be lower; (6) household water expenses will be higher; and (7) household water expenses as a percentage of income will be higher. Descriptive statistics and bivariate analyses were conducted in SAS 9.3.

Multiple regression using the imputed datasets and pooled results was conducted to answer Q3. This question aims to statistically test relationships among gender, household resources, and water insecurity by season among households in the study neighborhood. Directional hypotheses are summarized in Tables 6-9 between each key independent variable and dependent variable, capturing how relationships are expected to change by dimension of water insecurity and season.

It is important to note that most dependent variables—reported consumption, perceived sufficiency, experienced sufficiency, perceived cleanliness, perceived ease, and affordability—are coded in multiple regression so that higher values represent greater water *security*. For these analyses, positive and statistically significant results would suggest that female gender, household ownership of or access to the resource, or greater household amount of the resource

owned or accessed is associated with greater household water security. For one dependent variable—multi-dimensional hardship—higher values represent greater water *insecurity*. For this analysis, negative and statistically significant results would suggest that female gender, household ownership of or access to the resource, or greater household amount of the resource owned or accessed is associated with lower household water insecurity. Multiple regression was conducted with SAS 9.3., using survey methodologies that account for clustering of some households in a shared compound (e.g., boarders in the same building) and a finite population correction given the stratified random sampling design (Cochran, 1977).

To conduct multiple regression, I reviewed descriptive statistics for all variables in the models, and bivariates between each dependent and independent variable. By design, the same set of independent variables are included in each model, regardless of statistical significance, to show how relationships may vary depending on which dimension of water insecurity is being examined and for which season. Each model was built in a series of steps with the dependent variable regressed sequentially on: (1) gender, (2) other demographic characteristics of the survey respondent, (3) household size, (4) financial resources, (5) physical resources, and (6) social resources. The order separates the entry into the model of key independent variables (gender and resources) from control variables (other demographic characteristics and household size), while also preserving the order of entering individual factors (gender and other demographic characteristics) before household factors (size and resources). In Section VII, results are presented for the final complete model of each dependent variable. Supplemental

**Table 6. Q3 Hypotheses: Quantity**

| Independent Variable | DV1: Reported Consumption | | DV2: Perceived Sufficiency | | DV3: Experienced Sufficiency | |
|---|---|---|---|---|---|---|
| | Dry | Rainy | Dry | Rainy | Dry | Rainy |
| **Individual Factor** | | | | | | |
| Gender, female | − | + | − | NS | − | NS |
| **Household Factors** | | | | | | |
| *Financial Resources* | | | | | | |
| Income | + | NS | + | NS | + | NS |
| Savings | + | NS | + | NS | + | NS |
| *Physical Resources* | | | | | | |
| Tank/drum storage capacity | + | + | + | + | + | + |
| BWD connection | + | + | + | + | + | + |
| Homeownership | + | + | + | + | + | + |
| *Social Resources* | | | | | | |
| Water borrowing network | + | NS | + | NS | + | NS |
| Money borrowing network | + | NS | + | NS | + | NS |

*Note:* + = A positive and statistically significant relationship is hypothesized.
− = A negative and statistically significant relationship is hypothesized.
NS = Absence of a statistically significant relationship is hypothesized.

**Table 7. Q3 Hypotheses: Quality**

| Independent Variable | DV4: Perceived Cleanliness | |
|---|---|---|
| | Dry | Rainy |
| **Individual Factor** | | |
| Gender, female | NS | NS |
| **Household Factors** | | |
| *Financial Resources* | | |
| Income | + | NS |
| Savings | + | NS |
| *Physical Resources* | | |
| Tank/drum storage capacity | + | + |
| BWD connection | + | − |
| Homeownership | + | + |
| *Social Resources* | | |
| Water borrowing network | NS | NS |
| Money borrowing network | NS | NS |

*Note:* + = A positive and statistically significant relationship is hypothesized.
− = A negative and statistically significant relationship is hypothesized.
NS = Absence of a statistically significant relationship is hypothesized.

**Table 8. Q3 Hypotheses: Accessibility**

| Independent Variable | DV5: Perceived Ease | | DV6: Affordability | |
|---|---|---|---|---|
| | Dry | Rainy | Dry | Rainy |
| **Individual Factor** | | | | |
| Gender, female | − | NS | − | NS |
| **Household Factors** | | | | |
| *Financial Resources* | | | | |
| Income | + | NS | + | NS |
| Savings | + | NS | + | NS |
| *Physical Resources* | | | | |
| Tank/drum storage capacity | + | + | + | + |
| BWD connection | + | + | + | + |
| Homeownership | + | + | + | + |
| *Social Resources* | | | | |
| Water borrowing network | + | NS | + | NS |
| Money borrowing network | + | NS | + | NS |

*Note:* + = A positive and statistically significant relationship is hypothesized.
− = A negative and statistically significant relationship is hypothesized.
NS = Absence of a statistically significant relationship is hypothesized.

**Table 9. Q3 Hypotheses: Overall Water Insecurity**

| Independent Variable | DV7: Multi-Dimensional Hardship, Dry |
|---|---|
| **Individual Factor** | |
| Gender, female | + |
| **Household Factors** | |
| *Financial Resources* | |
| Income | − |
| Savings | − |
| *Physical Resources* | |
| Tank/drum storage capacity | − |
| BWD connection | − |
| Homeownership | − |
| *Social Resources* | |
| Water borrowing network | − |
| Money borrowing network | − |

*Note:* + = A positive and statistically significant relationship is hypothesized.
− = A negative and statistically significant relationship is hypothesized.

tables in Appendix A provide model building results, enabling comparison of how parameter estimates and statistical significance may have changed as additional variables were added.

For each final model with linear regression, I reviewed regression diagnostics by imputed dataset to ensure that assumptions of no multicollinearity, normal distribution of residuals with mean of zero, and homoscedasticity of error variance were not violated; and examined influential data points and outliers on a case-by-case basis (Fox, 1991). For each final model with logistic regression, I ensured that assumptions of no complete or quasi-complete separation and no problematic multicollinearity were met. I also reviewed diagnostic plots of leverage, influence, and predicted probabilities by imputed dataset, and examined influential data points and outliers as needed (SAS Institute Inc., 2011).

**Individual Subsurveys**

*Sampling*

The housing units chosen for the household survey comprised the initial sampling frame for the individual subsurveys. Immediately after drawing the household survey sample, I drew a random sample of 50% of the 454 chosen household cases (again, stratified by purok and permanent/boarder status), for a total of 234 potential household survey respondents who would also be invited to complete an individual subsurvey.[5] Also included in the subsurvey sample was any spouse or domestic partner residing in the home, since the subsurvey was designed for within household analyses. At the time, I estimated that 75% of households (or 176) would have a spouse or partner present, for an estimated subsurvey sample of 410 respondents.

[5] Due to rounding for some strata, the 234 cases are 51.54% of the chosen household cases.

*Instrument*

The subsurvey (Appendix C) measured individual demographics; individual water insecurity and water-related behaviors by season; and individual perceptions about water and environment-related issues. Like the household survey, a research assistant and I pilot tested the subsurvey with different respondents (five female, two male), and secured Institutional Review Board approval for the final version.

*Dependent variables.* The subsurvey measured individual water insecurity by asking if there are times in a typical week, by season, when the respondent does not have enough water for each of two needs: drinking and bathing. The subsurvey also asked respondents to rate their perceived cleanliness of the water used for each need with the same 11-point phrase completion item as the household survey (0=Not clean at all, 10=Completely clean). Respondents were then asked whether or not they engage in any of the following water-related behaviors: conserve by using less water for drinking, conserve by using less water for bathing, recycle own bath water for other household uses, spend time getting water for the household, or make water-related complaints to someone outside of the home. Finally, respondents were asked their individual perceptions of whether the household water situation had improved, stayed the same, or become worse over the past few years, and to briefly explain their response.

*Independent variables.* The key independent variable is the gender of the individual subsurvey respondent.

*Implementation*

For household water managers, research assistants administered individual subsurveys immediately after a household survey was completed, if the respondent was willing to spend more time answering questions. To collect data from the spouse or partner, if any, research

assistants typically scheduled a time to return when the spouse or partner would be home. Individual subsurveys took about 20 minutes to complete. Subsurveys were administered in the respondent's preferred language, and research assistants recorded responses in person. Like the surveys, I reviewed subsurveys within 1-3 days of completion while in the field. In the United States, I entered subsurvey data into the same Access database previously described. Subsurvey respondents also received a small incentive of dry goods to thank them for their time.

*Subsurvey Participation and Respondent Characteristics*

Of the 234 potential household survey respondents invited to complete an individual subsurvey, 142 were either known to have a spouse or partner residing in the home, or spousal/partner absence could not be assumed. Of these combined 376 potential individual subsurvey respondents, 338 were determined eligible cases. Participation among eligible cases was 86.1% (291 out of 338). Not surprisingly, participation was higher for household water managers (92.6% of eligible cases) than spouses/partners (74.6%; Table 10). Most household water managers agreed to complete the individual subsurvey immediately after having completed the household survey.

**Table 10. Subsurvey Participation**

| Status | Survey Respondents (Household Water Managers) | | | Spouses/Partners | | |
|---|---|---|---|---|---|---|
| | N | Percentage of All Cases (N=234) | Percentage of Eligible Cases (N=216) | N | Percentage of All Cases (N=142) | Percentage of Eligible Cases (N=122) |
| Completed | 200 | 85.5 | 92.6 | 91 | 64.1 | 74.6 |
| Incomplete | 5 | 2.1 | 2.3 | 18 | 12.7 | 14.8 |
| Refused | 6 | 2.6 | 2.8 | 8 | 5.6 | 6.6 |
| Not located | 5 | 2.1 | 2.3 | 5 | 3.5 | 4.1 |
| Ineligible/vacant | 18 | 7.7 | -- | 20 | 14.1 | -- |
| Total | 234 | | | 142 | | |

**Table 11. Subsurvey Respondent Characteristics (N=291)**

| Characteristic | Percent or Mean (SD) | | |
|---|---|---|---|
| | Women (N=174) | Men (N=117) | All (N=291) |
| HH water manager (survey respondent) | 90.2 | 36.8 | 68.7 |
| Education | | | |
| Less than a HS diploma | 20.8 | 34.2 | 26.2 |
| HS diploma/some post-secondary | 50.3 | 47.0 | 49.0 |
| College graduate or more | 28.9 | 18.8 | 24.8 |
| Marital status | | | |
| Not married/no partner | 25.3 | 16.2 | 21.6 |
| Married/partner, lives elsewhere | 12.1 | 7.7 | 10.3 |
| Married/partner, lives in home | 62.6 | 76.1 | 68.0 |
| Age (years) | 38.7 (13.3) | 39.6 (13.4) | 39.0 (13.3) |
| Ethnicity, Cordilleran indigenous | 58.6 | 61.5 | 59.8 |
| Years in Pinget | 14.9 (11.6) | 15.2 (12.4) | 15.1 (11.9) |
| Years in Baguio City | 21.9 (14.4) | 23.0 (15.4) | 22.3 (14.8) |

*Note:* HH=household. HS=high school.

Subsurvey respondent characteristics are summarized in Table 11. About 59.8% of respondents (174 out of 291) were female, and 40.2% were male (117 out of 291). Given the gender of the household water manager in the survey data (79.8% female), it is not surprising that 90.0% of females versus 36.8% of males were the household water manager. Overall, 24.8% of subsurvey respondents reported having a college degree or more; higher rates for female (28.9%) than male (18.8%) respondents are also not surprising given gendered education inequalities in the Philippines that favor women. About two-thirds (68.0%) of subsurvey respondents are married with a partner living in the home (who in most cases is also a subsurvey respondent), while 21.6% are not married nor have a partner. Respondent age averaged 39 years, and for 59.8% of respondents, ethnicity was coded as fully or partially Cordilleran indigenous. Respondents had lived an average of 15.1 years in Pinget and 22.3 years in Baguio City.

*Hypotheses and Analysis*

Individual subsurveys were analyzed to address research questions Q2 and Q4 (see Table 1). Descriptive statistics and bivariate analyses were used to answer Q2. There are no formal hypotheses for the descriptive statistics. For bivariate analyses, hypotheses are that a higher percentage of female than male respondents will report: (1) not having enough water for drinking, (2) not having enough water for bathing, (3) conserving by using less water for drinking, (4) conserving by using less water for bathing, (5) recycling own bath water for other household uses, (6) spending time getting water for the household, and (7) making water-related complaints to someone outside the home. No hypotheses are made for the relationship between gender and perceived cleanliness of drinking or bathing water. Bivariate analyses were conducted in SAS 9.3, using survey methodologies to account for clustering of individual subsurvey respondents within the same household and a finite population correction given the study's use of stratified random sampling (Cochran, 1977).

Responses to whether the household water situation had improved, stayed the same, or become worse over the past few years, and to briefly explain the response, were analyzed to help address Q4. Open-ended responses were analyzed with qualitative text analysis via descriptive coding using Microsoft Excel 2010. During coding, I focused on responses that corresponded with an attribution of change in the household water situation to some kind of neighborhood or municipal factor.

**In-Depth Interviews**

*Sampling*

A total of 18 in-depth interviews were conducted with household water managers who had completed a household survey, and in some cases, an individual subsurvey. I used purposive

sampling to construct a sample with a range of household water sources, water insecurity experiences or perceptions, and demographics such as gender, age, household structure, and household resources. By gender, the sample consisted of 15 women and three men.

*Instrument*

I prepared a topic guide for each in-depth interview. Topic guides generally included water security experiences by season; gender aspects of water management; acquisition and use of resources such as drums, tanks, and savings; and Pinget-specific environmental questions. I tailored each topic guide based on the individual's responses to the survey and subsurvey.

*Implementation*

I conducted 15 of the interviews (with translation when necessary), one research assistant conducted two interviews, and another conducted one interview. Interviews were audiotaped and conducted in person in the participant's preferred language. Most interviews took 50-55 minutes to complete; one was 20 minutes. My research team transcribed and translated all audiofiles. Interview participants received a small dry goods incentive.

*Analysis*

In-depth interviews were analyzed to address research questions Q1, Q2, Q4, and Q5 (see Table 1). First, I reviewed all transcripts and began a qualitative memo about concepts and themes that began to emerge (Charmaz, 2006). I then conducted first-level descriptive coding of all transcripts using NVIVO 9, in essence, coding all interview material whether or not it pertained to the specific research questions. I added further thoughts to the memo, then returned to the transcripts to conduct more focused coding.

During focused coding, I used analytic or interpretive codes to identify content most relevant to the questions being addressed, and to move beyond description toward interpretation

of each piece of text (Tracy, 2013). I also identified exemplar quotes that could be used to typify common ideas, as well as variations or nuances of experience. At this stage, clear themes addressing each research question began to emerge. I recorded the themes and examined them further through the use of qualitative memos.

## V. Pinget

Pinget is one of Baguio City's most populous neighborhoods, with a 2009 estimated population of 8,297 people. The neighborhood covers 48.40 hectares (about 120 acres), including nine forested hectares of the Buyog Watershed, and is divided into 12 *puroks* or districts (Pinget Barangay Council, 2010). Pinget is located in northwestern Baguio City, on a steeply sloped mountainside. The main road entering Pinget rises gradually through Lower Pinget, followed by steep switchbacks as Middle and Upper Pinget are reached. Figure 4 captures Pinget's location in Baguio City, proximity to the Buyog Watershed, division by purok, and housing development on steep inclines.

In this section, I overview Pinget's history and development, present current demographics, and describe the water sources available in the neighborhood. Throughout, I synthesize information from archival research, informal interviews, household surveys, observation, and field notes.

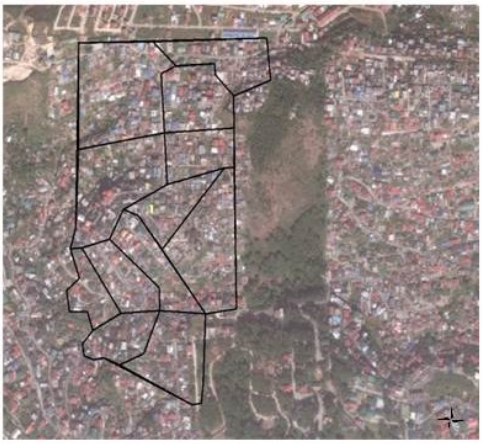
### History and Development

As one Pinget "old-timer" described, the mountainside which would become Pinget was initially "a beautiful mountain, filled with pine trees and cypress and, you can just imagine down below, the grass…under the trees, did not dry up because the whole day it was wet with dew." Some lands were pastureland for the original Ibaloi settlers of Baguio City. Over time, land claims were issued to wealthy landowners, the Philippine Women's University, and the Bureau of Plants and Industry.

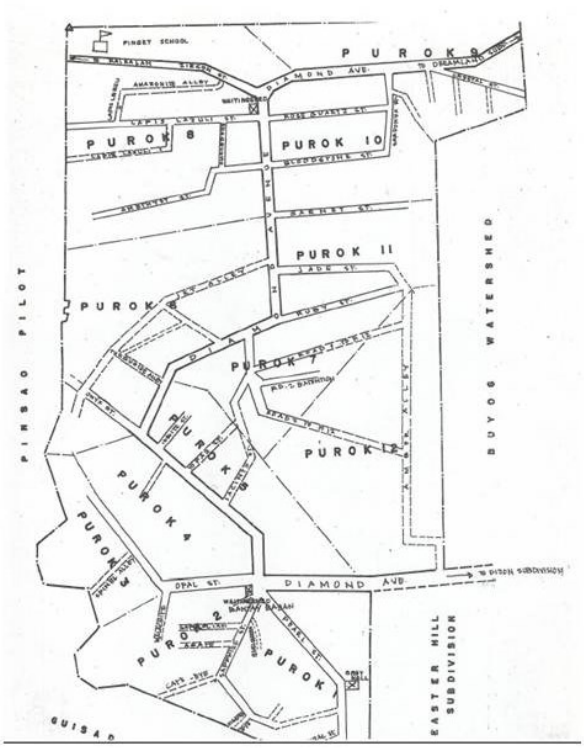
During the 1960s and 1970s, "pioneering" families began to build small tin houses in the area, relying on the Filipino tradition of *bayanihan* wherein neighbors and community members come together to help each other. Families did not necessarily have formal land claims. Instead,

**Figure 4. Pinget**

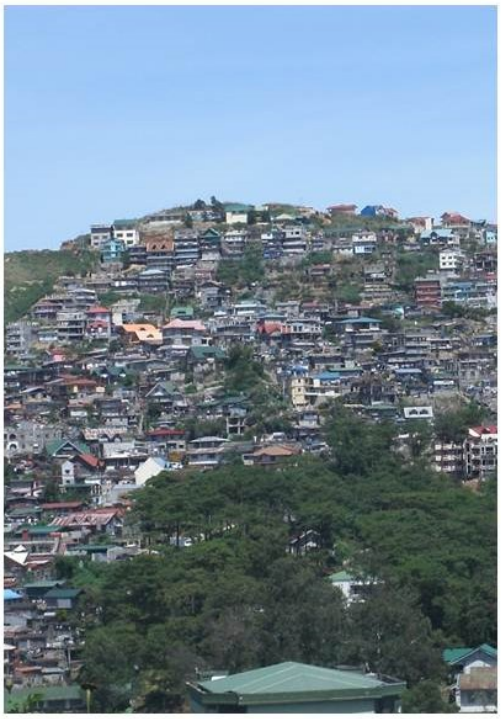
General Location of Pinget in Baguio City
*Basemap:* ESRI Bing Aerial



Proximity to Buyog Watershed
*Basemap:* ESRI Bing Aerial




Map of Pinget Puroks
*Source:* Pinget Barangay Council (2010)



Housing Development in Pinget
*Image:* Author

they might, "…put a rock there [on the ground], mark a line with your feet…and put up a stone there [at the end of the line]. And then that's your lot. That's your house. You put up a little shack Sunday night." Around this time, national law authorizing the relocation of "squatters" to specific parts of Baguio City was enacted, and some formal land titles for families to build homes in the area were issued.

By the early 1980s, houses in Lower Pinget were much more widespread, and development of Upper Pinget had also begun. By the early 1990s, old-timer residents recall, houses had already spread "up and down the mountain." Many homes were built by families who did not have formal claim to the land, giving rise to Pinget's reputation as a so-called squatter neighborhood, a situation not uncommon in Baguio City.

In 1992, then Philippine president Fidel Ramos declared the Buyog Watershed as federally protected land via Proclamation 93. The watershed's coordinate boundaries were also established, designating about 20 hectares of land as protected. Per several residents and neighborhood officials, however, numerous houses had already been built on the declared land. From archival records and satellite images reviewed for this study, it is unclear exactly what amount of the original 20 hectares was covered by homes when Proclamation 93 was issued.

In the late 1990s, due to growing concern about population growth in Pinget and new encroachment on the remaining watershed land, an interagency collaborative formed at the municipal level to protect the Buyog Watershed. This collaborative installed a fence around the nine hectares of watershed land that was forested (or at least, undeveloped by housing) at the time, and created a system of watershed "adoptees" or organizations responsible for cleaning and planting assigned portions of the fenced watershed land.

Over the next few years, struggles ensued between some Pinget residents and Baguio City authorities, as some families attempted to build inside of or move the fence and demolition orders for houses were issued. Today, there seems to be a shared view that residents who live near the fenced portion of the watershed will help ensure that there is no new encroachment beyond the fence. Meanwhile, no new demolition orders for Pinget have been issued over the past 12 years. Some families whose homes are not on official watershed land have been able to process formal land title claims. Those with homes located on the Buyog Watershed—on the developed portion outside of the fence—have not been able to legitimately pursue claims. Population growth in Pinget and pressures on the Buyog Watershed and other neighborhood resources continue to be of concern among residents, neighborhood officials, and some Baguio City agencies.

**Demographics**

Pinget demographics are based on responses to the household survey (N=396). The survey provides the only known source of data for the neighborhood that relied on probability-based sampling, so that inferences to the Pinget population may be drawn. Survey respondent characteristics are briefly described, followed by households in Pinget. These descriptives use non-imputed data; missing data rates are noted when greater than 1%.

*Households in Pinget*

Pinget is socially and economically diverse, with a population that continues to expand rapidly (Pinget Barangay Council, 2010). Table 12 summarizes household characteristics based on this study's survey data. Household size ranges from one to 13 members, with an average of 4.4. Smaller households often consist of young adults who rent apartments or serve as caretakers of homes while permanent owners are away. Many of these individuals are college students or

**Table 12. Household Characteristics (N=396)**

| Characteristic | Percent | Mean | SD | Min | Max |
|---|---|---|---|---|---|
| HH size | | 4.4 | 2.1 | 1.0 | 13.0 |
| Monthly income[a] | | | | | |
| Dry season (₱) | | 15,174 | 10,963 | 718 | 77,000 |
| Dry season (USD) | | 355 | 256 | 17 | 1,799 |
| Rainy season (₱) | | 14,092 | 10,519 | 700 | 70,000 |
| Rainy season (USD) | | 329 | 246 | 16 | 1,636 |
| Savings[b] | | | | | |
| None | 44.5 | | | | |
| Informal | 10.5 | | | | |
| Formal | 45.0 | | | | |
| Amount, if has savings (₱) | | 32,882 | 73,735 | 0 | 515,000 |
| Homeownership | | | | | |
| Homeowner | 55.4 | | | | |
| Non-homeowner, rent-free | 12.2 | | | | |
| Non-homeowner, rents | 32.4 | | | | |
| HH has title to land[c] | 15.1 | | | | |
| Water storage | | | | | |
| HH has tank(s) | 58.1 | | | | |
| Tank storage capacity (L) | | 1,527.0 | 1,711.4 | 0.0 | 12,000.0 |
| HH has drum(s) | 73.2 | | | | |
| Drum storage capacity (L) | | 403.5 | 400.9 | 0.0 | 3,000.0 |
| Total tank/drum capacity (L) | | 1,934.1 | 1,640.2 | 0.0 | 12,800.0 |
| Access to BWD connection | | | | | |
| Private | 43.2 | | | | |
| Shared/other way | 31.1 | | | | |
| None | 25.8 | | | | |
| Borrowing networks[d] | | | | | |
| Water | | | | | |
| 0 HHs | 14.6 | | | | |
| 1 HH | 52.4 | | | | |
| 2 or more HHs | 33.0 | | | | |
| Money for water | | | | | |
| 0 HHs | 16.8 | | | | |
| 1 HH | 46.9 | | | | |
| 2 or more HHs | 36.3 | | | | |

*Note:* HH=household. BWD=Baguio Water District. L=liters. [a] For income, n=347; data are missing for 49 cases (12.3%). Currency conversion is 42.8 ₱ (Philippine pesos) to 1 USD (U.S. dollars). [b] For savings, n=391; data are missing for 5 cases (1.26%). For savings amount, 217 cases report having informal or formal savings; 81 (37.33%) refused to provide or did not know the household savings amount, hence n=136. [c] For land title, n=383; data are missing for 13 cases (3.28%). [d] For water borrowing networks, n=391; data are missing for 5 cases (1.26%). For money borrowing networks, n=388; data are missing for 8 cases (2.02%).

work in the burgeoning "guest relations" industry, catering to Baguio City nightlife. Larger households may be one or two adults with many children, or may be intergenerational households with grandparents, grown children, and grandchildren living together as an extended family.

Household incomes in Pinget vary widely and can change seasonally. In the dry season, mean monthly income is ₱15,174 ($355), with a reported range of ₱718 to ₱77,000 ($17 to $1,799). In the rainy season, mean monthly income decreases to ₱14,092 ($329), with a range of ₱700 to ₱70,000 ($16 to $1,636). The range of economic status among Pinget households is apparent even when walking through the neighborhood, as large multi-story cement homes may be built next door to small, single-room tin ones.

Of note, the seasonal income changes observed in this study are driven largely by the nature of informal labor in Baguio City. Many men, for example, work in construction on a *per diem* basis. Daily work during the dry season may drop to once or twice a week during the rainy season, or none at all. Similarly, many women in Pinget work as vegetable sellers in Baguio City's central market. When rains are heavy, these women are often less able to reach the market or have substantially fewer customers.

About 55.5% of households in Pinget report having savings, and a similar percentage own their homes. Other households rent their homes or apartments (32.4%), or live in housing units rent-free (typically in a compound with related families) (12.2%). About 15.1% of all households report having title to their land; among homeowners, this rate is 28.1%.

Households in Pinget typically store water in tanks of varying sizes and/or standard 55-gallon drums. Water storage capacity in these vessels varies widely. Over half (58.1%) of households have (or have access to) a tank, and almost three-quarters (73.2%) have at least one

standard 55-gallon drum. Average storage capacity in tanks and drums combined is just under 2,000 L (the equivalent of about 10 drums), with a range of 0 to 12,800 L. Also, an estimated 43.2% of households have access to BWD water through a private, metered connection. An additional 31.1% access BWD water in some other way, typically through a landlord or neighbor who is paid on a per drum basis (e.g., 30 pesos per 55-gallon drum).[6] Finally, when asked how many different households the respondent's household could borrow water from, responses were zero (14.6%), one (52.4%), and from two to 90 (33.0%). Responses for the number of households that money could be borrowed from were similar: zero (16.8%), one (46.9%), and from two to 90 (36.3%).

**Water Sources**

Early in Pinget's development, new settlers relied year round on natural springs at the base of the Buyog Watershed and other nearby locations, plus rainwater during the rainy season. As Pinget developed and the main road through the neighborhood was paved and improved, some access to the BWD and water from private delivery trucks followed. Today, the following water sources are used by Pinget households to varying degrees: BWD, delivery truck, purified 5-gallon, springs, rainwater, recycled water, and other sources (e.g., deep wells, a neighboring community water system). This variety of sources does not necessarily mean that all Pinget households have adequate access to clean or sufficient water (see Section VI). I note the variety because it was a key criterion for this study's neighborhood selection, as described in Section IV.

At the base of the Buyog Watershed, the BWD manages piped natural spring water in the rainy season and a deep well in the dry season. Water from these sources is chlorinated, and then

[6] It is possible that some households who access BWD in some other way reported having private access to BWD, for example, if the respondent perceived the landlord's private access as their own. This descriptive characteristic should thus be interpreted with caution.

pumped to a holding tank at the top of the watershed, just below Pinget's Purok 9. Water from the tank is distributed by gravity to households with private BWD metered connections on a rationed schedule, typically three days per week in the rainy season for a set number of hours each day, and less frequently in the dry season. Some households with private BWD connections may sell or give water to other households on a per drum basis.

Private delivery truck companies service Pinget, selling water to households at typical rates of ₱25-30 per 55-gallon drum. Companies prefer to sell large volumes of water such as enough to fill one 12-drum tank or a set of 8-10 drums. Single drum sales are undesirable for companies. At least 8-10 delivery companies sell water in Pinget, and at least two are Pinget-based. Delivery truck companies may have their own water source such as a deep well or may purchase water from a third party supplier.

Purified water for drinking and, in some households for cooking, is typically sold in 5-gallon containers at water refill stations and some *sari-sari* (small boutique) stores in Pinget. Households with transportation means may choose to buy purified water outside of the neighborhood and bring it home by motorcycle or car.

Rainwater can be harvested via household gutters that downpour into one or more drums or tanks. Like the rest of Baguio City, rainwater is usually most abundant during the May to October rainy season. It may also rain, though, during the dry season from November to April. Recycled water is typically stored in drums or smaller containers before being used for other household purposes. Finally, other sources available in Pinget include private deep wells, community deep wells, and the neighboring Quirino Hill community water system to which a few Upper Pinget households are connected.

## VI. Extent and Nature of Seasonal Water Insecurity

In this section, I describe the extent and nature of seasonal water insecurity in Pinget through description of household water sources and the dimensional measures of water insecurity used in this study (Q1), based on household survey data. I then examine seasonal water insecurity and water-related behaviors within households (Q2), using individual subsurvey data. To provide more examples and depth to the survey and subsurvey findings, I integrate findings from in-depth interviews throughout this section.

### Household Water Insecurity

*Household Water Sources*

Most households in Pinget use more than one kind of water to meet their needs, constructing household water portfolios out of multiple sources, like households in other Baguio City neighborhoods (Mason, 2012). A comparison of the percentage of households that uses each water source by season informs an initial, broad picture of household water insecurity in Pinget (Table 13). About 70% of households report using BWD water in either season. While this may seem reasonably high or comparable to what seems to be the general perception in Baguio City

**Table 13. Household Water Source(s) by Season (N=396)**[a]

| | Percentage of HHs Using Source | |
|---|---|---|
| Water Source | Dry Season | Rainy Season |
| BWD, private | 41.9 | 42.8 |
| BWD, shared/other way | 29.6 | 26.6 |
| Delivery truck | 34.3 | 23.2 |
| Purified (5-gallon) | 92.4 | 92.7 |
| Spring | 8.3 | 2.9 |
| Rainwater | 46.5 | 81.2 |
| Recycled | 88.4 | 43.9 |
| Other (e.g., deep well) | 6.3 | 5.2 |

*Note:* HH=household. BWD=Baguio Water District. [a] For the rainy season, N=383; 13 cases (3.28%) moved to Pinget after the most recent rainy season.

that “almost all” or “about 80%” of households are covered by BWD, it should be noted that just 42% of households report accessing BWD through a private connection. Over one-quarter of households (29.6% dry, 26.6% rainy) report accessing BWD in some other way, typically paying a landlord, neighbor, or relative for BWD water at rates that are higher than the BWD rate.

Also, it is common knowledge in Pinget and Baguio City that water supply from the BWD during the dry season is often low or unpredictable. Hence, many households supplement BWD with other sources such as delivery truck water. In the rainy season, when BWD supply is stronger and rainwater abundant, many of these households no longer purchase delivery water, which helps to partially explain the decrease in delivery water usage from 34.3% of households in the dry season to 23.2% of households in the rainy season.

Similarly, households that rely on spring water as a primary or supplemental dry season source (8.3%) often turn to rainwater as a primary source or no longer need the spring supplement as other sources (BWD, delivery truck) become more reliable in the rainy season. Spring usage thus decreases to 2.9% of households in the rainy season.

Notably, rainwater is collected and used by some households in both seasons. Even in the dry season, almost half (46.5%) of households report some rainwater usage, although substantially more (88.4%) report using recycled water. During the rainy season, these percentages nearly reverse: 81.2% of households report rainwater use, and 43.9% report use of recycled water.

In-depth interviews suggest that the widespread practice of using recycled water (i.e., greywater) is primarily a response to household water hardship or uncertainty, particularly in the dry season. At the same time, however, generally high rates in both seasons suggest that some norm of using recycled water—at least for sanitation—may have developed over time, regardless

of degree of hardship. Or, it may be that there is a social desirability to saying that the household uses recycled water. The notion of conserving water because Baguio City as a whole has water problems was expressed by only one participant, who described how the experience of a relative who lives in a part of Baguio with limited BWD access shaped her ideas about water conservation. In contrast, during the rainy season, there is a notion that when water is abundant, it should be used. As one female participant expressed with enthusiasm:

> When you know that there's enough water, then you forget about using little. You could just open it and then *{laughter}*, you cannot control!

As suggested by Table 14, many households seem to substitute rainwater for recycled water in the rainy season for sanitation (pour-flushing the toilet in the "C.R." or "comfort room")

**Table 14. Seasonal Change in Rainwater and Recycled Water Use (N=396)[a]**

| Water Purpose | Percentage of HHs Using Rainwater for this Purpose | | Percentage of HHs Using Recycled Water for this Purpose | |
|---|---|---|---|---|
| | Dry Season | Rainy Season | Dry Season | Rainy Season |
| Drinking | 0.8 | 1.8 | 0.0 | 0.0 |
| Cooking | 3.0 | 9.1 | 0.0 | 0.0 |
| Washing hands/face | 5.1 | 16.7 | 0.0 | 0.0 |
| Bathing | 7.8 | 21.7 | 0.0 | 0.0 |
| Clean dishes | 8.6 | 20.9 | 0.3 | 0.3 |
| Laundry | 27.0 | 62.9 | 1.5 | 1.8 |
| Sanitation/flushing | 42.9 | 77.3 | 84.3 | 40.5 |
| Other HH cleaning | 17.4 | 46.5 | 29.6 | 12.5 |
| Other uses | 6.1 | 5.0 | 22.5 | 5.0 |

*Note:* HH=household. [a] For the rainy season, N=383; 13 cases (3.28%) moved to Pinget after the most recent rainy season.

and other household uses such as cleaning or backyard gardens. This substitution was typified by the following exchange with a female in-depth interview participant:

> *Participant*: So we will recycle the water. From washing clothes, we will keep the water, and we used that in the C.R. to flush.
>
> *Interviewer*: And in the rainy, do you still recycle or no more?
>
> *Participant*: No more. Because if it will rain, oh, my plants! Free from water!

*Water Quantity*

Objective, perceptual, and experiential measures of water insecurity are important for understanding the extent and nature of water insecurity at the household or individual level (Hadley & Wutich, 2009). While this study did not measure actual household water consumption, the survey did collect data on reported water consumption by the household for each water source used in each season. Table 15 summarizes reported consumption from all sources by season, with and without recycled water, in liters per capita, per day (LPCPD). For the dry season, average reported consumption from all sources is 68.5 LPCPD, and 64.2 LPCPD when recycled water is excluded. Not surprisingly, there is a wide range of reported consumption: from under 10 to over 400 LPCPD. While this range is probably partially due to measurement error—in Pinget, it is unlikely that a household subsists on less than 10 LPCPD—it also suggests that there are wide inequalities in actual consumption between households.

When subsets of the survey sample are examined, we find that households that rely mainly on BWD water through private connections in the dry season report significantly higher average consumption (90.0 LPCPD) than households that rely primarily on BWD water through

**Table 15. Reported Household Water Consumption (LPCPD)**

| Water Sources | Dry Season (N=388) | | | | Rainy Season (N=373) | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Min | Max | Mean | SD | Min | Max |
| All | 68.5 | 60.2 | 7.7 | 406.4 | 66.3 | 57.8 | 6.7 | 391.1 |
| All, less recycled | 64.2 | 59.0 | 7.5 | 372.1 | 64.1 | 57.0 | 6.7 | 388.3 |

*Note:* LPCPD=liters per capita, per day.

shared/non-private connections (40.1 LPCPD ) or delivery water (65.0 LPCPD ) (Welch's F=30.96; df=2, 301; p<.0001).

Like in the dry season data, we again observe a wide range in reported consumption in the rainy season: from less than 7 to almost 400 LPCPD, with a mean of 66.3 for all sources and 64.1 less recycled water. Of note, the mean change in reported consumption from all sources decreases from the dry season to the rainy season by 3.13 LPCPD, a statistically significant change (Wilcoxon Signed-Rank=-4,208, p=.01). This finding is contrary to the study hypothesis, which expected households to report lower consumption during the dry season. There are at least three possible explanations.

First, some households that use both BWD and delivery water in the dry season may have overestimated their reported consumption. For example, some households may have reported an amount for delivery water consumption for a typical week, when in fact such consumption (i.e., ordering delivery as a supplement to BWD) in practice occurs just once or twice a month. Second, some households may have provided a lower bound estimate of rainwater consumed during a typical rainy season week. For example, a household that collects rainwater in two drums via a roof gutter may have reported consuming two drums of rainwater per week "continuously," meaning that the drums are continuously being replenished with water, and the household was unable or perhaps unwilling at the time to estimate how many drums of rainwater are actually consumed in a typical week. Third, it may be that household water needs during the

rainy season decrease, despite the abundance of water. For example, some households may wash clothes less frequently in the rainy season than in the dry season, or individuals may bathe less frequently since the weather is cooler.

Survey respondents were also asked whether their household *always has enough*, *sometimes does not have enough*, or *often does not have enough* water for household needs in typical dry and rainy season weeks. As shown in Table 16, for the dry season, 48.2% reported always having enough, 45.7% reported sometimes not having enough, and 6.1% reported often not having enough. In the rainy season, these percentages improved substantially to 90.6%, 9.4%, and 0.0%, respectively. In support of the study hypothesis, a lower percentage of households report always having enough in the dry than rainy season (McNemar's S=158.4, df=1, p<.001).

**Table 16. Perceived Sufficiency of Water During a Typical Week**

| Response | Dry Season (N=396) | Rainy Season (N=382) |
|---|---|---|
| | % | % |
| Always have enough | 48.2 | 90.6 |
| Sometimes not have enough | 45.7 | 9.4 |
| Often not have enough | 6.1 | 0.0 |

*Note:* Responses are to the question: "Now, thinking about all the water your household uses during a typical dry/rainy season week, does your household… {response}…water for household needs?"

This seasonal change may reflect a theme from in-depth interviews—that hardship of water is *felt more* in the dry than rainy season. Households may use similar amounts of water in both seasons, but the difficulty and expense of obtaining and managing that water in the dry season feels more cumbersome to many households. In the dry season, BWD, spring, and rainwater are less abundant, and wait times for delivery trucks may be longer. As a result, some households postpone or reduce the frequency of chores such as laundry or cleaning when water

supplies run low. These delays seem to create an uncertainty and a related sense of stress about water and everyday living, as usual household work cannot be done due to lack of water. In the rainy season, by contrast, BWD water pressure and regularity improve, spring and rainwater are abundant, and delivery trucks have sufficient supply (although the latter are sometimes impeded by slippery roads), alleviating the feeling for many that water is difficult to obtain.

To assess sufficiency of water, this study also used an experiential measure: whether the household has times during a typical week that it does not have enough water for specific household needs. Seasonal differences are observed (Table 17). During the dry season, about one-quarter of households (26.0%) report at least one household need for which they do not have enough water during a typical dry season week. By need, rates range from 6.3% of households reporting not enough for drinking water to 20.5% of households reporting not enough for laundry water. During the rainy season, only 3.9% of households report typically experiencing insufficient water for at least one household need. The study hypothesis that a higher percentage of households experience insufficiency of water in the dry than rainy season is supported (McNemar's $S=83.0$, $df=1$, $p<.001$).

**Table 17. Experienced Insufficiency of Water During a Typical Week**

| Water Purpose | Dry Season (N=396) | Rainy Season (N=382) |
|---|---|---|
| | % | % |
| Drinking | 6.3 | 1.6 |
| Cooking | 12.2 | 1.6 |
| Bathing | 19.4 | 2.6 |
| Dishes | 15.2 | 2.1 |
| Laundry | 20.5 | 1.8 |
| Household cleaning | 8.8 | 1.1 |
| Sanitation/flushing | 9.9 | 0.8 |
| Yes to 1+ of the above | 26.0 | 3.9 |

*Note:* Respondent were asked, "During a typical dry/rainy season week, are there any times that your household does not have enough water for… {household need}?"

When this study's measures of perceived sufficiency versus experienced insufficiency are compared, a discrepancy emerges. In the dry season, a combined 51.8% of households report sometimes or often not having enough water for household needs in a typical week, but when asked about specific needs, only 26.0% report that there are times in a typical week when the household does not have enough. In the dry season, the percentage also declines from 9.4% (perceived insufficiency) to 3.9% (experienced insufficiency). One explanation for this difference may go back to the theme above, that households have a *sense* or *feeling of hardship* in the dry season, although this may not necessarily align with experiential measures of hardship.

Alternately, it may be that the household water managers who responded—recalling that these were primarily women expected to fulfill gendered domestic responsibilities—perceived themselves as "always finding a way" to find water for their household's needs, and were thus less likely to report that the household actually did not have enough for a particular need. For example, a respondent may perceive her decision to postpone laundry or use less water for bathing as coping strategies to "make water last" so that the household still has enough overall. Like the female in-depth interview participant who commented, "…we wash our clothes in summer season just twice a week because of water," it may be that some respondents adjust their expectations seasonally—doing laundry, for example, twice a week during the dry season may be perceived as "enough" given the overall hardship of water.

*Water Quality*

To assess perceived water quality, households were asked to rate, by season, the cleanliness of the water that the household uses overall and for specific household purposes. These are subjective measures, not intended to substitute for biological or chemical assessments of water quality.

**Table 18. Perceived Cleanliness of Water**

| Water Purpose | Dry Season (N=395) | | | | Rainy Season (N=381) | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Min | Max | Mean | SD | Min | Max |
| Overall | 7.5 | 1.7 | 1.0 | 10.0 | 6.9 | 1.9 | 1.0 | 10.0 |
| Drinking | 8.9 | 1.3 | 3.0 | 10.0 | 8.8 | 1.4 | 1.0 | 10.0 |
| Cooking | 7.7 | 1.6 | 1.0 | 10.0 | 7.2 | 1.8 | 1.0 | 10.0 |
| Bathing | 7.6 | 1.5 | 1.0 | 10.0 | 7.0 | 1.8 | 1.0 | 10.0 |
| Dishes | 7.6 | 1.5 | 1.0 | 10.0 | 7.1 | 1.8 | 1.0 | 10.0 |
| Laundry | 7.6 | 1.5 | 1.0 | 10.0 | 6.9 | 1.8 | 0.0 | 10.0 |
| HH cleaning | 6.9 | 2.4 | 0.0 | 10.0 | 6.6 | 2.1 | 0.0 | 10.0 |
| Sanitation | 5.7 | 2.8 | 0.0 | 10.0 | 5.8 | 2.3 | 0.0 | 10.0 |

*Note:* Respondents were asked about cleanliness of water using 11-point phrase completion items with 0=Not clean at all, and 10=Completely clean. HH=household.

Overall mean ratings are 7.5 in the dry season and 6.9 in the rainy season (Table 18). Although Wilcoxon Signed-Rank tests find that mean ratings are higher in the dry season than the rainy season overall ($p<.001$) and for each specific need except sanitation ($p=.04$ for drinking, $p<.001$ for the other needs), these changes do not seem practically very large. The largest declines of 0.6 for bathing and 0.7 for laundry likely reflect increased turbidity of BWD water in the rainy season, as described informally by many households. The following in-depth interview participant for example, an elderly and long-time female resident of Pinget, first described the problems with BWD water, then contrasted it with the perceived cleanliness of rainwater:

> …sometimes there are, if it is raining, and you open the {BWD} pipe, there are sand—particles of sand. And the water is not so clear.
>
> ...sometimes the water coming from the roof, the rainwater, is cleaner. Because the water from the {BWD} pipe is turbid. It's turbid. Really, it's turbid.

Relatively higher ratings for drinking water (8.9 dry, 8.8 rainy) reflect that households seem to deliberately choose sources that they trust enough for consumption. In most cases, this is purified water sold in 5-gallon jugs. In a few cases, BWD water is consumed either directly, boiled, or filtered. Some households also report drinking spring water in the dry season, though not usually during heavy rains of the rainy season when water may be turbid.

From in-depth interviews, the relationship between personal experience, indirect knowledge, and trust of different sources emerged. When asked why they choose purified water over other sources for drinking, several participants noted that it must be clean since no household members had become sick (i.e., absence of loose bowel movements). Others commented on greater "sweetness" or taste of one source over another. On a related point, some households described how the knowledge of someone close to them, whom they trusted, shaped their views of drinking water sources. One female participant, for example, described how her decision to switch from drinking spring to BWD water (a relatively uncommon decision in Pinget and Baguio City overall), was informed by her in-law's experience as a BWD technician:

> Even before, we still got water there [at the spring] for drinking. But I'm thinking, why do I have to go there? That is the source of the [BWD] water we collect…that they are pumping. So it's the same...And because I have this *Manong*, this in-law who said, because he works for the BWD, that they are the ones putting medicine {chlorine} in the tank.

Relatively lower ratings for water for sanitation reflect that many households use recycled water for flushing the toilet. These ratings were 5.7 for the dry season, and 5.8 for the rainy season.

*Water Accessibility*

This study's quantitative measures of water accessibility are an overall measure of perceived ease of obtaining water, and affordability of water. To assess perceived ease, respondents were asked to rate the overall ease of obtaining household water by season. Not surprisingly, ratings were higher (easier) in the rainy season (Table 19). The mean for the dry season was 6.9 with a standard deviation of 2.2. For the rainy season, the mean improved to 8.6, and the standard deviation decreased to 1.7. In support of the study hypothesis, the seasonal difference is statistically significant (Wilcoxon Signed-Rank=-15,316.5, p<.001).

**Table 19. Perceived Ease of Household Obtaining Water**

| Water Purpose | Dry Season (N=395) | | | | Rainy Season (N=381) | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Min | Max | Mean | SD | Min | Max |
| Overall Ease | 6.9 | 2.2 | 0.0 | 10.0 | 8.6 | 1.7 | 0.0 | 10.0 |

*Note:* Respondents were asked about ease of obtaining water for the household using an 11-point phrase completion item with 0=Not easy at all, and 10=Extremely easy.

Monthly household water expenses in this study averaged ₱787 in the dry season, and ₱638 in the rainy season, with high standard deviations (Table 20). The study hypothesis of a statistically significant difference is supported (Wilcoxon Signed-Rank=10,937.5, p<.001). To create an affordability measure, I calculated the percentage of monthly income spent on water. Raw data on both income and expenses were available for 337 cases (85.1%) in the dry season, and 318 cases (80.3%) in the rainy season. As shown in Table 21, about half of these households

**Table 20. Total Household Water Expenses**

| Water Expenses | Dry Season (N=386) | | | | Rainy Season (N=370) | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Min | Max | Mean | SD | Min | Max |
| Total (₱/month) | 787 | 757 | 0 | 11,397 | 638 | 680 | 0 | 11,397 |

*Note:* Currency conversion is ₱42.8 (Philippine pesos) to 1 USD.

**Table 21. Household Water Expenses as Percentage of Income**

| Category | Dry Season (N=337) | Rainy Season (N=318) |
|---|---|---|
| | % | % |
| 0 to 5.0% | 51.0 | 56.0 |
| 5.1 to 10.0% | 32.1 | 30.5 |
| 10.1% or more | 16.9 | 13.5 |

(51.0%) spend 0 to 5.0% of their income on water in the dry season, about one-third (32.1%) spend 5.1 to 10.0%, and almost 17% spend 10.1% or more of their income on water. In the rainy season, these numbers change somewhat to 56.0%, 30.5%, and 13.5%, respectively. These changes are statistically significant in expected directions, supporting the study hypothesis (McNemar's S=12.5, df=3, p=.006).

Intended quantitative measures of physical and temporal accessibility were difficult to standardize across different sources and are not included here (e.g., BWD water that may be piped to the home but delivered a few times per week; versus springs that may be located a 5-10 minute walk away, with long waiting lines, but usually available every day). Qualitative findings on these aspects of accessibility emerged, however, from in-depth interviews. First, for households that rely mainly on BWD or delivery truck water, there is uncertainty about when water will arrive, particularly in the dry season. Household water storage seems to be a response to this uncertainty, as typified by the following female participant, who uses the word "conserve" to mean "store" or "reserve":

> We conserve water…for the next day use. Because, if you do not conserve water, what will you use the next day?...So that you have something to use for the next schedule. Yes, because if it's Monday, comes at night. Tuesday, there's no water. What will you use if you do not conserve water? And then the following Wednesday, water at night…So that is what we are doing. I think everybody is doing that.

For households with one or more working adults, BWD and delivery truck schedules may collide with work schedules, formal or informal. In extreme cases, if no one is home to receive the delivery, other households might claim the delivery as their own, since they too may be in need of water and would rather not continue to wait for their turn on the delivery truck's list of customers. In the dry season, when delivery water is in high demand, household needs may be compromised by long waits for a delivery. One female participant described how she complains to the delivery company, imitating herself confronting a delivery truck driver:

> What kind of service do you have! I ordered water yesterday, and it is only now that you deliver! We don't even have water for cooking and flushing the C.R.!

This reference to "not even having water" for cooking or sanitation was made by other in-depth interview participants as well, suggesting that not having water for these particular purposes is a sign of more severe hardship. While laundry or household cleaning are more readily postponed, cooking must be performed daily and delayed flushing would become unsanitary.

In general for the dry season, many describe how waiting for water is disruptive or inefficient. In some cases, BWD water is delivered late at night, and household water managers or other members of the household must stay up late to regulate filling tanks or drums. For spring users, waiting in long lines at the spring feels inefficient and cumbersome. In the rainy season, by contrast, water accessibility is not perceived as problematic by most households, due to the abundance of rainwater if the household can harvest it, the increased pressure and improved reliability of BWD water, and the generally shorter wait times for delivery truck water (although in some cases, slippery roads and heavy rains can delay deliveries as well).

*Additional Measures of Water Insecurity*

The survey asked two additional experiential measures of water insecurity—whether the household had ever borrowed water from another household, or borrowed money to pay for water (Table 22). About one-third (34.1%) reported having borrowed water, in amounts ranging from two to 2,400 liters. Just under 20% had borrowed money, from ₱28 to ₱2,000.

**Table 22. Water and Money Borrowing (N=396)**

| Type | % | Mean | SD | Min | Max |
|---|---|---|---|---|---|
| HH has borrowed water | 34.1 | | | | |
| If yes, typical amount (L) | | 163.3 | 345.9 | 2.0 | 2,400.0 |
| HH has borrowed money to buy water | 18.7 | | | | |
| If yes, typical amount (₱) | | 331.72 | 345.30 | 28.00 | 2,000.00 |

*Note:* HH=household. L=liters. ₱=Philippine pesos.

Such cooperation around water—the willingness of neighbors to share water and money—also emerged during in-depth interviews. Households seem willing to cooperate around water because they, too, have had times when water was difficult and know how essential water

is to everyday well-being. One female participant succinctly stated what seemed to be a common sentiment:

> It's like *panagkuwak* {giving consideration}, because I know that they don't have any source of water.

Relationships among people with similar ethnic backgrounds may also facilitate some of this cooperation. In many puroks, neighbors are from the same village or province of origin outside Baguio, and may have a heightened sense of obligation to reciprocate water when another household is in need.

**Individual Water Insecurity and Related Behaviors**

*Individual Water Insecurity*

Results for quantitative measures of individual water insecurity and water-related behaviors are presented in Table 23 for the dry season, and Table 24 for the rainy season, based on individual subsurvey data. In the dry season, for water insecurity measures, 5.7% of women and 2.6% of men report not having enough water for drinking in a typical week. Higher percentages—16.7% of women and 12.8% of men—report times when they do not have enough for bathing. Mean perceived cleanliness ratings of drinking water are 8.7 for women and 8.8 for men, and 7.4 for bathing water for both. In the rainy season, results for quantitative measures of insufficient drinking and bathing water improve, particularly for bathing: rates for women decrease from 16.7% to 2.4%, and for men from 12.8% to 2.7%. Measures for perceived cleanliness of water remain the same as the dry season or decrease slightly. In both seasons,

**Table 23. Dry Season Individual Water Insecurity and Water-Related Behaviors (N=291)**

| Measure | Women (N=174) % or Mean (SD) | Men (N=117) % or Mean (SD) | Rao-Scott $\chi^2$ | t | p |
|---|---|---|---|---|---|
| **Water Insecurity** | | | | | |
| Times when not enough | | | | | |
| Drinking (%) | 5.7 | 2.6 | 2.92 | | .09 |
| Bathing (%) | 16.7 | 12.8 | 1.12 | | .29 |
| Perceived cleanliness | | | | | |
| Drinking (0 to 10) | 8.7 (1.4) | 8.8 (1.4) | | -.54 | .59 |
| Bathing (0 to 10) | 7.4 (1.7) | 7.4 (1.9) | | -.25 | .80 |
| **Water-Related Behaviors** | | | | | |
| Conservation practices | | | | | |
| Uses less for drinking (%) | 3.4 | 3.4 | .00 | | .99 |
| Uses less for bathing (%) | 30.5 | 28.2 | .21 | | .64 |
| Recycles bath water (%) | 31.0 | 23.1 | 3.13 | | .08 |
| Spends time getting water (%) | 66.1 | 48.7 | 10.72 | | .001 |
| Makes water complaints (%) | 18.4 | 11.1 | 4.69 | | .03 |

**Table 24. Rainy Season Individual Water Insecurity and Water-Related Behaviors (N=278)**

| Measure | Women (N=166) % or Mean (SD) | Men (N=112) % or Mean (SD) | Rao-Scott $\chi^2$ | t | p |
|---|---|---|---|---|---|
| **Water Insecurity** | | | | | |
| Times when not enough | | | | | |
| Drinking (%) | 1.2 | 1.8 | 0.15 | | 0.70 |
| Bathing (%) | 2.4 | 2.7 | 0.02 | | 0.89 |
| Perceived cleanliness | | | | | |
| Drinking (0 to 10) | 8.7 (1.5) | 8.7 (1.5) | | -.32 | 0.75 |
| Bathing (0 to 10) | 7.0 (1.8) | 7.1 (1.9) | | -.16 | 0.87 |
| **Water-Related Behaviors** | | | | | |
| Conservation practices | | | | | |
| Uses less for drinking (%)[a] | 0.0 | 2.7 | | | 0.06 |
| Uses less for bathing (%) | 8.4 | 9.8 | 0.16 | | 0.69 |
| Recycles bath water (%) | 9.0 | 9.8 | 0.05 | | 0.82 |
| Spends time getting water (%) | 56.0 | 39.3 | 9.56 | | 0.00 |
| Makes water complaints (%) | 0.6 | 1.8 | 0.72 | | 0.39 |

*Note:* NA=not applicable. [a]Due to at least one cell size of 0, the non-parametric Fisher's exact test is used.

using bivariate analyses that account for clustering of individuals in the same household, no statistically significant differences by gender are found.

Qualitative results, meanwhile, suggest interesting ways in which water insecurity may vary within households. Many women seem to *feel* the hardship of water more than men, as they are the ones primarily responsible for household activities that require water like cooking, bathing children, laundry, and cleaning. Without sufficient water, women are unable to perform the gendered responsibilities expected of them, and there seems to be a concern that they then perceive themselves—or that others in the household may perceive them—as unproductive. One female participant, in her 30s and widowed, described this in terms of not being able to "move", an idea that calls to mind notions of capability and self-determination (Sen, 1999):

> Of course, these children go to school and so take a bath. I can't even cook food early in the morning. Even me, I'm affected. I can't move inside the house.

On gendered efficiency with water, no agreement among participants emerged. Some men described themselves as unwise users of water; others complained that their wives do not know how to recycle or conserve water. One man, for example, criticized his wife's habit of rinsing rice more than once, a common Filipino practice which women likely consider the proper way to prepare food for their family:

> In terms of cooking, women do wash thoroughly the vegetables and when they cook rice, until the nutrients are lost! They would wash it many times, unlike men, where they simply wash rice only once.

Some women, meanwhile, described men as excessive water users for things like bathing. Others remarked on women's greater use of water for bathing and during menstrual cycles.

Finally, that some elderly individuals may have particular water needs and potential insecurities emerged. Some elderly residents of Pinget, accustomed to fetching spring water in the past, find themselves no longer physically able to transport water to and from the spring. However, they have not obtained BWD metered connections for their homes either. Or, for those who do have BWD connections, some find the schedule—such as water arriving only late at night—too difficult to manage.

*Conservation Behaviors*

Water-related conservation behaviors were also examined in subsurveys. Not surprisingly, differences are observed by season (Tables 23-24, above). In the dry season, 3.4% of both women and men report conserving water by drinking less; these rates decrease to 0.0% of women and 2.7% of men. On conserving water by bathing less, 30.5% of women and 28.2% of men report doing this in the dry season—rates that drop to 8.4% and 9.8%, respectively, in the rainy season. Recycling bath water is reportedly practiced by 31.0% of women and 28.2% of men in the dry season, and 9.0% and 9.8%, respectively, in the rainy season. For these conservation behavior measures, statistically significant differences by gender are not found in either season. At the same time, though, qualitative findings suggest that women may perceive themselves as more efficient and responsible conservers of water for the household overall. Several women expressed an idea similar to the following, made by a married, female participant:

> Most of the time we took a bath, and we do the laundry. For men, nothing. They just took a bath and then left for work. That is why we are more concerned…We know how to segregate, "This is for flushing." We recycle. They {the men} don't have that in mind. They just took a bath and then left no more.

Some women connected this to the idea of men being "out of the home" and women being "in the home," even though many women actually work in both spheres. A married female participant remarked:

> Maybe because men are not staying home…and do not know what is lacking inside the house like water.

Another married female elaborated:

> I think it's always on the women. It's the job of the women to see to it and then if, because like for me, I know if the water is enough for use. So I know that if it's not, if there is a little bit of problem, I recycle the water. If I wash dishes, I put it in a pail. And then, we will use that in the C.R. In my case, it's always me. I don't know for others, but in my side, it's always me. Because I remember also that when we lacked water before, I was the one who kept on bathing my children, so that they will not use, waste, the water.

Women, thus, often play an important role in conserving water through their individual water behaviors, and through reminders to other household members to conserve water as well. Also, even in households where both women and men work outside of the home, the idea that women are still primarily responsible for the household tasks that use water, while men are more free to leave the home for either work or leisure, is consistent with the gender norms previously described (Chant, 2007).

*Time Obtaining Water*

In the individual subsurvey data, a statistically significant and higher percentage of women than men report spending time getting water for the household (i.e., collecting, buying, or waiting for water)—66.1% versus 48.7% in the dry season (Rao-Scott $\chi^2$=10.72, df=1, p=.001), and 56.0% versus 39.3% in the rainy season (Rao-Scott $\chi^2$=9.56, df=1, p<.001) (Tables 23-24, above). This is not surprising, as substantially more women than men are considered the household water manager. Somewhat high rates for men, though, are notable as they reflect the norm observed in prior research in Baguio City that men often bear responsibility for carrying water from springs or transporting 5-gallon jugs of drinking water (Mason, 2012). In households with private BWD connections, men are often (though not exclusively) the ones to open and close valves for filling tanks or drums, or may perform the physical work of periodically checking the water supply in the tank. These gendered behaviors seem to align with the Filipino masculine attributes of providing for and protecting the family (Rubio & Green, 2011). One married male participant also shared insights on this, by comparing the gendered behavior in urban areas like Baguio City with rural provinces where many have migrated from, suggesting a connection between changing gender norms around water and women's employment:

> That is the situation here in the city. But in the province, women do the carrying of water…also in terms of cooking. But here in Baguio, women go out to work like getting vegetables…but in the province, it is really a woman's job.

*Making Water Complaints*

On making water-related complaints, 18.4% of women report having done so in the dry season, compared to 11.1% of men, a statistically significant difference (Rao-Scott $\chi^2$=4.69, df=1, p=.03). In the rainy season, reported rates decrease to 0.6% for women and 1.8% for men (Tables 23-24, above). From qualitative interviews, no pattern of who made complaints or why emerged. A common perception, though, was that if making a complaint, persistence and follow-up are key, particularly with BWD. A female participant summarized this as:

> If you are not that assertive, they will not act on it. But if you keep returning back to them, maybe they will act.

**Summary and Discussion**

*Household Water Insecurity*

In this section, a key finding is that water insecurity varies widely among households in Pinget. These differences are more pronounced in the dry than rainy season. In the dry season, supply from main sources often becomes insufficient or irregular, and households turn to supplemental sources of water. In the rainy season, rainwater brings an abundance of water for households that can harvest it and boosts the supply available from BWD, delivery trucks, and other sources. During both seasons, rainwater harvesting and recycling water are fairly common,

with possible substitution effects (recycled water for rainwater in the dry season; vice versa in the rainy season). Access to a BWD connection in Pinget is estimated at 70% of households, with private access estimated at 42%. Taken together, these results support the claim that municipal, regional, and national water statistics may mask important disparities among households at lower levels of analysis. Indeed, unmasking these disparities—and doing so by season—are emerging priorities in the water and development literature, if universal access to adequate water is to be achieved (UNICEF and World Health Organization, 2012).

In this study, mean reported water consumption in Pinget is above the 50 LPCPD standard first suggested by Gleick (1998). There is a wide range among households, however, and a high standard deviation for this measure in both seasons. This heterogeneity of water quantity among Pinget households is also evidenced by findings for perceived sufficiency and experienced insufficiency, and qualitative findings from in-depth interviews. From an equity perspective, these findings suggest that households with higher reported consumption may be unjustly overconsuming water, while households with lower reported consumption may be unjustly experiencing insufficient water. Also, possible overconsumption by some households may adversely affect the supply available to all households (Srinivasan, Seto, Emerson, & Gorelick, 2013). Given the self-report and recall nature of consumption data in this study, however, these findings should be interpreted with caution. Further, that mean consumption decreases slightly from the dry to rainy season in this study is an unexpected finding, potentially explained by measurement limitations described above. More refined collection of seasonal water consumption data among households in Pinget—perhaps through a random sample subset asked to complete water collection diaries—could shed further light on this unexpected result.

Perceived cleanliness of water is somewhat higher in the dry than rainy season, due to turbidity of water in various sources when rains are heavy, particularly BWD water as reported by households. Thus, while water quantity may be more problematic for households in Pinget in the dry season, quality may be of greater concern in the rainy season. Although the measure of perceived cleanliness in this study does not intend to measure the biologic or chemical quality of water, the findings suggest that BWD water—which would be classified as an improved source for those with private BWD access—may be perceived by households as of inadequate quality. In Pinget, like Baguio City in general, few households consume BWD for drinking. Study findings on quality thus support calls in the global water literature to move beyond access to an improved source as the proxy for water security, since improved sources of water may not always be viewed as clean or used for drinking (UNICEF and World Health Organization, 2012).

In general, households perceive accessibility of water as more difficult in the dry than rainy season. Waiting for water during the dry season—from BWD, delivery trucks, in line at the spring, or otherwise—can take time, disrupt work schedules, and disturb personal schedules. This uncertainty about when water will arrive seems to create a sense of stress and feeling of hardship for some, along with the need to store water as a coping strategy. The aspect of emotional distress is consistent with prior research by Wutich and Ragsdale (2008), and remains an important but still understudied issue in the urban water security literature. Meanwhile, affordability of water varies widely among Pinget households. On average, households in this study spend about 5% of their income on water, which exceeds a United Nations recommendation that water expenses should be 3% or less of household income. In the U.S., a 5% expenditure would be equivalent to a $100 water bill for a household with monthly income of $2,000. While some households in Pinget have zero expenses, others spend upwards of 30%

of their income on water. Although measurement limitations of obtaining accurate expense and income data should be considered, these findings provide support for new efforts to ensure equity in all dimensions of water security, again with the goal of moving beyond the proxy of improved access (UNICEF and World Health Organization, 2012).

*Individual Water Insecurity*

Within households, overall individual water insecurity can vary seasonally, like household water insecurity. In general, rates of not having enough water for drinking, not having enough water for bathing, using less water for drinking, using less water for bathing, and recycling bath water are higher in the dry season than rainy season. Although water insecurity is often measured at the household level, these findings serve to remind that some aspects of insecurity are experienced by individuals who may or may not have enough to drink or bathe, or who may need to or choose to adapt their behaviors given the household's water situation. As the water and development field moves toward achieving universal water coverage, additional data collection at the individual level will be important to document, understand, and address disparities.

On gender, two hypotheses supported by study findings are that female respondents are more likely than males to (1) spend time getting water for the household (significant in both seasons), and (2) make water-related complaints to someone outside the home (significant in the dry season). This study finds limited support, however, for the hypotheses that a higher percentage of female than male respondents will experience water insecurity or report engaging in water-related conservation behaviors. This is in contrast to Wutich (2009), who found statistically significant differences for several measures of individual water insecurity or related behaviors, with a much smaller sample size than this study. One possible explanation is that

Wutich's study setting, an urban neighborhood in Cochabamba, Bolivia, seemed to have a more severe water situation than Pinget, the neighborhood in this study. For example, mean water use reported by Wutich (2009) is 32.9 LPCPD, compared to mean reported consumption of 66.3-68.5 LPCPD in this study. It may be that during more severe water crises, gender differences within households in Pinget would emerge. At the same time, however, gender dimensions of the two contexts must be considered. As previously noted, gender relations in the Philippines tend to have some egalitarian qualities that may not be as common in many other developing countries.

Qualitative findings, meanwhile, shed more light on gender differences within households. An important theme from in-depth interviews is that women seem to feel water hardship more than men, due to gendered responsibilities for everyday cooking, child care, laundry, and cleaning, again calling to mind Wutich and Ragsdale's (2008) findings on emotional distress. To mitigate overall insecurity, women may thus be more active in conserving and recycling water within the home, although some of the men interviewed for this study would not agree. Men, meanwhile, perform important water-related roles such as transporting water from springs or water refill stations, and serving as household water managers when women are working outside the home or under other particular household circumstances.

To understand these gender dimensions further, however, the overall household structure should be considered. In urban Philippines, it may be that individual water-related experiences in households headed by a single-male with children resemble those in households headed by a single-female with children. In other words, outside of a "traditional" married or partnered household, in the context of urban Philippines, perhaps gender roles concerning water are not as distinct as those within more traditional households.

## VII. Individual and Household Factors

In this section, I present results from multiple regression analyses that examine how gender and financial, physical, and social resources relate to dimensional measures of water insecurity in seasonal ways (Q3). Analyses use the imputed household survey data, as described in Section IV. Tables in this section compare results for the final complete model of each dependent variable by season. Supplemental tables in Appendix A contain model building results, additional information for each complete model, and results for alternate models for robustness and sensitivity checks.

### Quantity

*Reported Consumption*

Results for the multiple linear regression models of log-transformed reported consumption (LPCPD) are summarized in Table 25. In the dry season, statistically significant associations are found between logged reported consumption and logged monthly income ($b=0.19$, $t=3.83$, $p<.001$), logged tank/drum capacity ($b=0.11$, $t=3.54$, $p<.001$), having a shared/other BWD connection ($b=-0.23$, $t=-3.35$, $p<0.001$), and having a private BWD connection ($b=0.24$, $t=3.25$, $p=.001$). Household size, as a control variable, is also significantly associated with the dependent variable ($b=-0.11$, $t=-7.24$, $p<.001$).

For the dry season, these results suggest that a 1% increase in monthly income is associated with a 0.19% increase in reported LPCPD, and that a 1% increase in tank/drum capacity is associated with a 0.11% increase in reported LPCPD. For BWD connection results, coefficients are exponentiated, then interpreted. Compared to households with no BWD connection, those with a shared/other connection have a 20.8% decrease in reported LPCPD, while those with a private connection have a 27.2% increase in reported LPCPD.

**Table 25. DV1: Linear Regression Models of Logged Reported Consumption (LPCPD)**

| Independent Variable | Dry Season | | | Rainy Season | | |
|---|---|---|---|---|---|---|
| | Est. | SE | t | Est. | SE | t |
| **Individual Factors** | | | | | | |
| *Gender* | | | | | | |
| Female | 0.03 | 0.08 | 0.44 | -0.05 | 0.07 | -0.63 |
| *Other Demographics* | | | | | | |
| Education, less than HS | | | | | | |
| HS diploma | 0.03 | 0.07 | 0.41 | 0.09 | 0.08 | 1.10 |
| College graduate | 0.09 | 0.08 | 1.08 | 0.14 | 0.08 | 1.67 |
| Marital status, not married[a] | | | | | | |
| Married, lives elsewhere | 0.13 | 0.10 | 1.32 | 0.05 | 0.10 | 0.51 |
| Married, lives in home | -0.05 | 0.07 | -0.69 | -0.04 | 0.07 | -0.57 |
| Age | 0.00 | 0.00 | 1.13 | 0.00 | 0.00 | 0.95 |
| Ethnicity, Cordilleran | 0.01 | 0.06 | 0.18 | 0.12 | 0.07 | 1.82 |
| **Household Factors** | | | | | | |
| HH size | -0.11 | 0.01 | -7.24*** | -0.13 | 0.01 | -8.41*** |
| *Financial resources* | | | | | | |
| Logged monthly income[b] (₱) | 0.19 | 0.05 | 3.83*** | 0.20 | 0.04 | 4.54*** |
| Savings, none | | | | | | |
| Informal | -0.06 | 0.10 | -0.67 | -0.13 | 0.10 | -1.25 |
| Formal | 0.06 | 0.07 | 0.87 | -0.04 | 0.07 | -0.62 |
| *Physical resources* | | | | | | |
| Logged tank/drum capacity (L) | 0.11 | 0.03 | 3.54*** | 0.11 | 0.03 | 3.60*** |
| BWD connection, None | | | | | | |
| Shared/other way | -0.23 | 0.07 | -3.35*** | -0.31 | 0.07 | -4.39*** |
| Private | 0.24 | 0.07 | 3.25** | 0.20 | 0.07 | 2.70** |
| Homeownership | 0.09 | 0.07 | 1.22 | 0.04 | 0.07 | 0.59 |
| *Social resources* | | | | | | |
| Water network, 0 HHs | | | | | | |
| 1 HH | 0.00 | 0.11 | 0.04 | 0.02 | 0.11 | 0.16 |
| 2+ HHs | -0.10 | 0.13 | -0.78 | 0.01 | 0.13 | 0.08 |
| Money network, 0 HHs | | | | | | |
| 1 HH | 0.00 | 0.10 | 0.03 | 0.01 | 0.10 | 0.14 |
| 2+ HHs | -0.01 | 0.12 | -0.11 | -0.03 | 0.12 | -0.27 |

*Note:* N=396. LPCPD=liters per capita, per day. HS=high school. HH=household. ₱=Philippine pesos. L=liter.
[a]Married/not married includes having a partner/no partner. [b]Seasonal values are used. *p<.05 **p<.01 ***p<.001

In general, results are similar for the rainy season, as for the dry season, between logged reported consumption and logged monthly income (b=0.20, t=4.54, p<.001), logged tank/drum capacity (b=0.11, t=3.60, p<.001), having a shared/other BWD connection (b=-0.31, t=-4.39, p<0.001), having a private BWD connection (b=0.20, t=2.70, p=.007), and, as a control variable, household size (b=-0.13, t=-8.41, p<.001). Here, a 1% increase in monthly income is associated with a 0.20% increase in reported LPCPD, and a 1% increase in tank/drum storage capacity is associated with a 0.11% increase in reported LPCPD. Compared to households with no BWD connection, those with a shared/other connection have a 26.9% decrease in reported consumption, and those with a private connection have a 21.8% increase in reported consumption.

*Perceived Sufficiency*

Logistic regression results for perceived sufficiency are summarized in Table 26. No statistically significant relationships are observed between the dependent variable and key independent variables in this study, for either season. In the dry season, for control variables, significant relationships are observed between perceived sufficiency and age (b=.03, t=3.95, p<.001) and household size (b=-0.17, t=-3.48, p<.001).

*Experienced Sufficiency*

Logistic regression results for experienced sufficiency are summarized in Table 27. In the dry season, statistically significant associations are found between the dependent variable and having a shared/other BWD connection (b=0.66, t=2.16, p=0.03) and homeownership (b=0.62, t=2.22, p=0.03). Significant results for control variables are found for age (b=0.03, t=2.91, p=0.004) and household size (b=-0.17, t=-3.14, p=0.002).

**Table 26. DV2: Logistic Regression Models of Perceived Sufficiency**

| Independent Variable | Dry Season | | | | Rainy Season | | | |
|---|---|---|---|---|---|---|---|---|
| | Est. | SE | OR | t | Est. | SE | OR | t |
| **Individual Factors** | | | | | | | | |
| *Gender* | | | | | | | | |
| Female | -0.08 | 0.25 | 0.93 | -0.30 | 0.26 | 0.38 | 1.29 | 0.67 |
| *Other Demographics* | | | | | | | | |
| Education, less than HS | | | | | | | | |
| HS diploma | 0.04 | 0.27 | 1.04 | 0.14 | 0.03 | 0.43 | 1.03 | 0.08 |
| College graduate | 0.42 | 0.30 | 1.52 | 1.39 | 0.14 | 0.49 | 1.15 | 0.28 |
| Marital status, not married[a] | | | | | | | | |
| Married, lives elsewhere | -0.15 | 0.32 | 0.86 | -0.47 | -0.12 | 0.49 | 0.89 | -0.24 |
| Married, lives in home | 0.21 | 0.24 | 1.23 | 0.88 | 0.66 | 0.37 | 1.93 | 1.77 |
| Age | 0.03 | 0.01 | 1.03 | 3.95*** | 0.02 | 0.01 | 1.02 | 1.71 |
| Ethnicity, Cordilleran | 0.10 | 0.23 | 1.10 | 0.42 | 0.20 | 0.37 | 1.22 | 0.53 |
| **Household Factors** | | | | | | | | |
| HH size | -0.17 | 0.05 | 0.84 | -3.48*** | 0.01 | 0.09 | 1.01 | 0.10 |
| *Financial resources* | | | | | | | | |
| Logged monthly income[b] (₱) | 0.16 | 0.17 | 1.18 | 0.97 | 0.09 | 0.28 | 1.10 | 0.33 |
| Savings, none | | | | | | | | |
| Informal | -0.23 | 0.35 | 0.79 | -0.66 | 0.32 | 0.67 | 1.37 | 0.47 |
| Formal | -0.01 | 0.22 | 0.99 | -0.05 | 0.21 | 0.43 | 1.24 | 0.50 |
| *Physical resources* | | | | | | | | |
| Logged tank/drum capacity (L) | 0.03 | 0.10 | 1.03 | 0.34 | 0.11 | 0.08 | 1.12 | 1.34 |
| BWD connection, None | | | | | | | | |
| Shared/other way | -0.15 | 0.24 | 0.86 | -0.65 | 0.53 | 0.43 | 1.69 | 1.24 |
| Private | 0.00 | 0.25 | 1.00 | 0.00 | 0.24 | 0.40 | 1.28 | 0.61 |
| Homeownership | -0.27 | 0.23 | 0.76 | -1.19 | 0.28 | 0.39 | 1.32 | 0.71 |
| *Social resources* | | | | | | | | |
| Water network, 0 HHs | | | | | | | | |
| 1 HH | 0.01 | 0.36 | 1.01 | 0.04 | 0.09 | 0.79 | 1.09 | 0.11 |
| 2+ HHs | 0.04 | 0.41 | 1.04 | 0.09 | 0.69 | 0.92 | 1.99 | 0.75 |
| Money network, 0 HHs | | | | | | | | |
| 1 HH | 0.13 | 0.34 | 1.14 | 0.39 | -0.05 | 0.70 | 0.95 | -0.08 |
| 2+ HHs | -0.10 | 0.38 | 0.91 | -0.25 | -0.57 | 0.83 | 0.57 | -0.68 |

*Note:* N=396. DV is modeled as 1=Always has enough. HS=high school. HH=household. ₱=Philippine pesos. L=liter. [a]Married/not married includes having a partner/no partner. [b]Seasonal values are used.
*p<.05 **p<.01 ***p<.001

**Table 27. DV3: Logistic Regression Models of Experienced Sufficiency**

| Independent Variable | Dry Season | | | | Rainy Season | | | |
|---|---|---|---|---|---|---|---|---|
| | Est. | SE | OR | t | Est. | SE | OR | t |
| **Individual Factors** | | | | | | | | |
| *Gender* | | | | | | | | |
| Female | 0.54 | 0.29 | 1.71 | 1.88 | 0.20 | 0.65 | 1.22 | 0.31 |
| *Other Demographics* | | | | | | | | |
| Education, less than HS | | | | | | | | |
| HS diploma | -0.31 | 0.30 | 0.73 | -1.03 | -1.75 | 0.97 | 0.17 | -1.81 |
| College graduate | 0.31 | 0.35 | 1.36 | 0.88 | -1.29 | 1.00 | 0.27 | -1.29 |
| Marital status, not married[a] | | | | | | | | |
| Married, lives elsewhere | -0.55 | 0.38 | 0.58 | -1.44 | -0.68 | 0.78 | 0.51 | -0.87 |
| Married, lives in home | 0.31 | 0.27 | 1.36 | 1.15 | 1.08 | 0.62 | 2.94 | 1.74 |
| Age | 0.03 | 0.01 | 1.03 | 2.91** | 0.02 | 0.03 | 1.02 | 0.88 |
| Ethnicity, Cordilleran | -0.15 | 0.26 | 0.86 | -0.55 | -0.11 | 0.59 | 0.90 | -0.18 |
| **Household Factors** | | | | | | | | |
| HH size | -0.17 | 0.05 | 0.84 | -3.14** | -0.12 | 0.16 | 0.89 | -0.71 |
| *Financial resources* | | | | | | | | |
| Logged monthly income[b] (₱) | 0.14 | 0.19 | 1.15 | 0.74 | 0.59 | 0.31 | 1.80 | 1.90 |
| Savings, none | | | | | | | | |
| Informal | 0.01 | 0.40 | 1.01 | 0.03 | -0.87 | 0.73 | 0.42 | -1.19 |
| Formal | 0.04 | 0.27 | 1.05 | 0.17 | 0.38 | 0.64 | 1.46 | 0.59 |
| *Physical resources* | | | | | | | | |
| Logged tank/drum capacity (L) | 0.06 | 0.10 | 1.06 | 0.58 | -0.12 | 0.16 | 0.89 | -0.75 |
| BWD connection, None | | | | | | | | |
| Shared/other way | 0.66 | 0.30 | 1.93 | 2.16* | 0.70 | 0.59 | 2.01 | 1.19 |
| Private | 0.49 | 0.29 | 1.63 | 1.69 | 1.64 | 0.71 | 5.14 | 2.31* |
| Homeownership | 0.62 | 0.28 | 1.86 | 2.22* | -0.11 | 0.68 | 0.89 | -0.17 |
| *Social resources* | | | | | | | | |
| Water network, 0 HHs | | | | | | | | |
| 1 HH | -0.36 | 0.48 | 0.70 | -0.76 | -1.86 | 1.31 | 0.16 | -1.42 |
| 2+ HHs | -0.66 | 0.54 | 0.52 | -1.21 | -1.34 | 1.39 | 0.26 | -0.96 |
| Money network, 0 HHs | | | | | | | | |
| 1 HH | -0.33 | 0.45 | 0.72 | -0.73 | 1.86 | 0.86 | 6.39 | 2.16* |
| 2+ HHs | -0.35 | 0.48 | 0.71 | -0.72 | 0.43 | 0.69 | 1.53 | 0.62 |

*Note:* N=396. DV is modeled as 1=HH reports always having enough water for each specific need in a typical week. HS=high school. HH=household. ₱=Philippine pesos. L=liter. [a]Married/not married includes having a partner/no partner. [b]Seasonal values are used. *p<.05 **p<.01 ***p<.001

For interpretation, coefficients of the two statistically significant key independent variables are exponentiated to obtain the odds ratio. Households with a shared/other BWD connection are 1.93 times as likely, in the sense of odds, to report experienced sufficiency than households with no BWD connection. Also, households that own their home are 1.86 times as likely to report experienced sufficiency as those that do not own their home.

Logistic regression results are different for the rainy season. Among key independent variables, statistical significance is found for having a private BWD connection (b=1.64, t=2.31, p=0.02) and reporting money borrowing network size of one household (b=1.86, t=2.16, p=0.03). Odds ratios suggest that households with a private BWD connection are 5.14 times as likely to report experienced sufficiency than households with no BWD connection. Also, households that report a money borrowing network size of one are 6.39 times as likely to report having experienced sufficiency than those reporting a money borrowing network size of zero.

**Quality**

*Perceived Cleanliness*

Linear regression results for the PCA score of perceived cleanliness are presented in Table 28. For the dry season, statistically significant associations are found between the PCA score and the following key independent variables: having formal savings (b=-0.23, t=-2.17, p=0.03), logged tank/drum capacity (b=0.08, t=2.27, p=0.02), and having a private BWD connection (b=0.35, t=2.76, p=0.006). Among control variables, household size is statistically significant (b=-0.05, t=-2.12, p=0.03).

Results suggest that the mean PCA score is 0.23 standard deviations lower for households with formal savings, than households with no savings. Meanwhile, a one standard deviation increase in logged tank/drum capacity is associated with a 0.08 standard deviation increase in the

**Table 28. DV4: Linear Regression Models of Perceived Cleanliness**

| Independent Variable | Dry Season | | | Rainy Season | | |
|---|---|---|---|---|---|---|
| | Est. | SE | t | Est. | SE | t |
| **Individual Factors** | | | | | | |
| *Gender* | | | | | | |
| Female | 0.01 | 0.11 | 0.13 | 0.16 | 0.11 | 1.44 |
| *Other Demographics* | | | | | | |
| Education, less than HS | | | | | | |
| HS diploma | -0.03 | 0.13 | -0.23 | -0.24 | 0.13 | -1.84 |
| College graduate | -0.14 | 0.13 | -1.05 | -0.42 | 0.14 | -2.94** |
| Marital status, not married[a] | | | | | | |
| Married, lives elsewhere | -0.19 | 0.16 | -1.16 | -0.08 | 0.15 | -0.54 |
| Married, lives in home | -0.02 | 0.11 | -0.19 | -0.07 | 0.10 | -0.69 |
| Age | 0.00 | 0.00 | 1.28 | -0.01 | 0.00 | -1.36 |
| Ethnicity, Cordilleran | 0.07 | 0.10 | 0.68 | 0.20 | 0.11 | 1.76 |
| **Household Factors** | | | | | | |
| HH size | -0.05 | 0.02 | -2.12* | -0.05 | 0.02 | -2.10* |
| *Financial resources* | | | | | | |
| Logged monthly income[b] (₱) | 0.07 | 0.07 | 1.00 | 0.11 | 0.07 | 1.69 |
| Savings, none | | | | | | |
| Informal | 0.10 | 0.15 | 0.64 | 0.37 | 0.14 | 2.60** |
| Formal | -0.23 | 0.11 | -2.17* | -0.12 | 0.11 | -1.12 |
| *Physical resources* | | | | | | |
| Logged tank/drum capacity (L) | 0.08 | 0.03 | 2.27* | 0.01 | 0.04 | 0.30 |
| BWD connection, None | | | | | | |
| Shared/other way | 0.18 | 0.14 | 1.28 | -0.24 | 0.14 | -1.73 |
| Private | 0.35 | 0.13 | 2.76** | 0.18 | 0.12 | 1.50 |
| Homeownership | 0.20 | 0.12 | 1.69 | 0.12 | 0.11 | 1.11 |
| *Social resources* | | | | | | |
| Water network, 0 HHs | | | | | | |
| 1 HH | 0.08 | 0.16 | 0.48 | 0.01 | 0.19 | 0.06 |
| 2+ HHs | 0.16 | 0.19 | 0.85 | 0.10 | 0.20 | 0.52 |
| Money network, 0 HHs | | | | | | |
| 1 HH | -0.03 | 0.15 | -0.21 | 0.01 | 0.16 | 0.05 |
| 2+ HHs | -0.26 | 0.17 | -1.56 | -0.17 | 0.17 | -0.99 |

*Note:* N=396. HS=high school. HH=household. ₱=Philippine pesos. L=liter. [a]Married/not married includes having a partner/no partner. [b]Seasonal values are used. *p<.05 **p<.01 ***p<.001

PCA score. Compared to households with no BWD connection, those with a private BWD connection have a mean PCA score that is higher by 0.35 standard deviations.

For the rainy season, statistically significant results are found for informal savings (b=0.37, t=2.60, p=0.009), and for two control variables: being a college graduate (b=-0.42, t=-2.94, p=0.003) and household size (b=-0.05, t=-2.10, p=0.04). Households with informal savings have a mean PCA score for perceived cleanliness that is 0.37 units higher than that for households with no savings.

**Accessibility**

*Perceived Ease*

Logistic regression models of perceived ease are presented in Table 29. In the dry season, statistically significant key independent variables are having a private BWD connection (b=0.77, t=3.02, p=0.003) and reporting a money borrowing network size of two or more (b=-0.91, t=-2.13, p=0.02). Significant control variables are age (b=0.02, t=2.26, p=0.02) and household size (b=-0.16, t=-3.07, p=0.002). Dry season results suggest that households with a private BWD connection are 2.16 times as likely to report extreme ease than households with no BWD connection. Meanwhile, households reporting a money borrowing network size of zero are 2.49 times as likely to report extreme ease than households reporting a money borrowing network size of two or more.[7]

In the rainy season, statistical significance is found between the dependent variable and female gender (b=0.96, t=3.32, p<.001), having a shared/other BWD connection (b=0.93, t=2.73, p=0.007) and having a private BWD connection (b=1.23, t=3.79, p<.001). Significant control variables are having a high school diploma (b=-1.01, t=-2.52, p=0.01), having a college degree

[7] For statistically significant odds ratios < 1.00, the inverse of the odds ratio is taken and reported for interpretability.

**Table 29. DV5: Logistic Regression Models of Perceived Ease**

| Independent Variable | Dry Season | | | | Rainy Season | | | |
|---|---|---|---|---|---|---|---|---|
| | Est. | SE | OR | t | Est. | SE | OR | t |
| **Individual Factors** | | | | | | | | |
| *Gender* | | | | | | | | |
| Female | 0.30 | 0.25 | 1.34 | 1.18 | 0.96 | 0.29 | 2.62 | 3.32*** |
| *Other Demographics* | | | | | | | | |
| Education, less than HS | | | | | | | | |
| HS diploma | -0.16 | 0.27 | 0.85 | -0.61 | -1.01 | 0.40 | 0.36 | -2.52* |
| College graduate | -0.01 | 0.31 | 0.99 | -0.03 | -1.16 | 0.44 | 0.31 | -2.62** |
| Marital status, not married[a] | | | | | | | | |
| Married, lives elsewhere | -0.58 | 0.32 | 0.56 | -1.80 | -0.46 | 0.44 | 0.63 | -1.06 |
| Married, lives in home | -0.03 | 0.24 | 0.97 | -0.13 | 0.26 | 0.31 | 1.30 | 0.83 |
| Age | 0.02 | 0.01 | 1.02 | 2.26* | 0.01 | 0.01 | 1.01 | 0.71 |
| Ethnicity, Cordilleran | -0.14 | 0.23 | 0.87 | -0.62 | 0.32 | 0.29 | 1.38 | 1.10 |
| **Household Factors** | | | | | | | | |
| HH size | -0.16 | 0.05 | 0.85 | -3.07** | -0.29 | 0.07 | 0.75 | -4.21*** |
| *Financial resources* | | | | | | | | |
| Logged monthly income[b] (₱) | 0.12 | 0.17 | 1.13 | 0.73 | 0.42 | 0.23 | 1.52 | 1.85 |
| Savings, none | | | | | | | | |
| Informal | -0.19 | 0.33 | 0.82 | -0.59 | 0.08 | 0.51 | 1.08 | 0.16 |
| Formal | -0.08 | 0.24 | 0.93 | -0.32 | 0.05 | 0.31 | 1.05 | 0.17 |
| *Physical resources* | | | | | | | | |
| Logged tank/drum capacity (L) | 0.12 | 0.10 | 1.13 | 1.18 | 0.01 | 0.11 | 1.01 | 0.13 |
| BWD connection, None | | | | | | | | |
| Shared/other way | 0.41 | 0.27 | 1.51 | 1.55 | 0.93 | 0.34 | 2.54 | 2.73** |
| Private | 0.77 | 0.26 | 2.16 | 3.02** | 1.23 | 0.33 | 3.44 | 3.79*** |
| Homeownership | -0.07 | 0.23 | 0.94 | -0.28 | 0.11 | 0.31 | 1.12 | 0.37 |
| *Social resources* | | | | | | | | |
| Water network, 0 HHs | | | | | | | | |
| 1 HH | 0.44 | 0.35 | 1.55 | 1.25 | 0.02 | 0.52 | 1.02 | 0.04 |
| 2+ HHs | 0.19 | 0.41 | 1.20 | 0.46 | -0.01 | 0.59 | 0.99 | -0.02 |
| Money network, 0 HHs | | | | | | | | |
| 1 HH | -0.43 | 0.35 | 0.65 | -1.23 | 0.24 | 0.45 | 1.27 | 0.53 |
| 2+ HHs | -0.91 | 0.39 | 0.40 | -2.31* | 0.18 | 0.54 | 1.20 | 0.34 |

*Note:* N=396. DV is modeled as 1=Extremely easy (raw values: 8-10). HS=high school. HH=household. ₱=Philippine pesos. L=liter. [a]Married/not married includes having a partner/no partner. [b]Seasonal values are used. *p<.05 **p<.01 ***p<.001

(b=-1.16, t=-2.62, p=0.009), and household size (b=-0.29, t=-4.21, p<.001). Odds ratios indicate that female household water managers are 2.62 times as likely as male household water managers to report extreme ease. Compared to households with no BWD connection, households with a shared/other connection are 2.54 times as likely to report extreme ease, and those with a private BWD connection are 3.44 times as likely.

*Affordability*

Logistic regression models for affordability (conservatively categorized here as 10.0% or less of income spent on water expenses) are presented in Table 30. For the dry season, statistically significant associations are found between affordability and the following key independent variables: logged monthly income (b=3.03, t=6.76, p<.001), logged tank/drum capacity (b=-0.61, t=-2.17, p=.03), having a shared/other BWD connection (b=1.00, t=2.29, p=0.02), and having a private BWD connection (b=1.01, t=2,40, p=0.02). Statistically significant control variables are having a spouse/partner who lives elsewhere (b=-1.13, t=-2.03, p=0.04), and household size (b=-0.27, t=-3.23, p=0.001).

Results suggest that for every 1% increase in monthly income, the odds of the household having affordable expenses in the dry season increase by 3.03%. For every 1% increase in tank/storage capacity, these odds decrease by 0.61%. Compared to households with no BWD connection, households with a shared/other connection are 2.71 times as likely to have affordable expenses, and those with a private BWD connection are 2.76 times as likely.

In the rainy season, logged monthly income is the only key independent variable significantly associated with affordability (b=2.95, t=7,23, p<.001), and household size is the only control variable (b=-0.20, t=-2.18, p=0.03). For every 1% increase in monthly income, the odds of affordable expenses increase by 2.95%.

**Table 30. DV6: Logistic Regression Models of Affordability**

| Independent Variable | Dry Season | | | | Rainy Season | | | |
|---|---|---|---|---|---|---|---|---|
| | Est. | SE | OR | t | Est. | SE | OR | t |
| **Individual Factors** | | | | | | | | |
| *Gender* | | | | | | | | |
| Female | 0.18 | 0.44 | 1.20 | 0.41 | 0.04 | 0.51 | 1.05 | 0.09 |
| *Other Demographics* | | | | | | | | |
| Education, less than HS | | | | | | | | |
| HS diploma | -0.62 | 0.47 | 0.54 | -1.31 | 0.14 | 0.50 | 1.15 | 0.28 |
| College graduate | -1.07 | 0.57 | 0.34 | -1.89 | -0.55 | 0.55 | 0.58 | -1.00 |
| Marital status, not married[a] | | | | | | | | |
| Married, lives elsewhere | -1.13 | 0.56 | 0.32 | -2.03* | -0.79 | 0.69 | 0.45 | -1.15 |
| Married, lives in home | -0.44 | 0.40 | 0.65 | -1.09 | -0.22 | 0.53 | 0.80 | -0.42 |
| Age | -0.01 | 0.02 | 0.99 | -0.32 | 0.02 | 0.01 | 1.02 | 1.21 |
| Ethnicity, Cordilleran | 0.12 | 0.41 | 1.12 | 0.28 | 0.72 | 0.42 | 2.06 | 1.74 |
| **Household Factors** | | | | | | | | |
| HH size | -0.27 | 0.08 | 0.77 | -3.23** | -0.20 | 0.09 | 0.82 | -2.18* |
| *Financial resources* | | | | | | | | |
| Logged monthly income[b] (₱) | 3.03 | 0.45 | 20.68 | 6.76*** | 2.95 | 0.41 | 19.03 | 7.23*** |
| Savings, none | | | | | | | | |
| Informal | 0.21 | 0.68 | 1.23 | 0.31 | -0.04 | 0.80 | 0.96 | -0.05 |
| Formal | -0.02 | 0.40 | 0.98 | -0.06 | -0.40 | 0.40 | 0.67 | -1.01 |
| *Physical resources* | | | | | | | | |
| Logged tank/drum capacity (L) | -0.61 | 0.28 | 0.54 | -2.17* | -0.33 | 0.19 | 0.72 | -1.74 |
| BWD connection, None | | | | | | | | |
| Shared/other way | 1.00 | 0.44 | 2.71 | 2.29* | 0.27 | 0.54 | 1.30 | 0.49 |
| Private | 1.01 | 0.42 | 2.76 | 2.40* | -0.39 | 0.49 | 0.68 | -0.79 |
| Homeownership | -0.26 | 0.46 | 0.77 | -0.57 | -0.58 | 0.47 | 0.56 | -1.24 |
| *Social resources* | | | | | | | | |
| Water network, 0 HHs | | | | | | | | |
| 1 HH | -0.59 | 0.80 | 0.55 | -0.74 | -0.08 | 0.78 | 0.92 | -0.11 |
| 2+ HHs | -0.37 | 0.89 | 0.69 | -0.41 | 0.22 | 0.90 | 1.25 | 0.24 |
| Money network, 0 HHs | | | | | | | | |
| 1 HH | -0.17 | 0.83 | 0.84 | -0.21 | -0.09 | 0.87 | 0.92 | -0.10 |
| 2+ HHs | -0.38 | 0.87 | 0.68 | -0.44 | -0.01 | 1.01 | 0.99 | -0.01 |

*Note:* N=396. DV is modeled as 1=10.0% or less. HS=high school. HH=household. ₱=Philippine pesos. L=liter.
[a]Married/not married includes having a partner/no partner. [b]Seasonal values are used. *p<.05 **p<.01 ***p<.001

**Multi-Dimensional Hardship**

Linear regression results for the PCA score of multi-dimensional hardship in the dry season are presented in Table 31. Statistically significant associations are found between hardship and the following key independent variables: logged monthly income (b=-0.20, t=-2.82, p=0.005), having a shared/other BWD connection (b=-0.37, t=-3.00, p=0.003), having a private BWD connection (b=-0.33, t=-2.48, p=0.01), and reporting a water borrowing network size of one (b=0.28, t=2.08, p=0.04). Among control variables, age (b=-0.01, t=-2.38, p=0.02) and household size (b=0.08, t=3.38, p<.001) are statistically significant.

For interpretation of results, it is important to note that this dependent variable is coded so that higher PCA scores correspond with more hardship. Hence, a one standard deviation increase in logged monthly income is associated with a 0.20 standard deviation decrease in hardship. Compared to households with no BWD connection, those with a shared/other connection have a mean hardship score that is lower by 0.37 standard deviations, and those with a private BWD connection have a mean score lower by 0.33 standard deviations. Households reporting a water borrowing network size of one have a mean hardship score that is 0.28 standard deviations higher than households reporting a borrowing network of zero.

**Summary and Discussion**

Results are summarized in Tables 32-33, for each key independent variable and dependent variable from the household survey. The tables present the direction of statistically significant associations, or indicate that associations were not significant. Overall, the independent variables that emerge as most relevant for understanding household water insecurity in this study are the financial resource of income, and the physical resources of tank/drum storage capacity and having a BWD connection.

**Table 31. DV7: Linear Regression Model of Multi-Dimensional Hardship**

| Independent Variable | Dry Season | | |
|---|---|---|---|
| | Est. | SE | t |
| **Individual Factors** | | | |
| *Gender* | | | |
| Female | 0.07 | 0.11 | 0.64 |
| *Other Demographics* | | | |
| Education, less than HS | | | |
| HS diploma | 0.05 | 0.12 | 0.40 |
| College graduate | -0.19 | 0.13 | -1.43 |
| Marital status, not married[a] | | | |
| Married, lives elsewhere | 0.04 | 0.14 | 0.27 |
| Married, lives in home | -0.13 | 0.11 | -1.21 |
| Age | -0.01 | 0.00 | -2.38* |
| Ethnicity, Cordilleran | 0.08 | 0.10 | 0.81 |
| **Household Factors** | | | |
| HH size | 0.08 | 0.02 | 3.38*** |
| *Financial resources* | | | |
| Logged monthly income[b] (₱) | -0.20 | 0.07 | -2.82** |
| Savings, none | | | |
| Informal | 0.12 | 0.17 | 0.71 |
| Formal | 0.15 | 0.10 | 1.43 |
| *Physical resources* | | | |
| Logged tank/drum capacity (L) | 0.02 | 0.04 | 0.60 |
| BWD connection, None | | | |
| Shared/other way | -0.37 | 0.12 | -3.00** |
| Private | -0.33 | 0.13 | -2.48* |
| Homeownership | -0.03 | 0.12 | -0.24 |
| *Social resources* | | | |
| Water network, 0 HHs | | | |
| 1 HH | 0.28 | 0.13 | 2.08* |
| 2+ HHs | 0.29 | 0.20 | 1.49 |
| Money network, 0 HHs | | | |
| 1 HH | 0.02 | 0.15 | 0.16 |
| 2+ HHs | 0.14 | 0.20 | 0.71 |

*Note:* N=396. Avg. adjusted-R-square is HS=high school. HH=household. ₱=Philippine pesos. L=liter. [a]Married/not married includes having a partner/no partner. [b]Seasonal values are used.
*p<.05 **p<.01 ***p<.001

**Table 32. Q3 Results Summary: Quantity**

| Independent Variable | DV1: Reported Consumption | | DV2: Perceived Sufficiency | | DV3: Experienced Sufficiency | |
|---|---|---|---|---|---|---|
| | Dry | Rainy | Dry | Rainy | Dry | Rainy |
| **Individual Factor** | | | | | | |
| Gender, female | NS | NS | NS | NS | NS | NS |
| **Household Factors** | | | | | | |
| *Financial Resources* | | | | | | |
| Income | + | + | NS | NS | NS | NS |
| Savings, none | | | | | | |
| Informal | NS | NS | NS | NS | NS | NS |
| Formal | NS | NS | NS | NS | NS | NS |
| *Physical Resources* | | | | | | |
| Tank/drum storage capacity | + | + | NS | NS | NS | NS |
| BWD connection, none | | | | | | |
| Shared/other | − | − | NS | NS | + | NS |
| Private | + | + | NS | NS | NS | + |
| Homeownership | NS | NS | NS | NS | + | NS |
| *Social Resources* | | | | | | |
| Water borrowing network, 0 HH | | | | | | |
| 1 HH | NS | NS | NS | NS | NS | NS |
| 2+ HH | NS | NS | NS | NS | NS | NS |
| Money borrowing network, 0 HH | | | | | | |
| 1 HH | NS | NS | NS | NS | NS | + |
| 2+ HH | NS | NS | NS | NS | NS | NS |

*Note:* + = A positive and statistically significant relationship was found. − = A negative and statistically significant relationship was found. NS = No statistically significant relationship was found.

*Gender*

This study finds limited associations between gender of the household water manager and household water insecurity. Perceived ease in the rainy season is the only dependent variable with which gender has a statistically significant relationship, and the positive association is different from the study hypothesis of no relationship. There are several possible explanations. First, the lack of statistical significance for gender in these analyses may be due to power limitations given the distribution of household water managers (79.8% female, 19.1% male).

**Table 33. Q3 Results Summary: Quality, Accessibility, Multi-Dimensional Hardship**

| Independent Variable | DV4: Perceived Cleanliness | | DV5: Perceived Ease | | DV6: Affordability | | DV7: MD Hardship |
|---|---|---|---|---|---|---|---|
| | Dry | Rainy | Dry | Rainy | Dry | Rainy | Dry |
| **Individual Factor** | | | | | | | |
| Gender, female | NS | NS | NS | + | NS | NS | NS |
| **Household Factors** | | | | | | | |
| *Financial Resources* | | | | | | | |
| Income | NS | NS | NS | NS | + | + | − |
| Savings, none | | | | | | | |
| Informal | NS | + | NS | NS | NS | NS | NS |
| Formal | − | NS | NS | NS | NS | NS | NS |
| *Physical Resources* | | | | | | | |
| Tank/drum storage capacity | + | NS | NS | NS | − | NS | NS |
| BWD connection, none | | | | | | | |
| Shared/other | NS | NS | NS | + | + | NS | − |
| Private | + | NS | + | + | + | NS | − |
| Homeownership | NS | NS | NS | NS | NS | NS | NS |
| *Social Resources* | | | | | | | |
| Water borrowing network, 0 HH | | | | | | | |
| 1 HH | NS | NS | NS | NS | NS | NS | + |
| 2+ HH | NS | NS | NS | NS | NS | NS | NS |
| Money borrowing network, 0 HH | | | | | | | |
| 1 HH | NS | NS | NS | NS | NS | NS | NS |
| 2+ HH | NS | NS | − | NS | NS | NS | NS |

*Note:* + = A positive and statistically significant relationship was found. − = A negative and statistically significant relationship was found. NS = No statistically significant relationship was found.

Second, it may be that the construct itself of a single household water manager is not as relevant in the study setting as it may be in other contexts. Through informal and in-depth interviews, it became clearer that in some households both women and men—and girls and boys—may be involved in household water management or water-related tasks in some ways. This may reflect some of the tendency toward greater gender equality in the Philippines, compared to many other developing countries. Or, it may also reflect a change in roles and relations that emerges in urban settings, in contrast to more clear gendered division of water roles in rural areas, where women may be more likely tasked with all aspects of water collection, use, and management.

Third, it may be that significant relationships would have been found if gender of the household head (e.g., male- or female-headed household, a more common application of gender in much development literature) had been used instead of gender of the household water manager. Any such relationships, however, might then have been accounted for by the inclusion of the resource variables in this study, if different household-head structures have unequal distribution of household resources. Similarly, it may be that bivariate associations between gender of the household water manager and the dependent variables in this study were explained in multiple regression analysis by differential household resources. Model building results in Appendix A, however, do not support this. Finally, it may be that under more severe water scarcity conditions, significant relationships with gender may have been found.

Of note, these findings of non-statistical significance do not mean that they are irrelevant for the gender, water, and development fields. On the one hand, if study findings mean that gender of the household water manager has no bearing on household water security in the study setting, then program and policy responses can be targeted to household characteristics that do matter and can be manipulated—namely, resources—whereas gender is fixed. In addition, the findings may suggest that when a community or society has improved gender relations overall (as the Philippines may broadly be considered to have, at least in relation to many other developing countries), then the "usual" gender differences in well-being outcomes, such as water security, may no longer persist. At the same time, as discussed in other sections of this study, more interesting results on gender and water security emerge from qualitative analysis, suggesting that women's and men's roles and responsibilities within a household may indeed relate to both household and individual water security. The difference between these results may be that regression analysis focuses on the role that gender of *the household water manager* may

play in household water insecurity, whereas qualitative findings focus on the gender of different individuals within households, regardless of whether the particular household water manager is male or female.

*Financial Resources*

*Income.* Income has a positive and statistically significant association with reported consumption and affordability in both seasons. Not surprisingly, as income increases, more water may be consumed, but at the same time, expenditures as a percentage of overall income may decrease. These findings are consistent with prior research on the regressive nature of water expenses in many urban areas of developing countries (Anthony, 2007; Gerlach & Franceys, 2009). Namely, wealthier households often have easier access to cheaper water such as piped municipal supplies, whereas lower income households often rely on more expensive non-municipal suppliers such as delivery trucks. In Baguio City, for example, privately accessed BWD water is about four times cheaper per unit than delivery truck water. The unexpected findings of positive associations between income and these measures—consumption and affordability—for the rainy season may be due to underestimated rainy season consumption, as described in Section VI. As expected, income is negatively associated with multi-dimensional hardship in the dry season. As income increases, hardship decreases.

Overall, findings for income suggest that at least some of the disparity in water security among Pinget households may be attributed to income poverty. In the dry season, households with higher incomes can more readily purchase supplemental water when main sources such as BWD are insufficient. In the rainy season, income still seems to serve as an important resource for obtaining preferred supplies of water. If water is indeed a human right, it may be that safety net programs and policies should be considered for the poorest families, so long as the most

affordable supply of water—here, privately pumped municipal water—is not yet universally available to all households.

*Savings.* Some associations between savings and perceived cleanliness are observed. Compared to households with no savings, those with formal savings have lower perceived cleanliness scores for the dry season. Meanwhile, compared to households with no savings, those with informal savings have higher perceived cleanliness scores in the rainy season. These findings are unexpected, and may perhaps be explained by different patterns of water source use by households with different types of savings. For example, in the rainy season, 66.3% of households with informal savings report using rainwater, compared to 85.6% of households with no savings. If rainwater were rated as less clean than other sources, this may help explain these findings. This study, however, did not ask respondents to rate cleanliness by source. Other than for perceived cleanliness, the overall lack of statistical significance between savings and water insecurity as measured here is also unexpected. As discussed later in Section IX, some households rely on savings to acquire the physical resources needed to mitigate water insecurity. It may be that the relationship between savings and water insecurity is fully mediated by physical resources or other factors not measured here.

*Physical Resources*

*Tank/drum storage capacity.* In support of study hypotheses, tank/drum storage capacity is positively associated with reported consumption in both seasons and with perceived cleanliness in the dry season. An unexpected negative association between storage capacity and affordability in the dry season may be because increased storage capacity means that greater volumes of water can be readily purchased and stored—thus increasing water expenses and decreasing overall affordability. Or, this may be due to measurement error by households

reporting both BWD and delivery truck use, some of whom may have overestimated both consumption and expenses in the dry season.

Here, findings point to the importance of ensuring more equitable access to physical resources like tanks and drums, in order to further more equal distribution of water security among households. In the context of Baguio City, the need for households to store water is likely long-term, unless some unforeseen and significant investment in municipal water infrastructure and supply is made.

*BWD connection.* Having a private BWD connection—compared to not having any connection—is associated with more reported consumption in both seasons, greater likelihood of experienced sufficiency in the rainy season, higher perceived cleanliness score in the dry season, greater likelihood of extreme ease in both seasons, and more affordability of water in the dry season. Also, having a private BWD connection is associated with less multi-dimensional hardship in the dry season, compared to not having any connection. Among key independent variables in this study, private BWD connection has the most consistent and frequent associations with the different measures of water security examined. It is important to point out that this variable is essentially equivalent to the proxy measure of "access to an improved source" that is used to measure progress toward water development goals globally (UNICEF and WHO, 2012). While using this proxy to measure water security itself is limiting, study findings do emphasize the importance of continuing to track this measure. Rather than framing private access to municipal water as an end, however, this study frames it as a resource or means to obtaining the end of adequate and sufficient access to clean water.

Meanwhile, having a shared/other BWD connection, compared to having no BWD connection, is associated with lower reported consumption in both seasons, greater likelihood of

experienced sufficiency in the dry season, greater likelihood of extreme ease in the rainy season, more affordability in the dry season, and less multi-dimensional hardship in the dry season. Overall then, having any kind of BWD access—even through a shared or other non-private connection—seems to promote household water security. This finding may be at least partially explained by the fact that Pinget houses many boarders, who live in boarding houses with private BWD access. These boarders may be able to purchase water from their landlords at any time. This situation would be in contrast to a family with no BWD connection, who may rely on delivery truck water (by choice or necessity) and be subject to scheduling constraints of these companies (e.g., heavy delivery volumes during the dry season, difficult road access during the rainy season).

*Homeownership.* Homeownership is positively associated with experienced sufficiency in the dry season. No other statistically significant associations for this variable are observed. While multicollinearity among independent variables was assessed and found non-problematic, it is possible that homeownership and tank/drum storage capacity may share some of the variance in explaining the dependent variables in this study. Compared to a renting household, a homeowner household may be more likely to invest in a permanent tank, or have more physical space to store multiple drums. Future analyses could test interactions between homeownership and tank/drum storage capacity, or use semipartial correlation techniques with regression to better assess any unique contribution of homeownership to water security.

*Social Resources*

Limited associations are found between household networks and household water insecurity in this study. For water borrowing, compared to households reporting a borrowing network size of zero, those with a network size of one are likely to have a higher multi-

dimensional hardship score. For money borrowing, compared to households reporting a borrowing network size of zero, those with a network size of two or more are less likely to report extreme ease of obtaining water in the dry season. No other statistically significant associations are observed. These findings for social resources, however, should be interpreted with caution. During survey fielding, it became apparent that some households who had never borrowed water or money because they did not need to, reported borrowing network sizes of zero when asked hypothetical questions of how many they could borrow from should the circumstance arrive. Households that had borrowed water or money in the past, meanwhile, tended to give non-zero responses to the hypothetical questions. If analyses were restricted to households with less water security, it may be that more interesting relationships between social resources and water security would be observed, if some less secure households do not have as much recourse to social resources as other households.

*Control Variables*

This study included several variables to control for individual characteristics of the household water manager (education, marital status, age, and Cordilleran ethnicity) and household size. Most statistically significant findings for individual characteristics were between education and age as control variables and perceptual or experiential measures of water security as dependent variables (perceived sufficiency, experienced sufficiency, perceived ease, and multi-dimensional hardship). Given the nature of these dependent variables, it would make sense that individual factors might relate to the individual respondent's perception of some aspect of household water security, in contrast to an individual reporting on an arguably more objective measure such as reported consumption. For example, it may be that individuals with higher levels of education have more formal knowledge about water quality or water-borne disease, and

in turn become more discerning about the quality of different sources. The statistically significant and negative relationship between having a spouse or partner who lives elsewhere and affordability may reflect some additional hardship that that these single-headed households may have. Not surprisingly, larger household size was inversely related to every measure of water security in this study for the dry season, and most measures for the rainy season. In Pinget, households with more members have, on average, less water security than households with fewer members.

## VIII. Neighborhood and Municipal Factors

In this section, I examine how the Pinget neighborhood and Baguio City municipal contexts matter for understanding seasonal water insecurity among households in this study (Q4). Findings are synthesized from archival research, informal interviews, individual subsurveys, and in-depth interviews.

### Pinget Context

*The Buyog Watershed*

Pinget's proximity to and relationship with the Buyog Watershed are important for understanding seasonal water insecurity among households. The watershed provides a key supply of water for Pinget in both seasons. Some households still fetch water directly from the natural spring at the base of the watershed or wash laundry at the spring. Although the latter practice is officially discouraged and the spring is enclosed within the watershed fence, some long-time residents of Pinget remarked, "You can't fence Filipino people!" suggesting that Filipinos have a tendency to keep "twisting and turning" until they find a solution.

A theme that emerged from subsurveys, when respondents were asked whether the household water situation had improved or not in recent years, is that reliance on the Buyog Watershed spring or other Pinget springs is a sign of household water hardship. When explaining why they said their household situation had improved, several respondents described this in relation to no longer having to use the spring. While Pinget's natural resources provide a free and often abundant source of water, many households would prefer to not use springs if they could afford to purchase more tanks and drums for water storage or secure a BWD connection. This finding is in contrast to pilot study findings of reliance on spring water in another Baguio City neighborhood, Hillside, where many households used a local spring without much sense of

hardship (Mason, 2012). This difference seems at least partially explained by different topographies of the two neighborhoods. Pinget has a larger land area, with much steeper slopes for people to descend and ascend when fetching or using spring water, compared to Hillside.

The Buyog Watershed also provides the main source of BWD water for Pinget and other nearby neighborhoods in the rainy season, since BWD pipes, pumps, and distributes chlorinated spring water to metered connections. Because the official boundaries for the Buyog Watershed, however, include many populated parts of Pinget, legal procurement of a BWD connection is not always possible. Households may not have all of the official paperwork and permits required to apply for a BWD connection.

*Location Matters*

Household location within Pinget also matters for understanding seasonal water insecurity. Pinget is a steep neighborhood; most roads are paved, but some are less developed. Depending on where a house is located in Pinget and if the household has a BWD connection, there may be strong and adequate water pressure, or very low water pressure where "only air" comes out when valves are opened. Also, for households that rely on delivery, some steep roads become too slippery for delivery truck companies to safely provide water in the rainy season. Households in these areas may use long hoses so delivery truck companies can reach them, or may place their drums further from their homes but closer to accessible roads, and then physically transport water from the drums back to their homes. These geographic variations may be entirely unrelated to socioeconomic position. Some wealthy families, for example, deliberately choose not to have a private BWD connection because they believe that the water pressure in their area would be too low to provide suitable service.

*Role of Barangay Council*

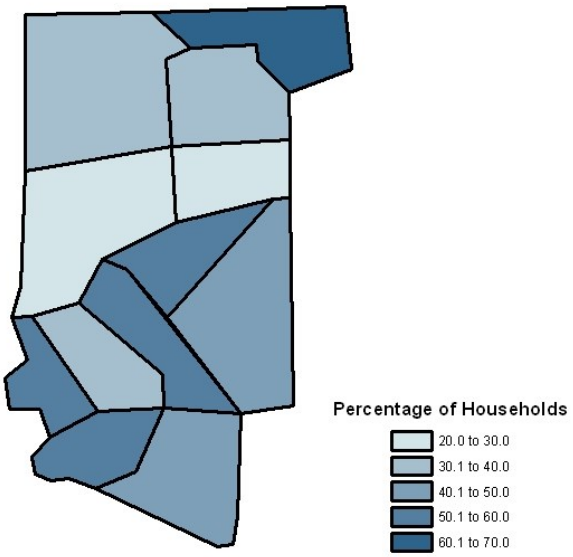
The Barangay Captain and Barangay Council have helped mitigate water insecurity in Pinget in several ways. The 2000 neighborhood profile, for example, called attention to Pinget's water problems, noting that only Lower and Middle Pinget were serviceable by BWD at the time (Pinget Barangay Council, 2000). Through combined efforts of a Baguio City "urban poor" association, researchers from the University of the Philippines-Baguio, the neighborhood leadership, and the BWD, an agreement was reached that BWD would extend service to residents of Purok 9 in part of Upper Pinget. BWD also implemented an installment plan for paying the BWD connection fee, so that households did not need to pay this substantial cost (minimum ₱6,000 or $140) at one time.

Although this service extension was not necessarily initiated by the Barangay Council, residents of Purok 9 recall the former Barangay Captain explaining the possibility of BWD connection to them, participating in community meetings to disseminate this information, and encouraging households to connect. Interestingly, although Purok 9 is almost entirely on watershed designated land, the purok has the highest household rate of private BWD connection in Pinget today (Figure 5; Purok 9 is in the northeast corner; see Figure 4 on p. 47 for other Pinget images).[8]

More recently, the Barangay Council has organized clean-ups at the base of the Buyog Watershed, helped ensure that animal waste (e.g., from piggery businesses) does not contaminate the source, and pursued possible legal action to segregate the developed portions of Pinget from the Buyog Watershed, so these portions are no longer declared as protected land.

[8] It should be noted, also, that Purok 9 has a high concentration of residents with origins in the same Cordilleran village. A relatively higher level of community cohesion and organizing among these residents may also help explain the success in obtaining the BWD expansion and high rate of private BWD connections.

**Figure 5. Private BWD Connections by Purok in Pinget**




## Baguio City Context

*Population Growth and Provider Expansion*

Rapid population growth in Baguio City has led to increased water demand in recent decades, a trend projected to continue in the future. With BWD unable to meet this demand, the private water delivery industry boomed in Baguio City. Households in neighborhoods like Pinget, underserved by BWD in the past, suddenly had recourse to multiple private delivery trucks from which they could order water. Although these companies charged rates approximately four times higher than BWD, they provided many Pinget households with relief from the physical labor and time spent transporting water from springs, or using water at spring sources. Delivery business to Pinget also expanded because of investments in road infrastructure, related to the development of a private subdivision north of Pinget.

As Baguio City's population grew, and infrastructure generally improved, BWD extended service to some previously underserved areas. For Pinget, general investments by BWD

in installing or upgrading main pipelines meant that households who could afford the BWD connection fee—plus additional costs of laying pipe from the BWD meter to their home and purchasing storage tanks and drums—and navigate the application process could now obtain private BWD connections. This included some boarding houses, which also began to increase in number in Pinget. By providing boarding house access to a private BWD connection (even if the tenant did not have a personal private BWD connection), landlords could attract more tenants. Indeed, "No water problem" is a common sign posted on boarding houses in Baguio City when vacancies are available.

*Private BWD Connection: Barriers and Opportunities*

Today, at least some part of each purok in Pinget is serviced by BWD, due in part to BWD's overall expansion and system improvements. Many subsurvey respondents who said their water situation improved in recent years attributed this to having a BWD connection. As suggested by regression results, having a private BWD connection is associated with multiple dimensions of water security, and water security overall. While household financial resources are needed to obtain a BWD connection, this study also finds that there are municipal-level barriers to and opportunities for obtaining this connection.

First, the household is supposed to be legally settled so that it has all paperwork required by BWD. Or, the household needs to apply for a BWD connection during Baguio City Council designated amnesty periods. Throughout Baguio City, many households do not have paperwork demonstrating that they are legal settlers or rightful owners of land. During amnesty periods, households with financial means to obtain a private BWD connection can do so without the documentation required during non-amnesty periods.

Another aspect of connecting to BWD, which emerged from in-depth interviews, is the need for households to "know how to talk" to BWD when submitting an application. This phrase was euphemistic for corruption at BWD, which is not uncommon in the Philippines, and the expectation that an applicant would pay some additional sum to a BWD employee to ensure that the application would be processed. Numerous references were also made to having to "keep following up" at BWD. While this phrase and the examples given by interview participants were less explicitly about corruption, they still portrayed that the BWD application process can take several months, even when the appropriate paperwork and fees have been submitted. Typically, someone in the household must be persistent, likely adjusting their own work and personal schedules, to regularly visit the BWD office and inquire about the application status.

*BWD Water Scheduling*

Although BWD expansion seems to have improved household water security in Pinget overall, many households still complain about difficulties related to BWD water rationing. To be clear, it is not rationing *per se* which is problematic. Most households are accustomed to storing water for use in between scheduled supply days. Also, calls for 24-hour BWD water supply among participants in this study were few, almost as though expectations for 24-hour supply are understood to be unrealistic given Baguio City's broader population and water situation.

Rather, it is the unannounced changes and interruptions in the scheduled supply of BWD water that households find difficult. Households with BWD prefer a regular, predictable schedule. In the rainy season, this preference is usually met. In the dry season, for many households, it is not.

*Increasing Water Demand*

Finally, there seems to be a shared sentiment and almost acceptance among people that the water situation in Baguio City is difficult. For example, an everyday way that people refer to BWD is as "Bawadi," pronouncing the acronym for Baguio Water District. The word has a double meaning, however, as many say with tongue-in-cheek that "Bawadi" stands for "*Baguio walang danom,*" which translates to "Baguio has no water."

Many respondents and informants recognize the relationship between increasing water demand, decreased or intermittent water availability, and increased population growth in Baguio City. Baguio City's population continues to grow at over 2% per year and, as previously noted, water demand is expected to double by 2026 (Muni & Peñalba, 2011). The BWD seems acutely aware of the projected demand-supply imbalance, and some progress in improving infrastructure and developing new sources has been achieved. At the same time, some stakeholders also attribute the broader water problem to the city's proliferation of water providers, who are competing over the same source of underground water like "many straws in the same cup." Finally, some identify the role of environmental change, such as the possibility of climate change and trends in deforestation and declining watersheds.

Baguio City's reputation as a tourist city in the Philippines is also a recognized factor. Dry season visitors to the area—seeking summertime relief from the hotter lowlands in Baguio's cooler climate—increase water demand seasonally, and at a time of year when the city's water supply would be pressed even without the presence of tourists.

**Summary and Discussion**

At the neighborhood level, Pinget's proximity to the Buyog Watershed provides an important source of spring and BWD water, particularly in the rainy season. At the same time,

however, the ability to have a private BWD connection is to some extent bound up with officially declared boundaries of the Buyog Watershed. Households residing on watershed land cannot legally obtain utility connections, an issue which, if further explored, could situate this study in the important area of land tenure, informal settlements, and environmental change. At the municipal level, this issue is periodically addressed through designated amnesty windows, suggesting that an institutional policy response at the municipal level can help address a policy restriction at the national level. Other neighborhood factors of interest are the location of households within the neighborhood, which may facilitate access to some sources but constrain access to others. Although this factor cannot necessarily be manipulated directly, neighborhood investments in spatial aspects that matter—such as additional road development or storm drain improvement—may be relevant for improving household water security. Also, the involvement of the Barangay Council in attempts to mitigate water insecurity resonates with Agrawal's (2009) work on local institutions and environmental change in rural areas, which finds that local governance matters for rural adaptation to climate change in almost all of the 118 cases reviewed.

At the municipal level, population growth in Baguio City led to a proliferation of providers, benefiting many neighborhoods, including Pinget. These providers, however, essentially compete over the same sources of underground water, which may also be declining due to other environmental changes such as deforestation and possibly climate change. This issue is complex and requires further investigation. It is widely recognized that commercial providers in many developing countries play important roles in expanding water access to lower income households. Water costs for consumers, however, are often regressive as previously

discussed, and the underlying issue of why there is inequitable access to municipal water should still be addressed.

The BWD, a municipal level institution, does take some action to help households mitigate water insecurity such as collaborating with the city government to provide amnesty periods for new connections. At the same time, however, the BWD may have institutional practices that impede household water security, such as cumbersome and possibly corrupt ways of processing BWD applications, and changes in dry season water supply that are poorly communicated to households, if at all. To some extent, these undesirable aspects of BWD seem accepted by many as the *status quo*. Despite a history of environmental activism in the Philippines, and occasional public complaints about BWD in outlets such as the local newspaper, there seems to be little public engagement around demanding improved service from the utility. Explanations for this are beyond the scope of this study, but could be ripe for future research.

## IX. Resource Acquisition and Use

In this section, I examine how individuals and households acquire and use financial, physical, and social resources to mitigate water insecurity, and include any gendered aspects of this acquisition and use (Q5). Findings are from qualitative analysis of in-depth interviews, and where appropriate, are discussed in relation to results from multiple regression analyses (Q3).

### Financial Resources

*Income*

Qualitative results confirm and illustrate multiple regression findings on the associations between income and water insecurity. In Pinget, households need money to purchase water, drums and tanks for storing water, and private BWD connections for easier access to water. Depending on household structure, income may come from men's or women's earnings, retirement pensions, or family members who are overseas foreign workers or living in other parts of the Philippines. For some families, rainwater abundance provides financial relief in the rainy season, as water expenses go down. As one lower income, female participant described:

> It's a great help for us because instead of using the money to buy delivery water for washing clothes, you use the money for other needs. Plus, like what I've said, we don't have enough money {always} to buy water.

Rainy season relief from some or all water expenses can also be critical in families where informal labor income decreases during the rainy season.

Not surprisingly, having to pay sometimes substantial amounts for water can raise awareness about the need to conserve. As women typically manage the household budget in married or partnered households, they may be more sensitive to overall household water

consumption when expenses increase. One married female participant described her role in managing males' water usage in her home as follows:

> It's their nature anyway. They are not the one who is holding the budget. And so they do not know how much. But I told them, "Wow! Our bill is raising up. Before it's 800, now it's 1,000. What do you think is the reason why? You keep on using, ah! You are using too much water, that's why!"

For lower income families, higher expenditures on water can mean more difficulty having enough money to pay for food, children's education, or emergency expenses. Tradeoffs between food and water security are sometimes made. One female participant observed:

> There is the budget for water and for food. But of course…if you prioritize, for example, you prioritized the food, and then of course there is no water, you won't be able to cook your food.

The women and men who serve as household water managers must thus make everyday budget decisions, sometimes juggling high expenditures on water with other basic household needs.

Income is also used by some households to purchase tanks and drums, and pay for the costs of connecting to BWD. Interview participants with higher household incomes tended to describe using income outright to pay for these items, rather than having to save for them. Inequalities of income may thus correspond with inequalities of water storage and BWD access

if poorer families cannot afford these resources, which were found to have significant associations with water security in multiple regression.

Extended family structures may also matter. In larger households wherein many adult siblings are working, incomes may be pooled to pay for water, tanks and drums, or BWD connections, or adult siblings may take turns paying for these items for the household.

*Savings*

Although multiple regression analysis finds limited associations between savings and water security, qualitative results shed light on a relationship. Many participants described purposefully saving to purchase tanks, drums, or a BWD connection. Some households saved for these items for a few months. Others, like the following participant who describes her challenge in saving for a BWD connection, saved for one year or more:

> Oh, it took one year. Because they {the children} were studying. It's not enough, you know. I have four kids, four in college, you know. It's very expensive. It takes a long time.

Meanwhile, some participants describe not having "even one penny" that could be saved for such expenses.

In married or partnered households, while women often manage everyday household budgets, the decision to commit income towards saving for a particular purchase was usually described as a joint decision between spouses, reflecting gender norms in the Philippines as previously described (Chant, 2007; Rubio & Green, 2011).

**Physical Resources**

*Tanks and Drums*

As suggested above, households need financial resources to obtain physical resources like tanks and drums, which multiple regression analysis finds are associated with increased water consumption in both seasons. These physical resources help households cope with the uncertainty of water supply common in Pinget and greater Baguio City, so that, as one male participant observed, "…whether the water will arrive or not, we have a water tank, a reserve." Another participant, female and married, seemed to emphasize that the periodic supply of BWD was non-problematic, since she has adequate storage capacity:

> It's okay. It's okay. Although only two days it {BWD water} will come to our place, it's okay for me because I have tanks. I have drums…I use that and then the next week it {BWD water} will come. It's okay.

For many families, however, these physical resources are expensive. Typical cost of a standard 55-gallon drum is around ₱500 ($12). One lower income participant whose household has limited storage capacity noted, "We just bought one drum and borrowed the other, because we don't have enough money to buy." Tank costs, meanwhile, vary depending on size, material, and labor to construct the tank. Sample costs for a 10-drum tank are from ₱10,000 to ₱25,000 ($233 to $584). Of note, mean monthly income in Pinget is around ₱15,000—the same price as some lower end 10-drum tanks. If a household is able to obtain or construct a tank, however, the tank can serve as an investment that will last for many years.

Since women (in married or partnered households) are usually the primary users of water for tasks such as cooking, washing dishes, and laundry, household water storage capacity can affect their individual experiences of water hardship. Many female participants attributed experiences of water insecurity to their "forgetting to check the tank" or "not realizing" that water reserves were low. There is a pervasive sense of having to monitor household water supply among women, and also some men who, as previously noted, may perform more of the physical labor of checking tank supplies or transporting supplemental water from springs.

*Private BWD Connections*

In multiple regression analysis, having a private BWD connection was associated with several measures of water insecurity in this study. Qualitative findings inform how expensive the connection process can be for some households—again showing how financial resources are needed to obtain the physical resources that matter. To obtain a BWD connection, households must pay the ₱6,000 connection fee, plus an estimated ₱4,000 to ₱8,000 in additional costs of laying pipes from the BWD meter to the home, which is the homeowner's responsibility. This combined cost of ₱10,000 to ₱14,000 ($234 to $327) is prohibitive for many households. For those who do save for a BWD connection, described above, the savings period may be lengthy. Also, since many households are accustomed to coping without a BWD connection, it may be that saving for BWD is not a priority over saving for expenses such as children's education or an emergency fund.

Per BWD personnel, the installment plan described in Section VIII—wherein households can spread the ₱6,000 fee over more than one payment—is still available to households on a case-by-case basis. This option does not seem to be common knowledge among Pinget households, however, or a typical installment plan of ₱3,000 up front and the remaining ₱3,000

spread over three months is still prohibitive. When two lower income in-depth interview participants, without BWD connections, were asked how much they could afford for an installment plan, ₱300 to ₱500 was the response, with a conditional "*Mabalin"* or "Maybe." At the same time, given heterogeneities of wealth in Pinget, the BWD connection process is not necessarily a financial burden for all families. One upper income, married female succinctly described, "I decided {to get BWD} because I had my money, and it would cost me less to pay the bill for my expenses on water {than delivery}."

Regarding the BWD connection process, a consistent theme was the need to regularly follow up with BWD, or "be annoyingly persistent" about an application as one participant said. Knowing how to "talk to" BWD personnel (i.e., pay under the table, see Section VIII) was also a frequent theme, although participants with BWD connections conveyed that they themselves had not done this. In general, several participants acknowledged that if you "know someone" at BWD, then the household can have its connection "right away."

When gender dimensions of obtaining BWD connections were probed, no pattern emerged. It did not seem to matter if the person making or following up on a BWD application was female or male, so much as that the person had the time and willingness to pursue the application process.

**Social Resources**

While multiple regression analyses found few associations between the size of borrowing networks and water insecurity, qualitative results suggest important ways in which social resources matter for mitigating household water insecurity in Pinget. Good relationships with neighbors enable households to borrow water or money during critical times, such as when water has completely run out and is unavailable for essential tasks like cooking or flushing toilets.

These relationships may also lay the groundwork for more substantial water access, such as paying a neighbor who has a BWD connection for water on a per drum basis. On these arrangements, one unanticipated finding was that many neighbors who sell BWD water are often perceived as generous. While I had anticipated that they would be seen as profiteering from their private BWD access, instead, they were perceived to be doing a favor to households with more difficult water situations.

At the same time, while participants who described borrowing experiences or paying neighbors for BWD were grateful to these neighbors, a sense of embarrassment about having to rely on neighbors also emerged. For one elderly female participant, this discomfort was a motivation to begin the BWD application process:

> Actually, I wanted to apply to Bawadi {BWD} so that I don't have to buy water {from the neighbor}…So, I just want to apply for myself, and have my own. So that I won't have to bother them anymore, telling them, "Can I buy some water or can I have some water?"

Maintaining good relationships with neighbors also seems to be preferred, even when conflict over water may be justified. In one case, a female participant described how another household "takes" her delivery order, if no one in her household is home to receive and pay for the delivery. Another female participant described how a relative with whom she shares water consumes more than what she pays for. In cases like these, direct confrontation with the other household or individual was generally avoided, in favor of preserving harmonious relationships.

While household members of either gender could borrow water or money, such borrowing is frequently done by women, as they are typically the ones who need water in moments of performing everyday household chores.

**Summary and Discussion**

Households in the study vary in their ability to obtain the financial and physical resources needed to mitigate water insecurity. For some, income is sufficient or savings can be obtained for larger purchases of drums, tanks, and BWD connections. For others, income is stretched in household budgets, and saving does not seem feasible. In married or partnered households, women are generally more involved with managing water-related finances than men, due to the gendered nature of household budgeting and financial management in the Philippines broadly, although decision-making for larger purchases seems to be shared. Beyond the absolute value of financial resources, the household decision of whether or not to dedicate income or savings toward physical resources is not entirely illuminated by this study. More detailed examination of this in future research, particularly with lower income households that nevertheless managed to purchase tanks, drums, and BWD connections, could shed further light on how to help other households do the same.

If acquired, tanks and drums are used to store water in reserve, a common coping strategy in response to uncertainties about water supply in Pinget and Baguio City in general. As previously noted, this strategy is likely to persist into the future, given the broader context of population and environmental pressures on Baguio City's underground water supply. In tandem with findings from multiple regression analysis, these results suggest that programs and policies to bolster household acquisition of tanks and drums could help mitigate water insecurity in Pinget. To fulfill gendered domestic responsibilities, women often need to stay aware of how

much water the household has at all times, potentially contributing to gendered water-related stress as observed by Wutich (2009) in urban Bolivia.

Obtaining a new BWD connection can be financially prohibitive for some, though not all, households. Savings from both men's and women's earnings, and other sources, may be accumulated for a year or more toward this goal. Like the decision to purchase tanks or drums, further insights into this decision-making process could be explored in future research. Regardless of financial position, most households also face challenges of perceived corruption at BWD and the need to spend time regularly following up with BWD during the application process.

Social resources, namely good relationships with neighbors, can provide a valuable recourse for obtaining water or money during moments of water-related crisis or insufficiency. This qualitative finding is noteworthy, given non-significant findings for social resources in multiple regression analysis, at least partially due to measurement limitations discussed above. Households with private BWD connections are perceived as generously sharing or selling water to others, while recipient or purchasing households may be both grateful and somewhat embarrassed to have to rely on neighbors on such a regular basis. It may also be important to observe these relationships over time, as more severe water situations or crises may lead to decreased reciprocity surrounding water.

# X. Implications and Conclusions

This study examined seasonal water insecurity in Pinget, a densely populated and highly urbanized neighborhood in Baguio City, the Philippines. Rigorous and multiple research methods shed light on the heterogeneities of water insecurity that can exist among and within households; and the individual, household, and contextual factors associated with water insecurity by season. The study's focus on seasonal aspects of water insecurity, in a medium sized city, is innovative and productive. Few studies have examined seasonal water insecurity in such contexts, yet population growth, urbanization, and environmental change trends suggest that this problem is increasing in many such cities worldwide. In this section, key contributions and implications of this study, and considerations for the broader field of adaptation to environmental change, are discussed. Methodological strengths and limitations are also addressed, followed by the study summary and conclusion.

## Extent and Nature of Seasonal Water Insecurity

### *Documentation of Disparities*

At municipal, regional, and national levels, water security is often measured by the proxy statistic of access to an improved water source (e.g., National Statistics Office and ICF Macro, 2009). While helpful in some ways, this metric can mask variations in water security among and within households. Using a multi-dimensional, multi-method approach to measuring water insecurity—and examining it by season—this study responds to calls for more detailed and nuanced assessments of water insecurity that can better inform program and policy interventions (Hadley & Wutich, 2009; Satterthwaite, 2003; UNICEF and World Health Organization, 2012).

A key study finding is that wide disparities in water quantity, quality, and accessibility exist among, and to some extent within, Pinget households. These disparities are generally worse

in the dry than rainy season, as many households have to cope with greater uncertainty about water supply. In the rainy season, however, water quality may be of particular concern. Rigorous intracommunity analysis of urban water insecurity, particularly by season, is surprisingly rare (Wutich, 2009). This study thus contributes an important example to an emerging literature, using multiple measures of water insecurity—objective, perceptual, and experiential—to provide a baseline for the study setting, which future studies might consider, refine, and test in other contexts. As multilateral organizations and funders such as the United Nations look beyond benchmarks like the Millenium Development Goals, and towards universal coverage for human rights like water, more micro-scale analyses such as this study will be necessary. A methodological challenge to be addressed will be measure development that can be adapted cross-culturally, and within different contexts in the same broader cultural setting such as urban versus rural.

At the local level, meanwhile, water insecurity disparities should be communicated and brought to the awareness of Baguio City municipal authorities, who are often perceived by community leaders as unaware of issues at the neighborhood level (Cleto, 2011). Although it is possible that these disparities are worse in Pinget than some other neighborhoods, prior research suggests that other areas of Baguio City have complex and disparate water situations as well (Mason, 2012; Muni & Peñalba, 2011). Indeed, next steps for this study include focused communication to local authorities through research and policy briefs. Such communication is timely, as Baguio City is one of eight cities currently involved in an international climate change initiative called Asian Cities Adapt. Findings from this study may inform how local planners and government agencies incorporate water security concerns into adaptation planning under both drier and wetter scenarios. Under drier scenarios, for example, Baguio City's adaptation plan

may want to consider how the least secure households will realize some basic right to water, particularly if free sources such as springs and rainwater become less abundant, or if increased competition over water sources leads to rate increases that do greatest harm to affordability of water for the lowest income households. Under wetter scenarios, local authorities may consider how quality of water may be adversely affected, and how rapid water testing, filtration, and treatment could be improved.

*Recycled Water and Rainwater Harvesting*

Households in Pinget use a variety of water sources to meet their needs. Two such sources may be of particular interest for broader water and climate adaptation scholarship: recycled water and rainwater. In this study, there is widespread adoption among Pinget households of recycled water use in the dry season, and rainwater harvesting in the rainy season. Further, some households practice both methods year round, although whether this is borne from necessity or social norm is not clear. The pilot for this study and informal interviews suggest that these practices are common throughout Baguio City generally, providing households with valuable supplemental sources of water that help mitigate water insecurity. In the environmental change literature, these would be classified as household adaptation practices or strategies.

These findings may be of interest to other cities—in developing or developed countries—where seasonal water insecurity is a growing problem, or being experienced for the first time. Indeed, a literature on greywater use (i.e., recycled water) and rainwater harvesting in urban areas of developing countries has started to emerge (e.g., Mandal et al., 2011), to which this study's findings may provide a valuable contribution given the probability-based survey design and attention to seasonal difference. New research in Pinget, Baguio City, or other cities may

examine how adoption of these practices develops over time, so that promotion or facilitation of household greywater use and rainwater harvesting can be proactively implemented.

In Baguio City, there has also been some discussion of developing communal rainwater harvesting systems (Fianza, 2012). Designing and testing such systems at the neighborhood level, if successful, could provide a valuable source of water for households unable to harvest rainwater themselves (e.g., due to landlord restrictions, differences in housing construction, geographic factors, etc.), and could potentially reduce demand from already stressed BWD and private delivery sources, if rainwater is harvested or distributed in the dry season. In steeply sloped neighborhoods like Pinget, rainwater harvesting might also, if appropriately designed and situated in the neighborhood, help mitigate localized flooding during heavy rains. Partnerships between local authorities, social scientists, engineers, and hydrologists could facilitate the development and testing of this intervention, with results that may inform dissemination of the technology to other locations with intense rainy seasons or occasional dry season rains as well.

*Gender Dimensions of Seasonal Water Insecurity*

This study finds that women, at least in married or partnered households, may experience water hardship to a greater extent than men due to gendered domestic responsibilities and particularly in the dry season. At the same time, or perhaps because of their more intimate relationship with water and related hardship, this study finds that more women than men make water complaints to the BWD, delivery truck companies, or local authorities.

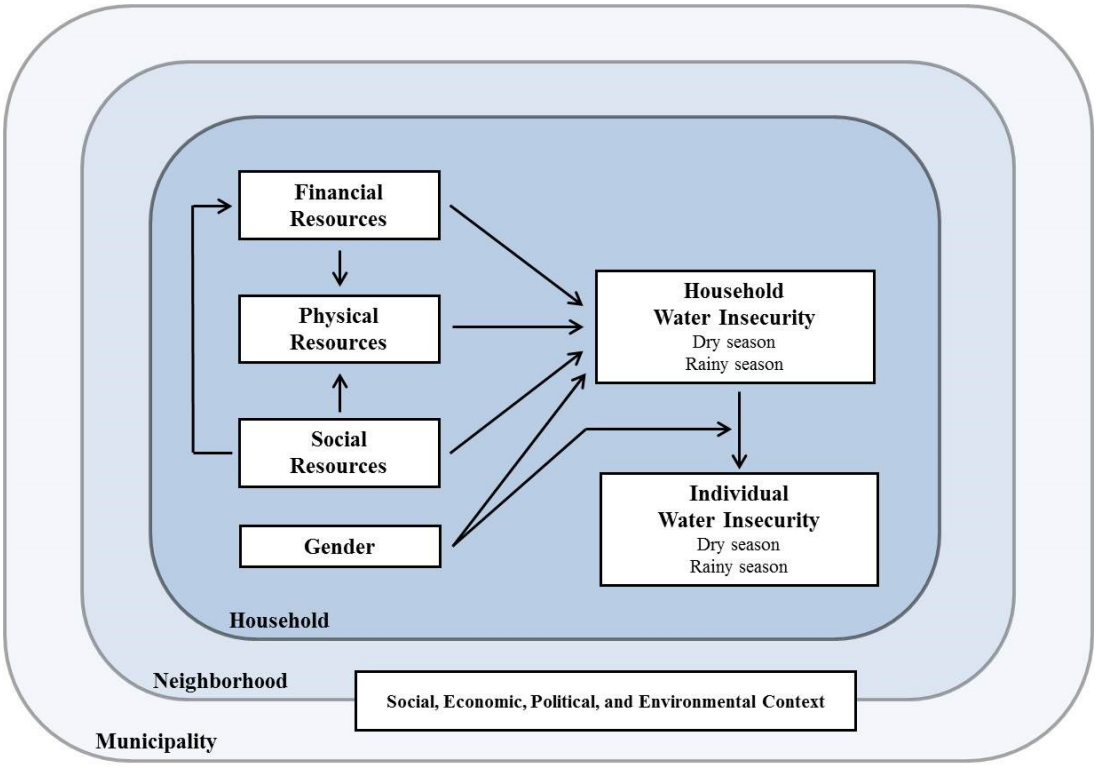
Taken together, these findings suggest that women could bring an important voice to improving Pinget's, and potentially Baguio City's, overall water situation if they were to engage in water-related activism or organizing (Loftus, 2007). Women in the Philippines, and Cordilleran women in particular, have a rich history of community organizing and civic

engagement, including around environmental issues (Castro-Palaganas, 2010). It may be that more intentional organizing efforts with women around water issues could effect change that improves household water situations in Pinget—a recommendation that could be taken up, for example, by local university students affiliated with a social development program. Two notes of caution, however. First, men's voices and potential organizing around water should also be considered, given this study's findings that about 20% of household water managers in Pinget are men, plus men's involvement in water collection and other related tasks. Second, this study did not explore to what extent women (or men, given some degree of shared decision-making in a typical Filipino household) may prioritize water issues over other concerns or goals that they have. There is some suggestion, from findings on saving for tanks, drums, and BWD connections, that households may prioritize saving for children's education over other possible goals, for example, which is a priority also described by Chant (2007). Thus, before such organizing around water could be recommended, more participatory assessment of how individuals and households rank water among priorities and needs may be more appropriate.

**Individual, Household, and Contextual Factors**

In the broader literature on environmental change, gender and resources are theorized to matter for a range of outcomes, and analysis of these relationships should ideally occur in a nesting of scales (Mearns & Norton, 2010; Prowse & Scott, 2008; Turner et al., 2003). This study contributes to this literature by examining how gender and specific financial, physical, and social resources relate to the specific problem of water insecurity by season, and given the neighborhood and municipal contexts of the chosen study site. As emphasized by Ribot (2010), this kind of outcome-focused research within the broad area of climate adaptation is potentially of more use to policymakers than more typical hazard-focused research. Hazards such as dry

**Figure 6. Revised Framework for Seasonal Water Insecurity in Urban Philippines**



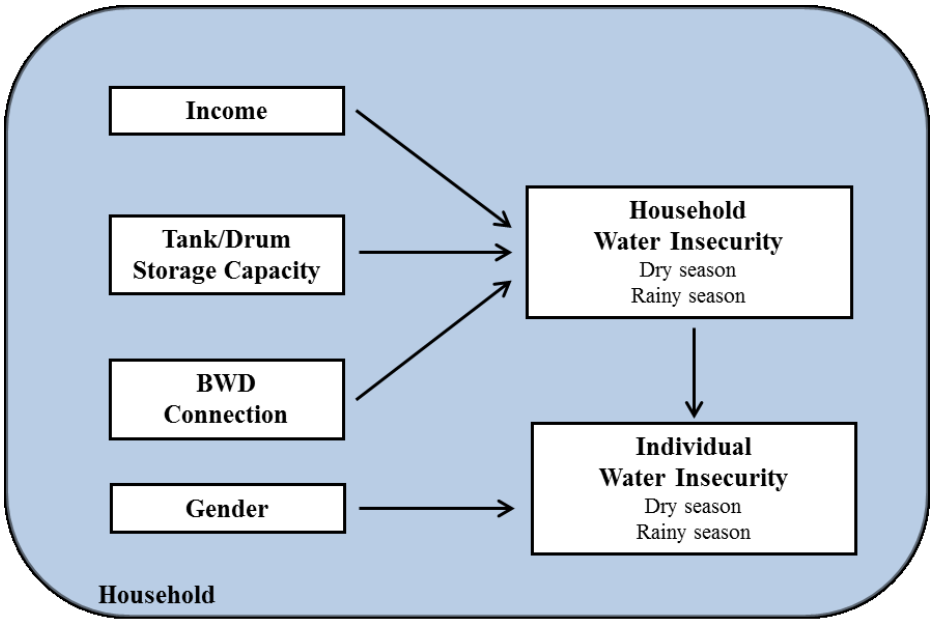

spells or typhoons cannot be directly manipulated. Causal determinants of outcomes, however, can likely be manipulated if rigorously identified.

Although this study cannot claim causal understanding, key quantitative findings are that the financial resource of income, and the physical resources of tank/drum storage capacity and having a private BWD connection, are positively associated with multiple measures of water security in the study setting. From qualitative findings, the roles of gender, social resources, and neighborhood and contextual factors also emerge. Taken together, results suggest a refinement of the broad conceptual framework which guided this study. Figure 6 captures the relationships in this revised framework, specifying direct relationships between each class of resources and household water insecurity, as well as mediating relationships among these variables, such as how greater financial resources can lead to greater physical resources. In this model, I decide to

retain gender, but relationships are refined for the study setting of urban Philippines, given (1) qualitative findings for the relationship between gender and household water insecurity (e.g., in married households, women may perform more water conservation behaviors on behalf of the household than men), and (2) quantitative and qualitative findings for how individual water insecurity may vary by gender.

To further specify the framework, in Figure 7, I identify the relationships among variables most strongly supported by this study—namely, that income, tank/drum storage capacity, and having a BWD connection are directly related to household water insecurity in Pinget, and that both gender and household water insecurity can matter for individual water insecurity.

**Figure 7. Specified Relationships with Strongest Support**



The main results that inform the above frameworks point to implications regarding the overlap of income, affordability, and consumption; facilitating acquisition of tanks and drums; improving BWD access and service; encouraging the role of neighborhood leadership in water security mitigation; and promoting long-term planning around water and development at the municipal level.

*Income, Affordability, and Consumption*

A key finding from multiple research methods in this study is the important role that income plays in mitigating household water insecurity. Households use income to purchase water and to pay for the physical resources (tanks, drums, and BWD connections) that matter for improved security. Policies that bolster income, including ways to smooth seasonal income for both men and women who work in informal economies, would thus be expected to bolster water security as well. More income would provide a direct means of affording adequate water for the household and may also permit households to pay outright or save for tanks, drums, or BWD connections. Through a BWD connection, households would have access to the most affordable commercially available source of water in Baguio City, per unit of water.

At the same time, however, the positive relationship in this study between income and reported consumption—and similarly between increased income, increased ability to purchase tanks and drums, and possible decreased affordability as households consume more water—must be considered given the greater Baguio City context of inadequate supply and competition over underground sources by multiple providers. Long the purview of developed countries, the need to promote water conservation in urban areas of developing countries—because of possible overconsumption by some households, including on a seasonal basis when water is perceived as abundant—is also emerging as an area for program and policy intervention, and additional

research. Based on this study's findings, women may have particular roles to play in monitoring or promoting conservation through their own use of water for domestic chores, and through their oversight of other household members' use. Men, however, may also have valuable water conservation insights or practices to share, also suggested by this study's qualitative findings, wherein men are sometimes perceived as more efficient water users than women.

*Facilitating Acquisition of Tanks and Drums*

This study finds a positive association between water storage capacity and reported consumption in both dry and rainy seasons, and perceived cleanliness in the dry season. In Pinget and likely the greater Baguio City area, it seems that households have adopted the practice of water storage over many years, in response to inadequate or unpredictable supply of water from BWD and other sources. As previously noted, the population, development, and environmental context of Baguio City suggests that this storage strategy will be used into the forseeable future. Inequitable distribution of this physical resource thus seems to be an important factor in inequitable distribution of water insecurity in this study. To better inform programs and policies that would bolster acquisition of these resources, future research could examine if there is some minimum storage capacity that seems to matter for household water security. Equity-minded interventions could then aim to ensure that each household has access to at least the minimum recommended capacity.

*Improving BWD Access and Service*

As noted above, having a private BWD connection is positively associated with several measures of water security in this study, sometimes in both seasons. As this study shows, however, such access in Pinget appears to be much lower than the general conception that there is "80% access" to BWD in Baguio City. This study estimates that access to BWD through

private connections is about 43% of Pinget households, and that an additional 31% access BWD through shared or other connections, such as paying a landlord or neighbor. Study findings distinguish between these two types of access in a potentially important way—whereas having a private BWD connection is associated with greater reported consumption (compared to no BWD connection), having a shared/other connection is associated with lower reported consumption. While some of this difference may be attributed to measurement error (possible overestimation in the dry season for households with private BWD connections), it remains likely that having a private BWD connection leads to greater consumption, and by extension, greater water security.

In light of these findings, the following BWD related recommendations may be considered, with the goals of more equitable access to a private BWD connection and improved quality of service by the utility. First, BWD should consider the viability and potential uptake of a more affordable installment plan for new connections in areas like Pinget, where there are lower income households for whom the connection fee or current installment scheme is prohibitive. Second, since any increase in connections will effectively spread the same water supply among more consumers (holding BWD production capacity and system loss rates constant), BWD should examine how it can promote water conservation among its users. As suggested by qualitative findings in this study, some BWD users seem accustomed to using water freely, given its affordability in relation to other sources and the perception that it is "flowing freely" when turned on. Third, inefficient and potentially corrupt processing of applications, which serve as barriers to legitimate household connection to BWD, should be addressed. Such complaints about BWD are not new in Baguio City. Perhaps increased organizing by residents or even neighborhood councils could provide new efforts to hold BWD accountable. Finally, BWD may consider simple, cost effective technologies for communicating

service interruptions and schedule changes to customers. Cell phones are ubiquitous in Baguio City, and texting is an affordable way of communicating with customers. Although a financial incentive for BWD to implement this recommendation is not clear, it would nonetheless have potential to improve water security for BWD users if implemented, particularly women who may be more likely to spend time waiting for or collecting water than men, as found in this study.

*Opportunities for Neighborhood Leadership*

Study findings suggest that local neighborhood leadership, here in the form of the Barangay Council, can help improve household water security. In Pinget, the Barangay Council has pursued this through written documentation of known problems, collaboration with partners, and attempts at legal action. One implication for the Barangay Council, from this study's findings, may be to find ways to mediate between the BWD and households who do not have private BWD connections, but would like them to improve their household water situation. This mediation or brokering could take the form of spreading information about the option of paying-by-installment for a BWD connection, or working with BWD administration to negotiate a lower installment plan for lower income Pinget households.

Considering the above discussion of increased consumption with increased BWD access, the Barangay Council may also have a role to play in promotion of water conservation by disseminating information among individuals and households. Finally, the Barangay Council might pursue partnership with appropriate city agencies or local research partners to test the possibility of a Pinget-based rainwater harvesting system, which would be the first neighborhood-level system of its kind in Baguio City.

*Long-Term Planning at the Municipal Level*

In Pinget specifically, and Baguio City more broadly, there seems to be a dual discourse on water. On the one hand, *"Baguio walang danom*" or "Baguio has no water." On the other, individuals and households are accustomed to water hardship, and know how to manage or otherwise draw on financial, physical, and social resources to cope during times of water insecurity. Both perspectives—shared by many participants and informants in this study—suggest a short-term focus on water for everyday use, rather than a long-term perspective on how households will cope if water sources become severely stressed. Such long-term scenarios, however, could be more carefully considered by households, neighborhood leaders, BWD officials, and municipal agencies, to ensure that basic water needs—a human right to water—can and will be met into the future.

If environmental change trends continue, and natural springs in Baguio City dry up, the poorest households who rely heavily on these free sources may be unprepared for new expenditures on water. At the same time, competition over increasingly scarce resources may lead to price increases for water by both BWD and commercial vendors. As a safety net, the local Department of Social Welfare and Development might consider a water relief program akin to a food relief and subsidy program. Similarly, local authorities might consider subsidy programs that offset the costs of water storage containers and BWD connections for low resource households. Although welfare-based programs may be politically less desirable, they may be increasingly necessary given the context of environmental change in numerous locations worldwide. As climate change scenarios at finer levels of analysis such as municipality become available, inter-sectoral agencies should consider how outcomes such as water insecurity may be affected, then plan for both safety net and resource accumulation policies in advance.

To proactively consider adaptation strategies, Pinget leaders and Baguio City officials might also turn to the Philippines own extensive history, relative to many other countries, with community-based and participatory disaster management (e.g., Luna, 2001; Victoria, 2003). In many respects, it seems that the overall context of water in Baguio City may be a pending disaster for some households and neighborhoods, if population growth, urbanization, and water extraction rates continue unabated. Approaching the challenges of water in Baguio City from a more community-based, proactive approach, may help avert crisis, and provide new opportunities and models of urban water management for medium sized cities in the Philippines, and elsewhere.

**Considerations for the Field**

Although this study focused on a particular outcome, in a particular context, the key findings and implications discussed above may have common themes of interest to the broader field of adaptation to environmental change. First, inequalities of social and climate-related outcomes—such as seasonal water insecurity—already exist. More rigorous documentation of these inequalities at lower levels of analysis (i.e., among and within households in a neighborhood or community) can provide valuable baseline information for adaptation planning, particularly as climate scenarios become more available at localized scales.

Second, causal determinants of these outcomes—particularly causes that can be manipulated through program and policy intervention—should continue to be identified at multiple scales of influence. As suggested by this study's findings for financial and physical resources in particular, the distribution of these determinants may be unequal in ways that formal institutions could address through policies that subsidize or facilitate accumulation of the resources that matter most. Likely, more equitable distribution of these resources would also

improve other social and climate-related outcomes as well, given theoretical linkages between resource accumulation and improved outcomes in general in the field of environmental change.

Third, while research into adaptation practices already used by households should continue—such as further inquiry into greywater use and rainwater harvesting suggested here—new rigorous testing of adaptation interventions should also ensue. Much adaptation to environmental change literature emphasizes the history and experience that people already have in adapting to environmental phenomena, then seeks to describe and predict patterns of adaptation, or discusses adaptation policy at the national and international level as it contrasts or complements with mitigation policy. Yet, through this one study of seasonal water insecurity in an urban Philippine neighborhood, several specific possible interventions were identified—from negotiating lower installment plans with the water utility, to implementing a neighborhood rainwater harvesting system. Implementation and testing of these recommendations could fill an important gap in the urban adaptation literature in particular, as more advances with adaptation interventions have been made in rural than urban contexts to date. Given urbanization trends worldwide, more rigorous adaptation intervention testing in urban areas may be a new priority in building an evidence base for the field.

**Methodological Strengths and Limitations**

This study used rigorous and multiple methods to answer critical questions about seasonal water insecurity. For surveys and subsurveys, the stratified random sampling design and relatively high participation rates strengthen generalizability of study findings to the Pinget population. Although Pinget is just one neighborhood in Baguio City, it is one of the most populous, and was selected in part because of the variety of water sources and household socioeconomic conditions that could be found within its boundaries. Iterative methods used for

archival research and informal interviews are another strength, as this approach enabled data collection to be tailored as fieldwork ensued. Also, purposive sampling for in-depth interviews and systematic qualitative analysis of interview transcripts provide rich information, triangulating or providing depth to findings from other research methods and, in some cases, illuminating relationships among variables that quantitative methods did not detect.

Limitations, meanwhile, must be carefully considered when interpreting study results. These include the cross-sectional design of the study, lack of standardized water insecurity measures in the literature to date, and chance variation in weather during the fieldwork period. This study used a cross-sectional design that relied on self-report and recall of seasonal data in surveys and subsurveys, due to resource constraints for collecting data over multiple waves. It is possible that respondent recall was inaccurate. In particular, given the repetitive nature of the questions (identical items asked for each season; see Appendices B and C), some respondents may have inadvertently given one season's response for the other's.

A lack of standardized measures of water insecurity is another limitation. While this study's multi-dimensional measures of water insecurity were informed by prior research and pilot tested in the field, they remain to be validated more broadly. Problems such as lumping of data (e.g., reporting water volumes in lumped amounts, such as "one drum" or "one cubic meter") were also encountered, a phenomena described by other water scholars as well.

Finally, the study's fieldwork period of February and March 2012 happened to correspond with an unexpected rainier-than-usual dry season, which may have improved household supplies of rainwater and other sources. Although households were asked to think about a "typical dry season week" or "typical rainy season week" when answering water insecurity questions, they were not directed to think about a particular year. Thus, it is possible

that some households referenced the current dry season, estimating higher volumes of or easier access to water than they might have during a more typical dry season. The possible problems of overestimating delivery water for the dry season and underestimating rainwater in the rainy season, described in Section VI, are also limitations to consider when interpreting results.

**Summary and Conclusion**

Despite the limitations above, this study provides a rigorous documentation and analysis of seasonal water insecurity—an understudied but growing problem in cities worldwide—in the context of an urban neighborhood in Baguio City, the Philippines. Key findings are that water insecurity can vary widely among and within households, by season. Quantitative analyses find important relationships between greater water security and income, water storage capacity, and private metered connection to the water utility. Qualitative results shed additional light on gender dimensions of water insecurity, the role social resources can play in mitigating insecurity, and how households acquire and use the resources that matter most. In addition, the importance of studying the neighborhood and municipal context within which households experience water insecurity is discussed.

This study has practice, policy, and research implications for Pinget and Baguio City specifically, and has potential to broadly inform efforts in other cities where the problem of seasonal water insecurity is starting to emerge. In collaboration with other social, environmental, and engineering sciences and professions, social work scholars and practitioners can play important roles in highlighting disparities that exist among and within populations affected by environmental change problems like water insecurity, and designing and testing effective interventions that mitigate harmful outcomes, improve lives, and help individuals and households thrive.

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# XII. Appendices

## Appendix A. Supplemental Tables

**Table A1. DV1: Linear Regression Model Building for Reported Consumption, Dry Season**

| Independent Variable | Est. | Est. | Est. | Est. | Est. | Est. |
|---|---|---|---|---|---|---|
| **Individual Factors** | | | | | | |
| Gender, female | -0.08 | -0.03 | 0.01 | 0.02 | 0.04 | 0.03 |
| Education, less than HS | | | | | | |
| HS diploma | | 0.18 * | 0.15 | 0.08 | 0.03 | 0.03 |
| College graduate | | 0.41 *** | 0.38 *** | 0.22 * | 0.09 | 0.09 |
| Marital status, not married | | | | | | |
| Married, lives elsewhere | | 0.13 | 0.18 | 0.12 | 0.12 | 0.13 |
| Married, lives in home | | -0.14 | -0.04 | -0.04 | -0.05 | -0.05 |
| Age | | 0.01 *** | 0.01 *** | 0.01 *** | 0.00 | 0.00 |
| Ethnicity, Cordilleran | | 0.12 | 0.14 * | 0.14 * | 0.01 | 0.01 |
| **Household Factors** | | | | | | |
| HH size | | | -0.07 *** | -0.09 *** | -0.11 *** | -0.11 *** |
| Logged monthly income | | | | 0.22 *** | 0.20 *** | 0.19 *** |
| Savings, none | | | | | | |
| Informal | | | | -0.10 | -0.09 | -0.06 |
| Formal | | | | 0.12 | 0.04 | 0.06 |
| Logged tank/drum capacity | | | | | 0.11 *** | 0.11 *** |
| BWD connection, none | | | | | | |
| Shared/other way | | | | | -0.23 ** | -0.23 *** |
| Private | | | | | 0.25 *** | 0.24 ** |
| Homeownership | | | | | 0.08 | 0.09 |
| Water network, 0 HHs | | | | | | |
| 1 HH | | | | | | 0.00 |
| 2+ HHs | | | | | | -0.10 |
| Money network, 0 HHs | | | | | | |
| 1 HH | | | | | | 0.00 |
| 2+ HHs | | | | | | -0.01 |

*Note:* *p<.05 **p<.01 ***p<.001

**Table A2. DV1: Linear Regression Model Building for Reported Consumption, Rainy Season**

| Independent Variable | Est. | Est. | Est. | Est. | Est. | Est. |
|---|---|---|---|---|---|---|
| **Individual Factors** | | | | | | |
| Gender, female | -0.17 | -0.11 | -0.05 | -0.05 | -0.04 | -0.05 |
| Education, less than HS | | | | | | |
| HS diploma | | 0.24 ** | 0.20 * | 0.15 | 0.09 | 0.09 |
| College graduate | | 0.46 *** | 0.42 *** | 0.27 ** | 0.14 | 0.14 |
| Marital status, not married | | | | | | |
| Married, lives elsewhere | | 0.03 | 0.09 | 0.05 | 0.04 | 0.05 |
| Married, lives in home | | -0.18 * | -0.05 | -0.04 | -0.04 | -0.04 |
| Age | | 0.01 *** | 0.01 *** | 0.01 *** | 0.00 | 0.00 |
| Ethnicity, Cordilleran | | 0.21 ** | 0.24 *** | 0.24 *** | 0.12 | 0.12 |
| | | | | | | |
| **Household Factors** | | | | | | |
| HH size | | | -0.09 *** | -0.11 *** | -0.13 *** | -0.13 *** |
| Logged monthly income | | | | 0.23 *** | 0.20 *** | 0.20 *** |
| Savings, none | | | | | | |
| Informal | | | | -0.16 | -0.13 | -0.13 |
| Formal | | | | 0.02 | -0.04 | -0.04 |
| Logged tank/drum capacity | | | | | 0.11 *** | 0.11 *** |
| BWD connection, none | | | | | | |
| Shared/other way | | | | | -0.31 *** | -0.31 *** |
| Private | | | | | 0.20 ** | 0.20 ** |
| Homeownership | | | | | 0.04 | 0.04 |
| Water network, 0 HHs | | | | | | |
| 1 HH | | | | | | 0.02 |
| 2+ HHs | | | | | | 0.01 |
| Money network, 0 HHs | | | | | | |
| 1 HH | | | | | | 0.01 |
| 2+ HHs | | | | | | -0.03 |

*Note:* *p<.05 **p<.01 ***p<.001

**Table A3. DV1: Final Linear Regression Models for Reported Consumption (Log-LPCPD), By Season: Supplemental Details**

| | Dry | | | | | | Rainy | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Independent Variable | Est. | SE | 95L | 95U | t | | Est. | SE | 95L | 95U | t | |
| **Individual Factors** | | | | | | | | | | | | |
| Gender, female | 0.03 | 0.08 | -0.12 | 0.18 | 0.44 | | -0.05 | 0.07 | -0.19 | 0.10 | -0.63 | |
| Education, less than HS | | | | | | | | | | | | |
| HS diploma | 0.03 | 0.07 | -0.11 | 0.17 | 0.41 | | 0.09 | 0.08 | -0.07 | 0.24 | 1.10 | |
| College graduate | 0.09 | 0.08 | -0.07 | 0.25 | 1.08 | | 0.14 | 0.08 | -0.02 | 0.30 | 1.67 | |
| Marital status, not married | | | | | | | | | | | | |
| Married, lives elsewhere | 0.13 | 0.10 | -0.06 | 0.33 | 1.32 | | 0.05 | 0.10 | -0.14 | 0.24 | 0.51 | |
| Married, lives in home | -0.05 | 0.07 | -0.19 | 0.09 | -0.69 | | -0.04 | 0.07 | -0.17 | 0.09 | -0.57 | |
| Age | 0.00 | 0.00 | 0.00 | 0.01 | 1.13 | | 0.00 | 0.00 | 0.00 | 0.01 | 0.95 | |
| Ethnicity, Cordilleran | 0.01 | 0.06 | -0.11 | 0.13 | 0.18 | | 0.12 | 0.07 | -0.01 | 0.25 | 1.82 | |
| **Household Factors** | | | | | | | | | | | | |
| HH size | -0.11 | 0.01 | -0.13 | -0.08 | -7.24 | *** | -0.13 | 0.01 | -0.15 | -0.10 | -8.41 | *** |
| Logged monthly income | 0.19 | 0.05 | 0.09 | 0.28 | 3.83 | *** | 0.20 | 0.04 | 0.11 | 0.28 | 4.54 | *** |
| Savings, none | | | | | | | | | | | | |
| Informal | -0.06 | 0.10 | -0.25 | 0.12 | -0.67 | | -0.13 | 0.10 | -0.33 | 0.07 | -1.25 | |
| Formal | 0.06 | 0.07 | -0.07 | 0.19 | 0.87 | | -0.04 | 0.07 | -0.17 | 0.09 | -0.62 | |
| Logged tank/drum capacity | 0.11 | 0.03 | 0.05 | 0.17 | 3.54 | *** | 0.11 | 0.03 | 0.05 | 0.16 | 3.60 | *** |
| BWD connection, none | | | | | | | | | | | | |
| Shared/other way | -0.23 | 0.07 | -0.37 | -0.10 | -3.35 | *** | -0.31 | 0.07 | -0.45 | -0.17 | -4.39 | *** |
| Private | 0.24 | 0.07 | 0.10 | 0.39 | 3.25 | ** | 0.20 | 0.07 | 0.05 | 0.34 | 2.70 | ** |
| Homeownership | 0.09 | 0.07 | -0.05 | 0.23 | 1.22 | | 0.04 | 0.07 | -0.10 | 0.18 | 0.59 | |
| Water network, 0 HHs | | | | | | | | | | | | |
| 1 HH | 0.00 | 0.11 | -0.21 | 0.22 | 0.04 | | 0.02 | 0.11 | -0.20 | 0.24 | 0.16 | |
| 2+ HHs | -0.10 | 0.13 | -0.36 | 0.16 | -0.78 | | 0.01 | 0.13 | -0.24 | 0.26 | 0.08 | |
| Money network, 0 HHs | | | | | | | | | | | | |
| 1 HH | 0.00 | 0.10 | -0.19 | 0.19 | 0.03 | | 0.01 | 0.10 | -0.18 | 0.21 | 0.14 | |
| 2+ HHs | -0.01 | 0.12 | -0.25 | 0.22 | -0.11 | | -0.03 | 0.12 | -0.26 | 0.20 | -0.27 | |

*Note:* *p<.05 **p<.01 ***p<.001

**Table A4. DV1: Alternate Linear Regression Models for Reported Consumption (Log-LPCPD), By Season: Omit HH Size IV**

| | Dry | | | | | | Rainy | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Independent Variable | Est. | SE | 95L | 95U | t | | Est. | SE | 95L | 95U | t | |
| **Individual Factors** | | | | | | | | | | | | |
| Gender, female | -0.03 | 0.08 | -0.19 | 0.13 | -0.37 | | -0.12 | 0.08 | -0.27 | 0.03 | -1.62 | |
| Education, less than HS | | | | | | | | | | | | |
| HS diploma | 0.08 | 0.08 | -0.07 | 0.24 | 1.09 | | 0.15 | 0.08 | -0.02 | 0.31 | 1.77 | |
| College graduate | 0.18 | 0.08 | 0.01 | 0.34 | 2.09 | * | 0.24 | 0.09 | 0.07 | 0.41 | 2.70 | ** |
| Marital status, not married | | | | | | | | | | | | |
| Married, lives elsewhere | 0.07 | 0.11 | -0.14 | 0.28 | 0.64 | | -0.03 | 0.11 | -0.24 | 0.18 | -0.31 | |
| Married, lives in home | -0.18 | 0.07 | -0.32 | -0.04 | -2.58 | ** | -0.20 | 0.07 | -0.33 | -0.06 | -2.87 | ** |
| Age | 0.00 | 0.00 | 0.00 | 0.01 | 1.21 | | 0.00 | 0.00 | 0.00 | 0.01 | 1.03 | |
| Ethnicity, Cordilleran | 0.01 | 0.06 | -0.12 | 0.14 | 0.14 | | 0.12 | 0.07 | -0.02 | 0.25 | 1.68 | |
| **Household Factors** | | | | | | | | | | | | |
| HH size | | | | | | | | | | | | |
| Logged monthly income | 0.12 | 0.05 | 0.02 | 0.22 | 2.42 | * | 0.15 | 0.05 | 0.06 | 0.25 | 3.21 | ** |
| Savings, none | | | | | | | | | | | | |
| Informal | -0.06 | 0.10 | -0.25 | 0.13 | -0.60 | | -0.13 | 0.11 | -0.35 | 0.09 | -1.19 | |
| Formal | 0.06 | 0.07 | -0.07 | 0.20 | 0.90 | | -0.04 | 0.07 | -0.18 | 0.10 | -0.59 | |
| Logged tank/drum capacity | 0.09 | 0.03 | 0.03 | 0.14 | 2.98 | ** | 0.08 | 0.03 | 0.03 | 0.13 | 2.89 | ** |
| BWD connection, none | | | | | | | | | | | | |
| Shared/other way | -0.23 | 0.07 | -0.38 | -0.09 | -3.17 | ** | -0.32 | 0.08 | -0.47 | -0.16 | -4.10 | *** |
| Private | 0.23 | 0.08 | 0.08 | 0.39 | 2.98 | ** | 0.19 | 0.08 | 0.04 | 0.34 | 2.44 | * |
| Homeownership | 0.02 | 0.07 | -0.13 | 0.17 | 0.28 | | -0.04 | 0.08 | -0.19 | 0.12 | -0.49 | |
| Water network, 0 HHs | | | | | | | | | | | | |
| 1 HH | -0.05 | 0.12 | -0.28 | 0.18 | -0.41 | | -0.04 | 0.12 | -0.28 | 0.21 | -0.30 | |
| 2+ HHs | -0.15 | 0.14 | -0.43 | 0.12 | -1.09 | | -0.04 | 0.14 | -0.30 | 0.23 | -0.26 | |
| Money network, 0 HHs | | | | | | | | | | | | |
| 1 HH | 0.04 | 0.10 | -0.16 | 0.24 | 0.41 | | 0.06 | 0.11 | -0.16 | 0.28 | 0.55 | |
| 2+ HHs | 0.02 | 0.13 | -0.23 | 0.27 | 0.16 | | 0.01 | 0.12 | -0.23 | 0.25 | 0.07 | |

*Note:* *p<.05 **p<.01 ***p<.001

**Table A5. DV1: Alternate Linear Regression Models for Reported Consumption (Log-LPW), By Season: Non-Per Capita DV**

| | Dry | | | | | | Rainy | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Independent Variable | Est. | SE | 95L | 95U | t | | Est. | SE | 95L | 95U | t | |
| **Individual Factors** | | | | | | | | | | | | |
| Gender, female | 0.06 | 0.07 | -0.09 | 0.20 | 0.75 | | -0.02 | 0.07 | -0.16 | 0.11 | -0.36 | |
| Education, less than HS | | | | | | | | | | | | |
| HS diploma | 0.02 | 0.07 | -0.12 | 0.17 | 0.31 | | 0.08 | 0.08 | -0.08 | 0.23 | 0.99 | |
| College graduate | 0.13 | 0.08 | -0.03 | 0.30 | 1.62 | | 0.18 | 0.08 | 0.02 | 0.34 | 2.14 | * |
| Marital status, not married | | | | | | | | | | | | |
| Married, lives elsewhere | 0.22 | 0.10 | 0.02 | 0.41 | 2.22 | * | 0.14 | 0.10 | -0.05 | 0.32 | 1.41 | |
| Married, lives in home | 0.05 | 0.07 | -0.09 | 0.19 | 0.66 | | 0.06 | 0.07 | -0.07 | 0.19 | 0.89 | |
| Age | 0.00 | 0.00 | 0.00 | 0.01 | 1.30 | | 0.00 | 0.00 | 0.00 | 0.01 | 1.11 | |
| Ethnicity, Cordilleran | -0.02 | 0.06 | -0.15 | 0.10 | -0.36 | | 0.08 | 0.07 | -0.05 | 0.22 | 1.27 | |
| **Household Factors** | | | | | | | | | | | | |
| HH size | 0.13 | 0.02 | 0.10 | 0.16 | 8.20 | *** | 0.11 | 0.02 | 0.07 | 0.14 | 6.71 | *** |
| Logged monthly income | 0.20 | 0.05 | 0.11 | 0.30 | 4.24 | *** | 0.23 | 0.04 | 0.14 | 0.31 | 5.15 | *** |
| Savings, none | | | | | | | | | | | | |
| Informal | -0.05 | 0.10 | -0.24 | 0.14 | -0.53 | | -0.12 | 0.10 | -0.32 | 0.08 | -1.18 | |
| Formal | 0.05 | 0.07 | -0.08 | 0.18 | 0.77 | | -0.05 | 0.07 | -0.18 | 0.08 | -0.78 | |
| Logged tank/drum capacity | 0.10 | 0.03 | 0.04 | 0.17 | 3.05 | ** | 0.10 | 0.03 | 0.04 | 0.16 | 3.09 | ** |
| BWD connection, none | | | | | | | | | | | | |
| Shared/other way | -0.25 | 0.07 | -0.39 | -0.11 | -3.55 | *** | -0.33 | 0.07 | -0.47 | -0.19 | -4.53 | *** |
| Private | 0.22 | 0.07 | 0.08 | 0.37 | 2.97 | ** | 0.18 | 0.07 | 0.03 | 0.32 | 2.42 | * |
| Homeownership | 0.12 | 0.07 | -0.02 | 0.26 | 1.69 | | 0.08 | 0.07 | -0.07 | 0.22 | 1.03 | |
| Water network, 0 HHs | | | | | | | | | | | | |
| 1 HH | 0.01 | 0.11 | -0.20 | 0.22 | 0.10 | | 0.03 | 0.11 | -0.19 | 0.24 | 0.24 | |
| 2+ HHs | -0.06 | 0.13 | -0.32 | 0.20 | -0.44 | | 0.06 | 0.13 | -0.19 | 0.30 | 0.46 | |
| Money network, 0 HHs | | | | | | | | | | | | |
| 1 HH | 0.05 | 0.09 | -0.14 | 0.23 | 0.49 | | 0.05 | 0.10 | -0.14 | 0.25 | 0.55 | |
| 2+ HHs | 0.02 | 0.12 | -0.21 | 0.25 | 0.14 | | 0.00 | 0.11 | -0.22 | 0.22 | -0.02 | |

*Note:* LPW = Liters per week. *p<.05 **p<.01 ***p<.001

**Table A6. DV2: Logistic Regression Model Building for Perceived Sufficiency, Dry Season**

| Independent Variable | Est. | Est. | | Est. | | Est. | | Est. | | Est. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Individual Factors** | | | | | | | | | | | |
| Gender, female | -0.15 | -0.16 | | -0.05 | | -0.05 | | -0.05 | | -0.08 | |
| Education, less than HS | | | | | | | | | | | |
| HS diploma | | 0.18 | | 0.11 | | 0.08 | | 0.05 | | 0.04 | |
| College graduate | | 0.60 | * | 0.54 | * | 0.46 | | 0.42 | | 0.42 | |
| Marital status, not married | | | | | | | | | | | |
| Married, lives elsewhere | | -0.17 | | -0.07 | | -0.11 | | -0.18 | | -0.15 | |
| Married, lives in home | | -0.04 | | 0.19 | | 0.20 | | 0.20 | | 0.21 | |
| Age | | 0.03 | *** | 0.03 | *** | 0.03 | *** | 0.03 | *** | 0.03 | *** |
| Ethnicity, Cordilleran | | 0.02 | | 0.06 | | 0.06 | | 0.09 | | 0.10 | |
| | | | | | | | | | | | |
| **Household Factors** | | | | | | | | | | | |
| HH size | | | | -0.16 | *** | -0.18 | *** | -0.17 | *** | -0.17 | *** |
| Logged monthly income | | | | | | 0.18 | | 0.17 | | 0.16 | |
| Savings, none | | | | | | | | | | | |
| Informal | | | | | | -0.26 | | -0.25 | | -0.23 | |
| Formal | | | | | | -0.04 | | -0.03 | | -0.01 | |
| Logged tank/drum capacity | | | | | | | | 0.04 | | 0.03 | |
| BWD connection, none | | | | | | | | | | | |
| Shared/other way | | | | | | | | -0.14 | | -0.15 | |
| Private | | | | | | | | 0.01 | | 0.00 | |
| Homeownership | | | | | | | | -0.27 | | -0.27 | |
| Water network, 0 HHs | | | | | | | | | | | |
| 1 HH | | | | | | | | | | 0.01 | |
| 2+ HHs | | | | | | | | | | 0.04 | |
| Money network, 0 HHs | | | | | | | | | | | |
| 1 HH | | | | | | | | | | 0.13 | |
| 2+ HHs | | | | | | | | | | -0.10 | |

*Note:* *p<.05 **p<.01 ***p<.001

**Table A7. DV2: Logistic Regression Model Building for Perceived Sufficiency, Rainy Season**

| Independent Variable | Est. | Est. | Est. | Est. | Est. | Est. |
|---|---|---|---|---|---|---|
| **Individual Factors** | | | | | | |
| Gender, female | 0.38 | 0.26 | 0.24 | 0.26 | 0.31 | 0.26 |
| Education, less than HS | | | | | | |
| HS diploma | | -0.01 | 0.01 | -0.06 | 0.02 | 0.03 |
| College graduate | | 0.19 | 0.21 | 0.07 | 0.08 | 0.14 |
| Marital status, not married | | | | | | |
| Married, lives elsewhere | | -0.08 | -0.11 | -0.13 | -0.12 | -0.12 |
| Married, lives in home | | 0.76 * | 0.70 * | 0.69 | 0.63 | 0.66 |
| Age | | 0.02 * | 0.02 * | 0.02 | 0.02 | 0.02 |
| Ethnicity, Cordilleran | | 0.32 | 0.31 | 0.31 | 0.23 | 0.20 |
| | | | | | | |
| **Household Factors** | | | | | | |
| HH size | | | 0.04 | 0.03 | 0.01 | 0.01 |
| Logged monthly income | | | | 0.10 | 0.09 | 0.09 |
| Savings, none | | | | | | |
| Informal | | | | 0.32 | 0.34 | 0.32 |
| Formal | | | | 0.30 | 0.24 | 0.21 |
| Logged tank/drum capacity | | | | | 0.12 | 0.11 |
| BWD connection, none | | | | | | |
| Shared/other way | | | | | 0.55 | 0.53 |
| Private | | | | | 0.21 | 0.24 |
| Homeownership | | | | | 0.30 | 0.28 |
| Water network, 0 HHs | | | | | | |
| 1 HH | | | | | | 0.09 |
| 2+ HHs | | | | | | 0.69 |
| Money network, 0 HHs | | | | | | |
| 1 HH | | | | | | -0.05 |
| 2+ HHs | | | | | | -0.57 |

*Note:* *p<.05 **p<.01 ***p<.001

**Table A8. DV2: Final Logistic Regression Models for Perceived Sufficiency, By Season: Supplemental Details**

| | Dry | | | | | | | Rainy | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Independent Variable | Est. | SE | OR | 95L | 95U | t | | Est. | SE | OR | 95L | 95U | t | |
| **Individual Factors** | | | | | | | | | | | | | | |
| Gender, female | -0.08 | 0.25 | 0.93 | 0.57 | 1.52 | -0.30 | | 0.26 | 0.38 | 1.29 | 0.61 | 2.72 | 0.67 | |
| Education, less than HS | | | | | | | | | | | | | | |
| HS diploma | 0.04 | 0.27 | 1.04 | 0.62 | 1.75 | 0.14 | | 0.03 | 0.43 | 1.03 | 0.44 | 2.42 | 0.08 | |
| College graduate | 0.42 | 0.30 | 1.52 | 0.84 | 2.76 | 1.39 | | 0.14 | 0.49 | 1.15 | 0.44 | 2.99 | 0.28 | |
| Marital status, not married | | | | | | | | | | | | | | |
| Married, lives elsewhere | -0.15 | 0.32 | 0.86 | 0.46 | 1.61 | -0.47 | | -0.12 | 0.49 | 0.89 | 0.34 | 2.31 | -0.24 | |
| Married, lives in home | 0.21 | 0.24 | 1.23 | 0.77 | 1.97 | 0.88 | | 0.66 | 0.37 | 1.93 | 0.93 | 4.00 | 1.77 | |
| Age | 0.03 | 0.01 | 1.03 | 1.02 | 1.05 | 3.95 | *** | 0.02 | 0.01 | 1.02 | 1.00 | 1.05 | 1.71 | |
| Ethnicity, Cordilleran | 0.10 | 0.23 | 1.10 | 0.70 | 1.72 | 0.42 | | 0.20 | 0.37 | 1.22 | 0.59 | 2.54 | 0.53 | |
| **Household Factors** | | | | | | | | | | | | | | |
| HH size | -0.17 | 0.05 | 0.84 | 0.76 | 0.93 | -3.48 | *** | 0.01 | 0.09 | 1.01 | 0.84 | 1.21 | 0.10 | |
| Logged monthly income | 0.16 | 0.17 | 1.18 | 0.85 | 1.63 | 0.97 | | 0.09 | 0.28 | 1.10 | 0.63 | 1.92 | 0.33 | |
| Savings, none | | | | | | | | | | | | | | |
| Informal | -0.23 | 0.35 | 0.79 | 0.40 | 1.58 | -0.66 | | 0.32 | 0.67 | 1.37 | 0.36 | 5.16 | 0.47 | |
| Formal | -0.01 | 0.22 | 0.99 | 0.64 | 1.53 | -0.05 | | 0.21 | 0.43 | 1.24 | 0.53 | 2.86 | 0.50 | |
| Logged tank/drum capacity | 0.03 | 0.10 | 1.03 | 0.86 | 1.25 | 0.34 | | 0.11 | 0.08 | 1.12 | 0.95 | 1.31 | 1.34 | |
| BWD connection, none | | | | | | | | | | | | | | |
| Shared/other way | -0.15 | 0.24 | 0.86 | 0.54 | 1.37 | -0.65 | | 0.53 | 0.43 | 1.69 | 0.73 | 3.91 | 1.24 | |
| Private | 0.00 | 0.25 | 1.00 | 0.62 | 1.62 | 0.00 | | 0.24 | 0.40 | 1.28 | 0.58 | 2.78 | 0.61 | |
| Homeownership | -0.27 | 0.23 | 0.76 | 0.49 | 1.19 | -1.19 | | 0.28 | 0.39 | 1.32 | 0.61 | 2.85 | 0.71 | |
| Water network, 0 HHs | | | | | | | | | | | | | | |
| 1 HH | 0.01 | 0.36 | 1.01 | 0.50 | 2.04 | 0.04 | | 0.09 | 0.79 | 1.09 | 0.23 | 5.12 | 0.11 | |
| 2+ HHs | 0.04 | 0.41 | 1.04 | 0.46 | 2.32 | 0.09 | | 0.69 | 0.92 | 1.99 | 0.33 | 12.16 | 0.75 | |
| Money network, 0 HHs | | | | | | | | | | | | | | |
| 1 HH | 0.13 | 0.34 | 1.14 | 0.59 | 2.20 | 0.39 | | -0.05 | 0.70 | 0.95 | 0.24 | 3.77 | -0.08 | |
| 2+ HHs | -0.10 | 0.38 | 0.91 | 0.43 | 1.92 | -0.25 | | -0.57 | 0.83 | 0.57 | 0.11 | 2.92 | -0.68 | |

*Note:* Confidence intervals (95L, 95U) are for the odds ratio (OR). *p<.05 **p<.01 ***p<.001

**Table A9. DV3: Logistic Regression Model Building for Experienced Sufficiency, Dry Season**

| Independent Variable | Est. | Est. | Est. | Est. | Est. | Est. |
|---|---|---|---|---|---|---|
| **Individual Factors** | | | | | | |
| Gender, female | 0.40 | 0.33 | 0.42 | 0.45 | 0.50 | 0.54 |
| Education, less than HS | | | | | | |
| HS diploma | | -0.20 | -0.28 | -0.34 | -0.26 | -0.31 |
| College graduate | | 0.50 | 0.43 | 0.28 | 0.33 | 0.31 |
| Marital status, not married | | | | | | |
| Married, lives elsewhere | | -0.65 | -0.57 | -0.63 | -0.59 | -0.55 |
| Married, lives in home | | 0.17 | 0.34 | 0.35 | 0.29 | 0.31 |
| Age | | 0.04 *** | 0.04 *** | 0.04 *** | 0.03 ** | 0.03 ** |
| Ethnicity, Cordilleran | | -0.01 | 0.02 | 0.03 | -0.16 | -0.15 |
| **Household Factors** | | | | | | |
| HH size | | | -0.12 * | -0.14 ** | -0.17 *** | -0.17 ** |
| Logged monthly income | | | | 0.23 | 0.24 | 0.14 |
| Savings, none | | | | | | |
| Informal | | | | -0.08 | -0.12 | 0.01 |
| Formal | | | | 0.11 | 0.02 | 0.04 |
| Logged tank/drum capacity | | | | | 0.06 | 0.06 |
| BWD connection, none | | | | | | |
| Shared/other way | | | | | 0.67 * | 0.66 * |
| Private | | | | | 0.48 | 0.49 |
| Homeownership | | | | | 0.60 * | 0.62 * |
| Water network, 0 HHs | | | | | | |
| 1 HH | | | | | | -0.36 |
| 2+ HHs | | | | | | -0.66 |
| Money network, 0 HHs | | | | | | |
| 1 HH | | | | | | -0.33 |
| 2+ HHs | | | | | | -0.35 |

*Note:* *p<.05 **p<.01 ***p<.001

**Table A10. DV3: Logistic Regression Model Building for Experienced Sufficiency, Rainy Season**

| Independent Variable | Est. | Est. | Est. | Est. | Est. | Est. |
|---|---|---|---|---|---|---|
| **Individual Factors** | | | | | | |
| Gender, female | 0.19 | 0.01 | 0.05 | 0.11 | 0.12 | 0.20 |
| Education, less than HS | | | | | | |
| HS diploma | | -1.61 | -1.64 | -1.84 | -1.66 | -1.75 |
| College graduate | | -0.91 | -0.94 | -1.43 | -1.32 | -1.29 |
| Marital status, not married | | | | | | |
| Married, lives elsewhere | | -0.29 | -0.25 | -0.37 | -0.54 | -0.68 |
| Married, lives in home | | 0.98 | 1.03 * | 1.20 * | 1.13 | 1.08 |
| Age | | 0.03 | 0.03 | 0.03 | 0.02 | 0.02 |
| Ethnicity, Cordilleran | | -0.02 | 0.00 | 0.01 | -0.07 | -0.11 |
| | | | | | | |
| **Household Factors** | | | | | | |
| HH size | | | -0.04 | -0.10 | -0.13 | -0.12 |
| Logged monthly income | | | | 0.66 ** | 0.69 * | 0.59 |
| Savings, none | | | | | | |
| Informal | | | | -0.79 | -0.98 | -0.87 |
| Formal | | | | 0.16 | 0.13 | 0.38 |
| Logged tank/drum capacity | | | | | -0.11 | -0.12 |
| BWD connection, none | | | | | | |
| Shared/other way | | | | | 0.82 | 0.70 |
| Private | | | | | 1.55 * | 1.64 * |
| Homeownership | | | | | 0.09 | -0.11 |
| Water network, 0 HHs | | | | | | |
| 1 HH | | | | | | -1.86 |
| 2+ HHs | | | | | | -1.34 |
| Money network, 0 HHs | | | | | | |
| 1 HH | | | | | | 1.86 * |
| 2+ HHs | | | | | | 0.43 |

*Note:* *p<.05 **p<.01 ***p<.001

**Table A11. DV3: Final Logistic Regression Models for Experienced Sufficiency, By Season: Supplemental Details**

| | Dry | | | | | | | Rainy | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Independent Variable | Est. | SE | OR | 95L | 95U | t | | Est. | SE | OR | 95L | 95U | t | |
| **Individual Factors** | | | | | | | | | | | | | | |
| Gender, female | 0.54 | 0.29 | 1.71 | 0.98 | 3.00 | 1.88 | | 0.20 | 0.65 | 1.22 | 0.34 | 4.34 | 0.31 | |
| Education, less than HS | | | | | | | | | | | | | | |
| HS diploma | -0.31 | 0.30 | 0.73 | 0.40 | 1.33 | -1.03 | | -1.75 | 0.97 | 0.17 | 0.03 | 1.15 | -1.81 | |
| College graduate | 0.31 | 0.35 | 1.36 | 0.68 | 2.72 | 0.88 | | -1.29 | 1.00 | 0.27 | 0.04 | 1.95 | -1.29 | |
| Marital status, not married | | | | | | | | | | | | | | |
| Married, lives elsewhere | -0.55 | 0.38 | 0.58 | 0.27 | 1.22 | -1.44 | | -0.68 | 0.78 | 0.51 | 0.11 | 2.33 | -0.87 | |
| Married, lives in home | 0.31 | 0.27 | 1.36 | 0.80 | 2.32 | 1.15 | | 1.08 | 0.62 | 2.94 | 0.86 | 10.08 | 1.74 | |
| Age | 0.03 | 0.01 | 1.03 | 1.01 | 1.05 | 2.91 | ** | 0.02 | 0.03 | 1.02 | 0.97 | 1.08 | 0.88 | |
| Ethnicity, Cordilleran | -0.15 | 0.26 | 0.86 | 0.51 | 1.45 | -0.55 | | -0.11 | 0.59 | 0.90 | 0.28 | 2.87 | -0.18 | |
| **Household Factors** | | | | | | | | | | | | | | |
| HH size | -0.17 | 0.05 | 0.84 | 0.76 | 0.94 | -3.14 | ** | -0.12 | 0.16 | 0.89 | 0.65 | 1.23 | -0.71 | |
| Logged monthly income | 0.14 | 0.19 | 1.15 | 0.79 | 1.69 | 0.74 | | 0.59 | 0.31 | 1.80 | 0.98 | 3.29 | 1.90 | |
| Savings, none | | | | | | | | | | | | | | |
| Informal | 0.01 | 0.40 | 1.01 | 0.46 | 2.22 | 0.03 | | -0.87 | 0.73 | 0.42 | 0.10 | 1.76 | -1.19 | |
| Formal | 0.04 | 0.27 | 1.05 | 0.62 | 1.76 | 0.17 | | 0.38 | 0.64 | 1.46 | 0.42 | 5.10 | 0.59 | |
| Logged tank/drum capacity | 0.06 | 0.10 | 1.06 | 0.88 | 1.28 | 0.58 | | -0.12 | 0.16 | 0.89 | 0.65 | 1.22 | -0.75 | |
| BWD connection, none | | | | | | | | | | | | | | |
| Shared/other way | 0.66 | 0.30 | 1.93 | 1.06 | 3.51 | 2.16 | * | 0.70 | 0.59 | 2.01 | 0.63 | 6.40 | 1.19 | |
| Private | 0.49 | 0.29 | 1.63 | 0.92 | 2.87 | 1.69 | | 1.64 | 0.71 | 5.14 | 1.27 | 20.73 | 2.31 | * |
| Homeownership | 0.62 | 0.28 | 1.86 | 1.07 | 3.23 | 2.22 | * | -0.11 | 0.68 | 0.89 | 0.24 | 3.36 | -0.17 | |
| Water network, 0 HHs | | | | | | | | | | | | | | |
| 1 HH | -0.36 | 0.48 | 0.70 | 0.27 | 1.77 | -0.76 | | -1.86 | 1.31 | 0.16 | 0.01 | 2.04 | -1.42 | |
| 2+ HHs | -0.66 | 0.54 | 0.52 | 0.18 | 1.50 | -1.21 | | -1.34 | 1.39 | 0.26 | 0.02 | 4.00 | -0.96 | |
| Money network, 0 HHs | | | | | | | | | | | | | | |
| 1 HH | -0.33 | 0.45 | 0.72 | 0.30 | 1.73 | -0.73 | | 1.86 | 0.86 | 6.39 | 1.18 | 34.72 | 2.16 | * |
| 2+ HHs | -0.35 | 0.48 | 0.71 | 0.27 | 1.82 | -0.72 | | 0.43 | 0.69 | 1.53 | 0.40 | 5.93 | 0.62 | |

*Note:* Confidence intervals (95L, 95U) are for the odds ratio (OR). *p<.05 **p<.01 ***p<.001

**Table A12. DV4: Linear Regression Model Building for Perceived Cleanliness, Dry Season**

| Independent Variable | Est. | Est. | Est. | Est. | Est. | Est. |
|---|---|---|---|---|---|---|
| **Individual Factors** | | | | | | |
| Gender, female | -0.02 | 0.02 | 0.04 | 0.02 | 0.04 | 0.01 |
| Education, less than HS | | | | | | |
| HS diploma | | -0.04 | -0.05 | -0.03 | -0.02 | -0.03 |
| College graduate | | -0.11 | -0.12 | -0.09 | -0.14 | -0.14 |
| Marital status, not married | | | | | | |
| Married, lives elsewhere | | -0.23 | -0.21 | -0.21 | -0.21 | -0.19 |
| Married, lives in home | | -0.05 | -0.01 | 0.00 | -0.04 | -0.02 |
| Age | | 0.01 ** | 0.01 ** | 0.01 ** | 0.00 | 0.00 |
| Ethnicity, Cordilleran | | 0.16 | 0.17 | 0.18 | 0.07 | 0.07 |
| | | | | | | |
| **Household Factors** | | | | | | |
| HH size | | | -0.03 | -0.03 | -0.05 * | -0.05 * |
| Logged monthly income | | | | 0.09 | 0.07 | 0.07 |
| Savings, none | | | | | | |
| Informal | | | | 0.10 | 0.09 | 0.10 |
| Formal | | | | -0.16 | -0.24 * | -0.23 * |
| Logged tank/drum capacity | | | | | 0.08 * | 0.08 * |
| BWD connection, none | | | | | | |
| Shared/other way | | | | | 0.19 | 0.18 |
| Private | | | | | 0.35 ** | 0.35 ** |
| Homeownership | | | | | 0.20 | 0.20 |
| Water network, 0 HHs | | | | | | |
| 1 HH | | | | | | 0.08 |
| 2+ HHs | | | | | | 0.16 |
| Money network, 0 HHs | | | | | | |
| 1 HH | | | | | | -0.03 |
| 2+ HHs | | | | | | -0.26 |

*Note:* *p<.05 **p<.01 ***p<.001

**Table A13. DV4: Linear Regression Model Building for Perceived Cleanliness, Rainy Season**

| Independent Variable | Est. | Est. | Est. | Est. | Est. | Est. |
|---|---|---|---|---|---|---|
| **Individual Factors** | | | | | | |
| Gender, female | 0.10 | 0.18 | 0.20 | 0.17 | 0.17 | 0.16 |
| Education, less than HS | | | | | | |
| HS diploma | | -0.18 | -0.20 | -0.20 | -0.23 | -0.24 |
| College graduate | | -0.32 * | -0.34 * | -0.35 * | -0.42 ** | -0.42 ** |
| Marital status, not married | | | | | | |
| Married, lives elsewhere | | -0.14 | -0.12 | -0.13 | -0.10 | -0.08 |
| Married, lives in home | | -0.13 | -0.08 | -0.09 | -0.08 | -0.07 |
| Age | | 0.00 | 0.00 | 0.00 | -0.01 | -0.01 |
| Ethnicity, Cordilleran | | 0.27 * | 0.28 ** | 0.30 ** | 0.20 | 0.20 |
| **Household Factors** | | | | | | |
| HH size | | | -0.03 | -0.04 | -0.05 * | -0.05 * |
| Logged monthly income | | | | 0.13 * | 0.12 | 0.11 |
| Savings, none | | | | | | |
| Informal | | | | 0.38 ** | 0.36 ** | 0.37 ** |
| Formal | | | | -0.08 | -0.12 | -0.12 |
| Logged tank/drum capacity | | | | | 0.02 | 0.01 |
| BWD connection, none | | | | | | |
| Shared/other way | | | | | -0.23 | -0.24 |
| Private | | | | | 0.18 | 0.18 |
| Homeownership | | | | | 0.12 | 0.12 |
| Water network, 0 HHs | | | | | | |
| 1 HH | | | | | | 0.01 |
| 2+ HHs | | | | | | 0.10 |
| Money network, 0 HHs | | | | | | |
| 1 HH | | | | | | 0.01 |
| 2+ HHs | | | | | | -0.17 |

*Note:* *p<.05 **p<.01 ***p<.001

**Table A14. DV4: Final Linear Regression Models for Perceived Cleanliness, By Season: Supplemental Details**

| | Dry | | | | | | Rainy | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Independent Variable | Est. | SE | 95L | 95U | t | | Est. | SE | 95L | 95U | t | |
| **Individual Factors** | | | | | | | | | | | | |
| Gender, female | 0.01 | 0.11 | -0.20 | 0.23 | 0.13 | | 0.16 | 0.11 | -0.06 | 0.37 | 1.44 | |
| Education, less than HS | | | | | | | | | | | | |
| HS diploma | -0.03 | 0.13 | -0.28 | 0.23 | -0.23 | | -0.24 | 0.13 | -0.50 | 0.02 | -1.84 | |
| College graduate | -0.14 | 0.13 | -0.41 | 0.12 | -1.05 | | -0.42 | 0.14 | -0.69 | -0.14 | -2.94 | ** |
| Marital status, not married | | | | | | | | | | | | |
| Married, lives elsewhere | -0.19 | 0.16 | -0.51 | 0.13 | -1.16 | | -0.08 | 0.15 | -0.38 | 0.22 | -0.54 | |
| Married, lives in home | -0.02 | 0.11 | -0.24 | 0.20 | -0.19 | | -0.07 | 0.10 | -0.27 | 0.13 | -0.69 | |
| Age | 0.00 | 0.00 | 0.00 | 0.01 | 1.28 | | -0.01 | 0.00 | -0.01 | 0.00 | -1.36 | |
| Ethnicity, Cordilleran | 0.07 | 0.10 | -0.13 | 0.27 | 0.68 | | 0.20 | 0.11 | -0.02 | 0.42 | 1.76 | |
| **Household Factors** | | | | | | | | | | | | |
| HH size | -0.05 | 0.02 | -0.10 | 0.00 | -2.12 | * | -0.05 | 0.02 | -0.10 | 0.00 | -2.10 | * |
| Logged monthly income | 0.07 | 0.07 | -0.07 | 0.20 | 1.00 | | 0.11 | 0.07 | -0.02 | 0.24 | 1.69 | |
| Savings, none | | | | | | | | | | | | |
| Informal | 0.10 | 0.15 | -0.20 | 0.39 | 0.64 | | 0.37 | 0.14 | 0.09 | 0.64 | 2.60 | ** |
| Formal | -0.23 | 0.11 | -0.45 | -0.02 | -2.17 | * | -0.12 | 0.11 | -0.33 | 0.09 | -1.12 | |
| Logged tank/drum capacity | 0.08 | 0.03 | 0.01 | 0.14 | 2.27 | * | 0.01 | 0.04 | -0.07 | 0.09 | 0.30 | |
| BWD connection, none | | | | | | | | | | | | |
| Shared/other way | 0.18 | 0.14 | -0.09 | 0.44 | 1.28 | | -0.24 | 0.14 | -0.51 | 0.03 | -1.73 | |
| Private | 0.35 | 0.13 | 0.10 | 0.60 | 2.76 | ** | 0.18 | 0.12 | -0.05 | 0.42 | 1.50 | |
| Homeownership | 0.20 | 0.12 | -0.03 | 0.43 | 1.69 | | 0.12 | 0.11 | -0.09 | 0.33 | 1.11 | |
| Water network, 0 HHs | | | | | | | | | | | | |
| 1 HH | 0.08 | 0.16 | -0.24 | 0.40 | 0.48 | | 0.01 | 0.19 | -0.36 | 0.39 | 0.06 | |
| 2+ HHs | 0.16 | 0.19 | -0.21 | 0.54 | 0.85 | | 0.10 | 0.20 | -0.29 | 0.49 | 0.52 | |
| Money network, 0 HHs | | | | | | | | | | | | |
| 1 HH | -0.03 | 0.15 | -0.33 | 0.27 | -0.21 | | 0.01 | 0.16 | -0.31 | 0.32 | 0.05 | |
| 2+ HHs | -0.26 | 0.17 | -0.59 | 0.07 | -1.56 | | -0.17 | 0.17 | -0.50 | 0.16 | -0.99 | |

*Note:* *p<.05 **p<.01 ***p<.001

**Table A15. DV5: Logistic Regression Model Building for Perceived Ease, Dry Season**

| Independent Variable | Est. | Est. | Est. | Est. | Est. | Est. |
|---|---|---|---|---|---|---|
| **Individual Factors** | | | | | | |
| Gender, female | 0.25 | 0.25 | 0.33 | 0.33 | 0.37 | 0.30 |
| Education, less than HS | | | | | | |
| HS diploma | | -0.05 | -0.11 | -0.15 | -0.15 | -0.16 |
| College graduate | | 0.24 | 0.20 | 0.09 | 0.01 | -0.01 |
| Marital status, not married | | | | | | |
| Married, lives elsewhere | | -0.57 | -0.51 | -0.56 | -0.67 * | -0.58 |
| Married, lives in home | | -0.17 | 0.00 | 0.01 | -0.07 | -0.03 |
| Age | | 0.02 ** | 0.02 *** | 0.02 ** | 0.02 * | 0.02 * |
| Ethnicity, Cordilleran | | -0.11 | -0.08 | -0.08 | -0.15 | -0.14 |
| **Household Factors** | | | | | | |
| HH size | | | -0.12 * | -0.14 ** | -0.15 ** | -0.16 ** |
| Logged monthly income | | | | 0.20 | 0.17 | 0.12 |
| Savings, none | | | | | | |
| Informal | | | | -0.22 | -0.24 | -0.19 |
| Formal | | | | -0.01 | -0.09 | -0.08 |
| Logged tank/drum capacity | | | | | 0.13 | 0.12 |
| BWD connection, none | | | | | | |
| Shared/other way | | | | | 0.47 | 0.41 |
| Private | | | | | 0.76 ** | 0.77 ** |
| Homeownership | | | | | -0.10 | -0.07 |
| Water network, 0 HHs | | | | | | |
| 1 HH | | | | | | 0.44 |
| 2+ HHs | | | | | | 0.19 |
| Money network, 0 HHs | | | | | | |
| 1 HH | | | | | | -0.43 |
| 2+ HHs | | | | | | -0.91 * |

*Note:* *p<.05 **p<.01 ***p<.001

**Table A16. DV5: Logistic Regression Model Building for Perceived Ease, Rainy Season**

| Independent Variable | Est. | Est. | Est. | Est. | Est. | Est. |
|---|---|---|---|---|---|---|
| **Individual Factors** | | | | | | |
| Gender, female | 0.59 * | 0.67 * | 0.86 ** | 0.90 ** | 0.98 *** | 0.96 *** |
| Education, less than HS | | | | | | |
| HS diploma | | -0.75 * | -0.91 * | -1.03 ** | -1.01 * | -1.01 * |
| College graduate | | -0.62 | -0.79 * | -1.10 ** | -1.16 ** | -1.16 ** |
| Marital status, not married | | | | | | |
| Married, lives elsewhere | | -0.39 | -0.24 | -0.33 | -0.47 | -0.46 |
| Married, lives in home | | 0.04 | 0.37 | 0.39 | 0.26 | 0.26 |
| Age | | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Ethnicity, Cordilleran | | 0.26 | 0.35 | 0.39 | 0.32 | 0.32 |
| **Household Factors** | | | | | | |
| HH size | | | -0.23 *** | -0.26 *** | -0.29 *** | -0.29 *** |
| Logged monthly income | | | | 0.44 * | 0.42 | 0.42 |
| Savings, none | | | | | | |
| Informal | | | | 0.15 | 0.09 | 0.08 |
| Formal | | | | 0.08 | 0.02 | 0.05 |
| Logged tank/drum capacity | | | | | 0.02 | 0.01 |
| BWD connection, none | | | | | | |
| Shared/other way | | | | | 0.93 ** | 0.93 ** |
| Private | | | | | 1.24 *** | 1.23 *** |
| Homeownership | | | | | 0.11 | 0.11 |
| Water network, 0 HHs | | | | | | |
| 1 HH | | | | | | 0.02 |
| 2+ HHs | | | | | | -0.01 |
| Money network, 0 HHs | | | | | | |
| 1 HH | | | | | | 0.24 |
| 2+ HHs | | | | | | 0.18 |

*Note:* *p<.05 **p<.01 ***p<.001

**Table A17. DV5: Final Logistic Regression Models for Perceived Ease, By Season: Supplemental Details**

| | Dry | | | | | | | Rainy | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Independent Variable | Est. | SE | OR | 95L | 95U | t | | Est. | SE | OR | 95L | 95U | t | |
| **Individual Factors** | | | | | | | | | | | | | | |
| Gender, female | 0.30 | 0.25 | 1.34 | 0.82 | 2.20 | 1.18 | | 0.96 | 0.29 | 2.62 | 1.48 | 4.63 | 3.32 | *** |
| Education, less than HS | | | | | | | | | | | | | | |
| HS diploma | -0.16 | 0.27 | 0.85 | 0.50 | 1.44 | -0.61 | | -1.01 | 0.40 | 0.36 | 0.16 | 0.80 | -2.52 | * |
| College graduate | -0.01 | 0.31 | 0.99 | 0.54 | 1.83 | -0.03 | | -1.16 | 0.44 | 0.31 | 0.13 | 0.75 | -2.62 | ** |
| Marital status, not married | | | | | | | | | | | | | | |
| Married, lives elsewhere | -0.58 | 0.32 | 0.56 | 0.30 | 1.05 | -1.80 | | -0.46 | 0.44 | 0.63 | 0.27 | 1.48 | -1.06 | |
| Married, lives in home | -0.03 | 0.24 | 0.97 | 0.61 | 1.54 | -0.13 | | 0.26 | 0.31 | 1.30 | 0.70 | 2.40 | 0.83 | |
| Age | 0.02 | 0.01 | 1.02 | 1.00 | 1.04 | 2.26 | * | 0.01 | 0.01 | 1.01 | 0.99 | 1.03 | 0.71 | |
| Ethnicity, Cordilleran | -0.14 | 0.23 | 0.87 | 0.55 | 1.36 | -0.62 | | 0.32 | 0.29 | 1.38 | 0.78 | 2.45 | 1.10 | |
| **Household Factors** | | | | | | | | | | | | | | |
| HH size | -0.16 | 0.05 | 0.85 | 0.77 | 0.94 | -3.07 | ** | -0.29 | 0.07 | 0.75 | 0.66 | 0.86 | -4.21 | *** |
| Logged monthly income | 0.12 | 0.17 | 1.13 | 0.81 | 1.57 | 0.73 | | 0.42 | 0.23 | 1.52 | 0.97 | 2.37 | 1.85 | |
| Savings, none | | | | | | | | | | | | | | |
| Informal | -0.19 | 0.33 | 0.82 | 0.43 | 1.57 | -0.59 | | 0.08 | 0.51 | 1.08 | 0.40 | 2.92 | 0.16 | |
| Formal | -0.08 | 0.24 | 0.93 | 0.58 | 1.48 | -0.32 | | 0.05 | 0.31 | 1.05 | 0.58 | 1.92 | 0.17 | |
| Logged tank/drum capacity | 0.12 | 0.10 | 1.13 | 0.92 | 1.38 | 1.18 | | 0.01 | 0.11 | 1.01 | 0.82 | 1.26 | 0.13 | |
| BWD connection, none | | | | | | | | | | | | | | |
| Shared/other way | 0.41 | 0.27 | 1.51 | 0.90 | 2.55 | 1.55 | | 0.93 | 0.34 | 2.54 | 1.30 | 4.97 | 2.73 | ** |
| Private | 0.77 | 0.26 | 2.16 | 1.31 | 3.56 | 3.02 | ** | 1.23 | 0.33 | 3.44 | 1.82 | 6.51 | 3.79 | *** |
| Homeownership | -0.07 | 0.23 | 0.94 | 0.59 | 1.48 | -0.28 | | 0.11 | 0.31 | 1.12 | 0.61 | 2.05 | 0.37 | |
| Water network, 0 HHs | | | | | | | | | | | | | | |
| 1 HH | 0.44 | 0.35 | 1.55 | 0.78 | 3.10 | 1.25 | | 0.02 | 0.52 | 1.02 | 0.36 | 2.87 | 0.04 | |
| 2+ HHs | 0.19 | 0.41 | 1.20 | 0.54 | 2.67 | 0.46 | | -0.01 | 0.59 | 0.99 | 0.31 | 3.17 | -0.02 | |
| Money network, 0 HHs | | | | | | | | | | | | | | |
| 1 HH | -0.43 | 0.35 | 0.65 | 0.33 | 1.29 | -1.23 | | 0.24 | 0.45 | 1.27 | 0.53 | 3.06 | 0.53 | |
| 2+ HHs | -0.91 | 0.39 | 0.40 | 0.19 | 0.87 | -2.31 | * | 0.18 | 0.54 | 1.20 | 0.42 | 3.44 | 0.34 | |

*Note:* Confidence intervals (95L, 95U) are for the odds ratio (OR). *p<.05 **p<.01 ***p<.001

**Table A18. DV6: Logistic Regression Model Building for Affordability, Dry Season**

| Independent Variable | Est. | Est. | Est. | Est. | Est. | Est. |
|---|---|---|---|---|---|---|
| **Individual Factors** | | | | | | |
| Gender, female | 0.11 | 0.13 | 0.16 | 0.33 | 0.16 | 0.18 |
| Education, less than HS | | | | | | |
| HS diploma | | -0.22 | -0.24 | -0.73 | -0.58 | -0.62 |
| College graduate | | -0.16 | -0.18 | -1.39 ** | -1.04 | -1.07 |
| Marital status, not married | | | | | | |
| Married, lives elsewhere | | -0.23 | -0.20 | -0.99 * | -1.09 * | -1.13 * |
| Married, lives in home | | -0.45 | -0.38 | -0.51 | -0.41 | -0.44 |
| Age | | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 |
| Ethnicity, Cordilleran | | -0.27 | -0.26 | -0.09 | 0.09 | 0.12 |
| | | | | | | |
| **Household Factors** | | | | | | |
| HH size | | | -0.05 | -0.29 *** | -0.27 ** | -0.27 ** |
| Logged monthly income | | | | 2.80 *** | 3.03 *** | 3.03 *** |
| Savings, none | | | | | | |
| Informal | | | | 0.37 | 0.13 | 0.21 |
| Formal | | | | -0.18 | 0.01 | -0.02 |
| Logged tank/drum capacity | | | | | -0.60 * | -0.61 * |
| BWD connection, none | | | | | | |
| Shared/other way | | | | | 0.99 * | 1.00 * |
| Private | | | | | 1.01 * | 1.01 * |
| Homeownership | | | | | -0.22 | -0.26 |
| Water network, 0 HHs | | | | | | |
| 1 HH | | | | | | -0.59 |
| 2+ HHs | | | | | | -0.37 |
| Money network, 0 HHs | | | | | | |
| 1 HH | | | | | | -0.17 |
| 2+ HHs | | | | | | -0.38 |

*Note:* *p<.05 **p<.01 ***p<.001

**Table A19. DV6: Logistic Regression Model Building for Affordability, Rainy Season**

| Independent Variable | Est. | Est. | Est. | Est. | Est. | Est. |
|---|---|---|---|---|---|---|
| **Individual Factors** | | | | | | |
| Gender, female | 0.05 | 0.07 | 0.11 | 0.10 | 0.00 | 0.04 |
| Education, less than HS | | | | | | |
| HS diploma | | 0.19 | 0.16 | 0.10 | 0.14 | 0.14 |
| College graduate | | 0.35 | 0.32 | -0.80 | -0.56 | -0.55 |
| Marital status, not married | | | | | | |
| Married, lives elsewhere | | -0.09 | -0.05 | -0.69 | -0.78 | -0.79 |
| Married, lives in home | | -0.36 | -0.27 | -0.34 | -0.22 | -0.22 |
| Age | | -0.01 | -0.01 | 0.00 | 0.02 | 0.02 |
| Ethnicity, Cordilleran | | 0.00 | 0.02 | 0.41 | 0.75 | 0.72 |
| | | | | | | |
| **Household Factors** | | | | | | |
| HH size | | | -0.06 | -0.23 ** | -0.20 * | -0.20 * |
| Logged monthly income | | | | 2.78 *** | 2.90 *** | 2.95 *** |
| Savings, none | | | | | | |
| Informal | | | | 0.00 | -0.04 | -0.04 |
| Formal | | | | -0.59 | -0.35 | -0.40 |
| Logged tank/drum capacity | | | | | -0.34 | -0.33 |
| BWD connection, none | | | | | | |
| Shared/other way | | | | | 0.24 | 0.27 |
| Private | | | | | -0.41 | -0.39 |
| Homeownership | | | | | -0.56 | -0.58 |
| Water network, 0 HHs | | | | | | |
| 1 HH | | | | | | -0.08 |
| 2+ HHs | | | | | | 0.22 |
| Money network, 0 HHs | | | | | | |
| 1 HH | | | | | | -0.09 |
| 2+ HHs | | | | | | -0.01 |

*Note:* *p<.05 **p<.01 ***p<.001

**Table A20. DV6: Final Logistic Regression Models for Affordability, By Season: Supplemental Details**

| | Dry | | | | | | | Rainy | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Independent Variable | Est. | SE | OR | 95L | 95U | t | | Est. | SE | OR | 95L | 95U | t | |
| **Individual Factors** | | | | | | | | | | | | | | |
| Gender, female | 0.18 | 0.44 | 1.20 | 0.51 | 2.83 | 0.41 | | 0.04 | 0.51 | 1.05 | 0.38 | 2.86 | 0.09 | |
| Education, less than HS | | | | | | | | | | | | | | |
| HS diploma | -0.62 | 0.47 | 0.54 | 0.21 | 1.36 | -1.31 | | 0.14 | 0.50 | 1.15 | 0.43 | 3.04 | 0.28 | |
| College graduate | -1.07 | 0.57 | 0.34 | 0.11 | 1.04 | -1.89 | | -0.55 | 0.55 | 0.58 | 0.19 | 1.71 | -1.00 | |
| Marital status, not married | | | | | | | | | | | | | | |
| Married, lives elsewhere | -1.13 | 0.56 | 0.32 | 0.11 | 0.97 | -2.03 | * | -0.79 | 0.69 | 0.45 | 0.12 | 1.76 | -1.15 | |
| Married, lives in home | -0.44 | 0.40 | 0.65 | 0.29 | 1.42 | -1.09 | | -0.22 | 0.53 | 0.80 | 0.28 | 2.29 | -0.42 | |
| Age | -0.01 | 0.02 | 0.99 | 0.96 | 1.03 | -0.32 | | 0.02 | 0.01 | 1.02 | 0.99 | 1.05 | 1.21 | |
| Ethnicity, Cordilleran | 0.12 | 0.41 | 1.12 | 0.50 | 2.52 | 0.28 | | 0.72 | 0.42 | 2.06 | 0.91 | 4.66 | 1.74 | |
| **Household Factors** | | | | | | | | | | | | | | |
| HH size | -0.27 | 0.08 | 0.77 | 0.65 | 0.90 | -3.23 | ** | -0.20 | 0.09 | 0.82 | 0.68 | 0.98 | -2.18 | * |
| Logged monthly income | 3.03 | 0.45 | 20.68 | 8.58 | 49.83 | 6.76 | *** | 2.95 | 0.41 | 19.03 | 8.55 | 42.36 | 7.23 | *** |
| Savings, none | | | | | | | | | | | | | | |
| Informal | 0.21 | 0.68 | 1.23 | 0.33 | 4.64 | 0.31 | | -0.04 | 0.80 | 0.96 | 0.20 | 4.70 | -0.05 | |
| Formal | -0.02 | 0.40 | 0.98 | 0.45 | 2.13 | -0.06 | | -0.40 | 0.40 | 0.67 | 0.30 | 1.46 | -1.01 | |
| Logged tank/drum capacity | -0.61 | 0.28 | 0.54 | 0.31 | 0.95 | -2.17 | * | -0.33 | 0.19 | 0.72 | 0.50 | 1.04 | -1.74 | |
| BWD connection, none | | | | | | | | | | | | | | |
| Shared/other way | 1.00 | 0.44 | 2.71 | 1.15 | 6.37 | 2.29 | * | 0.27 | 0.54 | 1.30 | 0.45 | 3.77 | 0.49 | |
| Private | 1.01 | 0.42 | 2.76 | 1.20 | 6.34 | 2.40 | * | -0.39 | 0.49 | 0.68 | 0.25 | 1.80 | -0.79 | |
| Homeownership | -0.26 | 0.46 | 0.77 | 0.31 | 1.91 | -0.57 | | -0.58 | 0.47 | 0.56 | 0.22 | 1.41 | -1.24 | |
| Water network, 0 HHs | | | | | | | | | | | | | | |
| 1 HH | -0.59 | 0.80 | 0.55 | 0.12 | 2.64 | -0.74 | | -0.08 | 0.78 | 0.92 | 0.20 | 4.23 | -0.11 | |
| 2+ HHs | -0.37 | 0.89 | 0.69 | 0.12 | 3.96 | -0.41 | | 0.22 | 0.90 | 1.25 | 0.21 | 7.38 | 0.24 | |
| Money network, 0 HHs | | | | | | | | | | | | | | |
| 1 HH | -0.17 | 0.83 | 0.84 | 0.17 | 4.25 | -0.21 | | -0.09 | 0.87 | 0.92 | 0.17 | 5.11 | -0.10 | |
| 2+ HHs | -0.38 | 0.87 | 0.68 | 0.12 | 3.76 | -0.44 | | -0.01 | 1.01 | 0.99 | 0.14 | 7.29 | -0.01 | |

*Note:* Confidence intervals (95L, 95U) are for the odds ratio (OR). *p<.05 **p<.01 ***p<.001

**Table A21. DV6: Alternate Logistic Regression Models for Affordability, By Season: Omit Logged Monthly Income IV**

| | Dry | | | | | | | Rainy | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Independent Variable | Est. | SE | OR | 95L | 95U | t | | Est. | SE | OR | 95L | 95U | t | |
| **Individual Factors** | | | | | | | | | | | | | | |
| Gender, female | 0.17 | 0.32 | 1.19 | 0.64 | 2.21 | 0.53 | | 0.11 | 0.34 | 1.11 | 0.57 | 2.16 | 0.32 | |
| Education, less than HS | | | | | | | | | | | | | | |
| HS diploma | -0.23 | 0.34 | 0.79 | 0.41 | 1.55 | -0.68 | | 0.14 | 0.36 | 1.15 | 0.56 | 2.35 | 0.39 | |
| College graduate | -0.11 | 0.42 | 0.90 | 0.39 | 2.06 | -0.26 | | 0.38 | 0.43 | 1.46 | 0.62 | 3.41 | 0.87 | |
| Marital status, not married | | | | | | | | | | | | | | |
| Married, lives elsewhere | -0.35 | 0.44 | 0.71 | 0.30 | 1.69 | -0.78 | | -0.17 | 0.50 | 0.84 | 0.31 | 2.27 | -0.34 | |
| Married, lives in home | -0.54 | 0.32 | 0.58 | 0.31 | 1.08 | -1.71 | | -0.33 | 0.35 | 0.72 | 0.36 | 1.44 | -0.93 | |
| Age | -0.01 | 0.01 | 0.99 | 0.97 | 1.01 | -0.66 | | 0.01 | 0.01 | 1.01 | 0.98 | 1.03 | 0.43 | |
| Ethnicity, Cordilleran | -0.10 | 0.35 | 0.90 | 0.46 | 1.79 | -0.29 | | 0.26 | 0.32 | 1.30 | 0.69 | 2.42 | 0.81 | |
| **Household Factors** | | | | | | | | | | | | | | |
| HH size | -0.03 | 0.06 | 0.98 | 0.86 | 1.11 | -0.39 | | -0.04 | 0.07 | 0.96 | 0.84 | 1.11 | -0.55 | |
| Logged monthly income | | | | | | | | | | | | | | |
| Savings, none | | | | | | | | | | | | | | |
| Informal | 1.16 | 0.59 | 3.18 | 1.01 | 10.03 | 1.98 | * | 1.09 | 0.69 | 2.97 | 0.76 | 11.53 | 1.59 | |
| Formal | 0.60 | 0.28 | 1.83 | 1.06 | 3.17 | 2.16 | * | 0.43 | 0.29 | 1.53 | 0.87 | 2.69 | 1.49 | |
| Logged tank/drum capacity | -0.33 | 0.18 | 0.72 | 0.51 | 1.03 | -1.80 | | -0.08 | 0.10 | 0.92 | 0.76 | 1.13 | -0.77 | |
| BWD connection, none | | | | | | | | | | | | | | |
| Shared/other way | 0.81 | 0.39 | 2.25 | 1.05 | 4.83 | 2.08 | * | 0.28 | 0.48 | 1.32 | 0.51 | 3.43 | 0.57 | |
| Private | 0.70 | 0.32 | 2.01 | 1.07 | 3.77 | 2.19 | * | -0.15 | 0.41 | 0.86 | 0.39 | 1.92 | -0.37 | |
| Homeownership | -0.16 | 0.37 | 0.85 | 0.41 | 1.77 | -0.42 | | -0.57 | 0.37 | 0.57 | 0.27 | 1.19 | -1.51 | |
| Water network, 0 HHs | | | | | | | | | | | | | | |
| 1 HH | -1.08 | 0.56 | 0.34 | 0.11 | 1.03 | -1.92 | | -0.41 | 0.52 | 0.66 | 0.24 | 1.83 | -0.80 | |
| 2+ HHs | -1.24 | 0.64 | 0.29 | 0.08 | 1.03 | -1.93 | | -0.50 | 0.62 | 0.60 | 0.18 | 2.03 | -0.82 | |
| Money network, 0 HHs | | | | | | | | | | | | | | |
| 1 HH | 0.26 | 0.48 | 1.30 | 0.51 | 3.36 | 0.55 | | 0.30 | 0.51 | 1.35 | 0.50 | 3.67 | 0.59 | |
| 2+ HHs | 0.06 | 0.53 | 1.07 | 0.38 | 3.02 | 0.12 | | 0.32 | 0.63 | 1.37 | 0.39 | 4.86 | 0.50 | |

*Note:* Confidence intervals (95L, 95U) are for the odds ratio (OR). *p<.05 **p<.01 ***p<.001

**Table A22. DV7: Linear Regression Model Building for Multi-Dimensional Hardship, Dry Season**

| Independent Variable | Est. | Est. | Est. | Est. | Est. | Est. |
|---|---|---|---|---|---|---|
| **Individual Factors** | | | | | | |
| Gender, female | 0.09 | 0.12 | 0.07 | 0.09 | 0.08 | 0.07 |
| Education, less than HS | | | | | | |
| HS diploma | | 0.02 | 0.05 | 0.06 | 0.03 | 0.05 |
| College graduate | | -0.27 * | -0.23 | -0.17 | -0.20 | -0.19 |
| Marital status, not married | | | | | | |
| Married, lives elsewhere | | 0.02 | -0.03 | 0.01 | 0.04 | 0.04 |
| Married, lives in home | | -0.06 | -0.16 | -0.18 | -0.14 | -0.13 |
| Age | | -0.01 ** | -0.01 ** | -0.01 ** | -0.01 * | -0.01 * |
| Ethnicity, Cordilleran | | 0.12 | 0.10 | 0.09 | 0.08 | 0.08 |
| | | | | | | |
| **Household Factors** | | | | | | |
| HH size | | | 0.07 ** | 0.09 *** | 0.09 *** | 0.08 *** |
| Logged monthly income | | | | -0.24 *** | -0.24 *** | -0.20 ** |
| Savings, none | | | | | | |
| Informal | | | | 0.15 | 0.18 | 0.12 |
| Formal | | | | 0.15 | 0.16 | 0.15 |
| Logged tank/drum capacity | | | | | 0.03 | 0.02 |
| BWD connection, none | | | | | | |
| Shared/other way | | | | | -0.37 ** | -0.37 ** |
| Private | | | | | -0.33 * | -0.33 * |
| Homeownership | | | | | -0.02 | -0.03 |
| Water network, 0 HHs | | | | | | |
| 1 HH | | | | | | 0.28 * |
| 2+ HHs | | | | | | 0.29 |
| Money network, 0 HHs | | | | | | |
| 1 HH | | | | | | 0.02 |
| 2+ HHs | | | | | | 0.14 |

*Note:* *p<.05 **p<.01 ***p<.001

**Table A23. DV7: Final Linear Regression Model for Multi-Dimensional Hardship, Dry Season: Supplemental Details**

| Independent Variable | Est. | SE | 95L | 95U | t | |
|---|---|---|---|---|---|---|
| **Individual Factors** | | | | | | |
| Gender, female | 0.07 | 0.11 | -0.14 | 0.28 | 0.64 | |
| Education, less than HS | | | | | | |
| HS diploma | 0.05 | 0.12 | -0.18 | 0.28 | 0.40 | |
| College graduate | -0.19 | 0.13 | -0.45 | 0.07 | -1.43 | |
| Marital status, not married | | | | | | |
| Married, lives elsewhere | 0.04 | 0.14 | -0.24 | 0.31 | 0.27 | |
| Married, lives in home | -0.13 | 0.11 | -0.35 | 0.08 | -1.21 | |
| Age | -0.01 | 0.00 | -0.02 | 0.00 | -2.38 | * |
| Ethnicity, Cordilleran | 0.08 | 0.10 | -0.12 | 0.28 | 0.81 | |
| | | | | | | |
| **Household Factors** | | | | | | |
| HH size | 0.08 | 0.02 | 0.03 | 0.13 | 3.38 | *** |
| Logged monthly income | -0.20 | 0.07 | -0.34 | -0.06 | -2.82 | ** |
| Savings, none | | | | | | |
| Informal | 0.12 | 0.17 | -0.21 | 0.44 | 0.71 | |
| Formal | 0.15 | 0.10 | -0.05 | 0.35 | 1.43 | |
| Logged tank/drum capacity | 0.02 | 0.04 | -0.06 | 0.11 | 0.60 | |
| BWD connection, none | | | | | | |
| Shared/other way | -0.37 | 0.12 | -0.62 | -0.13 | -3.00 | ** |
| Private | -0.33 | 0.13 | -0.58 | -0.07 | -2.48 | * |
| Homeownership | -0.03 | 0.12 | -0.25 | 0.20 | -0.24 | |
| Water network, 0 HHs | | | | | | |
| 1 HH | 0.28 | 0.13 | 0.02 | 0.54 | 2.08 | * |
| 2+ HHs | 0.29 | 0.20 | -0.09 | 0.68 | 1.49 | |
| Money network, 0 HHs | | | | | | |
| 1 HH | 0.02 | 0.15 | -0.27 | 0.31 | 0.16 | |
| 2+ HHs | 0.14 | 0.20 | -0.25 | 0.54 | 0.71 | |

*Note:* *p<.05 **p<.01 ***p<.001

## Appendix B. Household Survey Instrument

# Gender, Resources, and Seasonal Water Insecurity in Urban Philippines

## Household Survey

Lisa Reyes Mason
Center for Social Development
George Warren Brown School of Social Work
Washington University in St. Louis

**Contact Log**

Household ID Number: _____

Purok Number: _____

Interviewer's Name: _____

Date of 1st contact: _____ Time of 1st contact: _____

Survey completed? ___ Yes ___ No

If not completed, why not? _____

Day/time/how to recontact: _____

Date of 2nd contact: _____ Time of 2nd contact: _____

Survey completed? ___ Yes ___ No

If not completed, why not? _____

Day/time/how to recontact: _____

Date of 3rd contact: _____ Time of 3rd contact: _____

Survey completed? ___ Yes ___ No

If not completed, why not? _____

Day/time/how to recontact: _____

Date of 4th contact: _____ Time of 4th contact: _____

Survey completed? ___ Yes ___ No

If not completed, why not? _____

Day/time/how to recontact: _____

Date of 5th contact: _____ Time of 5th contact: _____

Survey completed? ___ Yes ___ No

If not completed, why not? _____

Day/time/how to recontact: _____

**IF SURVEY NOT COMPLETED AFTER 5TH CONTACT,**
**COMPLETE ITEMS H29 AND H30 ON PAGES 30-31**
**BASED ON OBSERVATION OF HOME EXTERIOR.**

**A. Introduction and Consent**

***Hello. My name is _____. I'm with a research team from Washington University in St. Louis. We are conducting a survey about the water situation in Pinget. We would like to speak with the person who is most responsible for managing water in your household. This person, for example, makes sure your household has enough water for drinking, cooking, and cleaning every day. In your household, who is that person?***

A1. Name of household water manager (i.e., RESPONDENT):

A1a. First Name: _____

A1b. Last Name: _____

**IF SAME PERSON, READ CONSENT SCRIPT BELOW. IF DIFFERENT PERSON, ASK:**

***May I please speak with* [FILL RESPONDENT NAME]*?***

**IF NOT AVAILABLE, ASK WHEN TO RETURN. FILL CONTACT LOG ON PAGE 1.**

**IF AVAILABLE, READ CONSENT SCRIPT:**

***Thank you for speaking with me. This survey is about your household's water situation, in the rainy and dry seasons. I would like you to know that any information you provide will be confidential. You are free to skip any questions that you do not want to answer, and are free to discontinue the survey at any time. The survey will last about 45 minutes. You will also receive a small incentive for participating in the survey. Do you have any questions? Do you agree to participate in this survey?***

A2. RESPONDENT agreement to participate:

1 Yes…**THANK RESPONDENT AND GO TO NEXT PAGE.**

2 No, not at this time…**ASK BEST DAY/TIME TO RETURN, FILL CONTACT LOG.**

3 No, refuse to participate…**COMPLETE ITEMS H29 AND H30 ON PAGES 30-31.**

**RECORD INTERVIEW START TIME: _____ A.M. / P.M.**

**B. Demographic Information**

B1. **RECORD GENDER AS OBSERVED**

0 Male
1 Female

***I'd like to begin by asking you a few questions about yourself.***

B2. How old are you?

Age in years: _____

B3. Since what year have you lived in this house?

Year: _____

B4. Since what year have you lived in Pinget?

Year: _____

B5. And since what year have you lived in Baguio City?

Year: _____

B6. What is your place of origin?

Province: _____

B7. To what group do you belong, if any? For example, are you a Kankana-ey, Kalinga, Pangasinense, Ilocano, Ifugao, or something else?

1 Ilocano
2 Ifugao
3 Kalinga
4 Kankana-ey
5 Pangasinense
6 Tagalog
7 More than one group **(SPECIFY)**: _____
8 Other **(SPECIFY)**: _____
9 Do not belong to a group

B8. How much schooling did you complete?

Verbatim Response: _____

0 None
1 Some elementary
2 Elementary graduate
3 Some high school
4 High school graduate
5 Some postsecondary, not college
6 Postsecondary graduate, not college
7 Some college
8 College graduate
9 Some post-baccalaureate (e.g., toward Master's, MD, Law, PhD)
10 Post-baccalaureate graduate (e.g., completed Master's, MD, Law, PhD)

B9. What is your current marital status?

1 Single, never married
2 Married
3 Divorced
4 Widowed
5 Separated
6 Other **(SPECIFY)**: _____

**IF MARRIED, ASK B10. OTHERWISE, SKIP TO B12.**

B10. Does your spouse usually live with you or live elsewhere?

1 Usually lives with me
2 Usually lives elsewhere
99 Not applicable

B11. How much schooling did your spouse complete?

Verbatim Response: _____

0 None
1 Some elementary
2 Elementary graduate
3 Some high school
4 High school graduate
5 Some postsecondary, not college
6 Postsecondary graduate, not college
7 Some college
8 College graduate
9 Some post-baccalaureate (e.g., toward Master's, MD, Law, PhD)
10 Post-baccalaureate graduate (e.g., completed Master's, MD, Law, PhD)
99 Not applicable

***Thank you. Now, please think about all the people who usually live in your household. That is, people who usually sleep and eat here most days of the week.***

B12. Please tell me the first names of those people, their year of birth, and how they are related to you.

| ID | First Name | Year of Birth | Relationship to Respondent |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |

B13. Are there any other people such as small children, infants, friends, or domestic helpers whom we have not listed, who usually sleep and eat here most days of the week?

0 No…**SKIP TO SECTION D**

1 Yes

B14. Please tell me the first names of those people, their year of birth, and how they are related to you.

| ID | First Name | Year of Birth | Relationship to Respondent |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |

**SECTION C OMITTED FROM HOUSEHOLD SURVEY**

**D. Household Water Storage**

***I'd now like to ask about some things your household may use to store water at any point during the year.***

D1. Does your household have any water tanks?

0 No…**SKIP TO D5**

1 Yes

D2. How many water tanks does your household have?

Number of tanks: _____

99 Not applicable

D3. How much water can each tank hold when it is full?

**PROBE TO HELP CALCULATE EXACT VOLUME. FOR EXAMPLE, IF RESPONDENT SAYS, "15 DRUMS," FIND OUT WHAT SIZE DRUM THE RESPONDENT MEANS (E.G., STANDARD DRUMS HOLD 55-GALLONS)**

**IN THE TABLE BELOW, FILL IN ONE ROW FOR EACH TANK.**

| Tank # | Notes/Details to Help With Calculation | Volume Tank Holds When Full (Specify: cubic meters, gallons, liters) |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |

9999 Not applicable

D4. Who owns this/these tank(s)?

1 Respondent's household
2 Relative
3 Neighbor
4 Employer
5 Other **(SPECIFY)**: _____
99 Not applicable

D5. Does your household have any drums, which are used to store water?

0 No…**SKIP TO D9**
1 Yes

D6. How many drums does your household have?

Number of drums: _____
99 Not applicable

D7. How much water can <u>each drum</u> hold when it is full?

**PROBE FOR EXACT VOLUME. IF RESPONDENT IS UNSURE, FIND OUT IF DRUMS ARE "STANDARD" SIZE (55-GALLON) OR SOME OTHER SIZE.**

**IN THE TABLE BELOW, FILL IN ONE ROW FOR EACH DRUM.**

| Drum # | Notes/Details to Help With Calculation | Volume Drum Holds When Full (<u>Specify</u>: cubic meters, gallons, liters) |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |

9999 Not applicable

D8. Who owns this/these drum(s)?

1 Respondent's household
2 Relative
3 Neighbor
4 Employer
5 Other **(SPECIFY)**:_____
99 Not applicable

D9. Does your household have buckets or any other item, which are used primarily to store water?

0 No…**SKIP TO D11**
1 Yes

D10. Please describe those other items.

| Item | Volume Item Holds When Full (Specify: cubic meters, gallons, liters) | Owner of Item |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

99 Not applicable

D11. Does your household have its own private connection to the Baguio Water District?

0 No
1 Yes…**SKIP TO D13**

D12. Does your household get water from the Baguio Water District in some other way?

0 No
1 Yes **(SPECIFY HOW: _____)**
99 Not applicable

D13. Does your household have its own private deep well?

0 No
1 Yes

**E. Water Security in the Dry Season**

***Now, I'd like to ask about your household's water situation during the dry season or "summer." First, I'll ask about a typical week during the dry season. Please take a moment to think about a typical dry season week for your household.***

E1. During a typical dry season week, on how many days does it rain?

Days: _____ (0 to 7)
**IF DAYS = 0, SKIP TO E3**

E2. On those days, about how many hours does it rain per day?

Hours per day: _____ (0 to 24)
99 Not applicable

E3. During a typical dry season week, does your household use water from the Baguio Water District?

0 No…**SKIP TO E9**
1 Yes

E4. What does your household use Water District water for, during a typical dry season week?

**CHECK ALL THAT APPLY. ASK ABOUT EACH SPECIFIC USE IF RESPONDENT SAYS "EVERYTHING" OR SOMETHING SIMILAR.**

| | | | |
|---|---|---|---|
| ____ | Drinking | ____ | Laundry |
| ____ | Cooking | ____ | Flushing the C.R. |
| ____ | Washing hands/face | ____ | Other household cleaning (wash floors/walls, etc.) |
| ____ | Bathing | ____ | Other use: _____ |
| ____ | Washing dishes | | |
| 99 | Not applicable | | |

E5. During the dry season, about how much water does your household consume each month from the Water District?

**SPECIFY UNITS AS PRECISELY AS POSSIBLE. FOR EXAMPLE, IF RESPONDENT SAYS, "HALF A TANK" REFER TO TABLE ON PAGE 7 TO CALCULATE AND CONFIRM HOW MANY CUBIC METERS (OR GALLONS) ARE IN "HALF A TANK."**

**IF RESPONDENT UNSURE, ASK HOW MANY CUBIC METERS ARE ON THE HOUSEHOLD WATER BILL DURING A TYPICAL DRY SEASON MONTH.**

**IF RESPONDENT IS STILL UNSURE, CHECK HERE __ AND ASK IF RESPONDENT THINKS HOUSEHOLD CONSUMES MORE OR LESS THAN THE "MINIMUM" CHARGE OF 10 CUBIC METERS PER MONTH.**

Total Volume **(SPECIFY UNITS):** _____

99 Not applicable

E6. During the dry season, about how much is your Water District bill each month?

**IF RESPONDENT DOES NOT RECEIVE A BILL (E.G., PAYS A NEIGHBOR FOR THE WATER), CHECK HERE _____ AND ASK HOW MUCH RESPONDENT SPENDS ON THIS WATER DURING A TYPICAL DRY SEASON <u>MONTH</u>)**

Amount in Pesos: _____

99 Not applicable

E7. During a typical dry season week, on how many days does your household receive water from the Water District?

Days: _____ (1 to 7)

99 Not applicable

E8. On those days, how many hours per day is water supplied?

Hours per day: _____ (0 to 24)

99 Not applicable

E9. During a typical dry season week, does your household use delivery water (i.e., water from a tanker truck)?

0 No…**SKIP TO E15**

1 Yes

E10. Does your household usually...

1 Order a delivery on its own,

2 Order a delivery with one or more other households, or

3 Get delivery water in some other way **(SPECIFY)**?: _____

99 Not applicable

E11. What does your household use this delivery water for, during a typical dry season week?

**CHECK ALL THAT APPLY. ASK ABOUT EACH SPECIFIC USE IF RESPONDENT SAYS "EVERYTHING" OR SOMETHING SIMILAR.**

| | | | |
|---|---|---|---|
| ____ | Drinking | ____ | Laundry |
| ____ | Cooking | ____ | Flushing the C.R. |
| ____ | Washing hands/face | ____ | Other household cleaning (wash floors/walls, etc.) |
| ____ | Bathing | ____ | Other use: _____ |
| ____ | Washing dishes | | |
| 99 | Not applicable | | |

E12. About how much delivery water does your household use during a typical dry season week?

**SPECIFY UNITS AS PRECISELY AS POSSIBLE. FOR EXAMPLE, IF RESPONDENT SAYS, "TWO DRUMS" REFER TO TABLE ON PAGE 8 TO CALCULATE AND CONFIRM HOW MANY GALLONS ARE IN "TWO DRUMS."**

Total Volume **(SPECIFY UNITS):** _____

99 Not applicable

E13. How much does this amount of water cost your household?

Cost (PhP): _____

99 Not applicable

E14. During a typical dry season week, how long does it take for water to arrive once you have ordered it?

Number of Hours and/or Days: _____

99 Not applicable

E15. During a typical dry season week, does your household use mineral water?

0 No…**SKIP TO E19**

1 Yes

E16. What does your household use mineral water for, during a typical dry season week?

**CHECK ALL THAT APPLY. ASK ABOUT EACH SPECIFIC USE IF RESPONDENT SAYS "EVERYTHING" OR SOMETHING SIMILAR.**

| | | | |
|---|---|---|---|
| ____ | Drinking | ____ | Laundry |
| ____ | Cooking | ____ | Flushing the C.R. |
| ____ | Washing hands/face | ____ | Other household cleaning (wash floors/walls, etc.) |
| ____ | Bathing | ____ | Other use: _____ |
| ____ | Washing dishes | | |
| 99 | Not applicable | | |

E17. How much mineral water does your household use during a typical dry season week?

**SPECIFY UNITS AS PRECISELY AS POSSIBLE. FOR EXAMPLE, IF RESPONDENT SAYS, "5 JUGS" FIND OUT IF 1 JUG IS THE STANDARD 5-GALLON SIZE OR SOME OTHER SIZE, AND WHETHER ENTIRE JUG WAS CONSUMED OR PARTIAL JUG. ETC.**

Total Volume **(SPECIFY UNITS)**:_____

99 Not applicable

E18. How much does your household pay per 5-gallons of mineral water?

Cost (PhP): _____

99 Not applicable

E19. During a typical dry season week, does your household use water from a spring?

0 No…**SKIP TO E26**

1 Yes

E20. Where is this spring located?

Location: _____

99 Not applicable

E21. Is the spring protected or unprotected?

1 Protected
2 Unprotected
99 Not applicable

E22. What does your household use water from the spring for, during a typical dry season week?

**CHECK ALL THAT APPLY. ASK ABOUT EACH SPECIFIC USE IF RESPONDENT SAYS "EVERYTHING" OR SOMETHING SIMILAR.**

____ Drinking
____ Cooking
____ Washing hands/face
____ Bathing
____ Washing dishes
____ Laundry
____ Flushing the C.R.
____ Other household cleaning (wash floors/walls, etc.)
____ Other use: _____
99 Not applicable

E23. About how much water does your household pitch from the spring (carry from the spring back to your home) during a typical dry season week?

**SPECIFY UNITS AS PRECISELY AS POSSIBLE. FOR EXAMPLE, IF RESPONDENT SAYS, "10 BUCKETS" PROBE FOR HOW MANY GALLONS EACH BUCKET HOLDS, SO TOTAL VOLUME CAN BE CALCULATED AND LISTED IN THE SPACE BELOW.**

Total Volume **(SPECIFY UNITS)**:_____
99 Not applicable

E23A. About how much water does your household use at the spring during a typical dry season week?

**ASSIST THE RESPONDENT AS NEEDED TO ESTIMATE VOLUME OF WATER USED AT THE SPRING. FOR EXAMPLE, IF RESPONDENT WASHES LAUNDRY AT THE SPRING ONCE PER WEEK, PROBE TO HELP ESTIMATE HOW MANY BUCKETS (AT WHAT TOTAL VOLUME) ARE USED FOR LAUNDRY. DO SIMILAR PROBING FOR ACTIVITIES SUCH AS BATHING, WASHING DISHES, ETC. THAT MAY BE DONE AT THE SPRING ITSELF.**

Total Volume **(SPECIFY UNITS)**:_____

99 Not applicable

E24. Please complete this sentence by choosing a number on the scale to represent your answer.

During a typical dry season week, the spring has…

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| No water at all | | | | | | | | | | Abundant water |
| Awan pulos ti danum na | | | | | | | | | | Nabuslon ti danum |
| Walang tubig | | | | | | | | | | Masagana ang tubig |

99 Not applicable

E25. How many minutes does it take to walk from your house to the spring?

Minutes: _____

99 Not applicable

E26. During a typical dry season week, does your household use rainwater?

0 No…**SKIP TO E29**

1 Yes

E27. What does your household use rainwater for, during a typical dry season week?

**CHECK ALL THAT APPLY. ASK ABOUT EACH SPECIFIC USE IF RESPONDENT SAYS "EVERYTHING" OR SOMETHING SIMILAR.**

| | | | |
|---|---|---|---|
| ____ | Drinking | ____ | Laundry |
| ____ | Cooking | ____ | Flushing the C.R. |
| ____ | Washing hands/face | ____ | Other household cleaning (wash floors/walls, etc.) |
| ____ | Bathing | ____ | Other use: _____ |
| ____ | Washing dishes | | |
| 99 | Not applicable | | |

E28. About how much rainwater does your household use during a typical dry season week?

**SPECIFY UNITS AS PRECISELY AS POSSIBLE. FOR EXAMPLE, IF RESPONDENT SAYS, "TWO DRUMS" REFER TO TABLE ON PAGE 8 AND CONFIRM HOW MANY GALLONS EACH DRUM HOLDS, ETC.**

Total Volume **(SPECIFY UNITS)**: _____

99 Not applicable

E29. During a typical dry season week, does your household collect used water from activities like washing dishes, bathing, or doing the laundry, and later recycle it for other household use?

0 No…**SKIP TO E33**

1 Yes

E30. From which activities does your household collect used water, during a typical dry season week?

**CHECK ALL THAT APPLY**

| | | | |
|---|---|---|---|
| ____ | Cooking | ____ | Laundry |
| ____ | Washing hands/face | ____ | Other household cleaning (wash floors/walls, etc.) |
| ____ | Bathing | ____ | Other activity: _____ |
| ____ | Washing dishes | | |
| 99 | Not applicable | | |

E31. What does your household use this recycled water for, during a typical dry season week?

**CHECK ALL THAT APPLY**

| | | | |
|---|---|---|---|
| ____ | Drinking | ____ | Laundry |
| ____ | Cooking | ____ | Flushing the C.R. |
| ____ | Washing hands/face | ____ | Other household cleaning (wash floors/walls, etc.) |
| ____ | Bathing | ____ | Watering plants |
| ____ | Washing dishes | ____ | Other use: _____ |
| 99 | Not applicable | | |

E32. About how much recycled water does your household use during a typical dry season week?

**SPECIFY UNITS AS PRECISELY AS POSSIBLE. FOR EXAMPLE, IF RESPONDENT SAYS, "5 BUCKETS" PROBE FOR HOW MANY GALLONS OR LITERS THESE BUCKETS HOLD.**

Total Volume **(SPECIFY UNITS)**: _____

99 Not applicable

E33. During a typical dry season week, does your household use water from any other source, such as a private deep well, a community deep well, a creek, or any other source that we have not yet talked about?

0 No…**SKIP TO E35**

1 Yes **(SPECIFY SOURCES):** _____

E34. Please tell me about those sources:

E34A. Source: _____

Household Uses: _____

Total Volume **(SPECIFY UNITS AND IF WEEKLY/MONTHLY):** _____

Cost of Water **(SPECIFY IF WEEKLY/MONTHLY):** _____

Availability of Water (**E.G., EVERYDAY? ALL DAY?):** _____

Other details: _____

E34B. Source: _____

Household Uses: _____

Total Volume **(SPECIFY UNITS AND IF WEEKLY/MONTHLY):** _____

Cost of Water **(SPECIFY IF WEEKLY/MONTHLY):** _____

Availability of Water (**E.G., EVERYDAY? ALL DAY?):** _____

Other details: _____

E35. Now, thinking about all the water your household uses during a typical dry season week, does your household: *(USDA Food Sufficiency single item, modified)*

1 Always have enough water,
2 Sometimes not have enough water, or
3 Often not have enough water for household needs?

*Ilocano:*

1 Kanayon nga adda usto nga danum,
2 No maminsan ket kurang ti danum, wenno
3 Kanayon nga kurang ti danum nga maususar idiay balay yo?

*Tagalog:*

1 Laging may katamtamang tubig,
2 Paminsan minsan ay kulang ang tubig, o
3 Kadalasang kinukulang ang tubig para sa pangangailangan ng sambahayan?

E36. Please complete this sentence by choosing a number on the scale to represent your answer.

Overall, the water that my household uses during a typical dry season week is…

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Not clean at all | | | | | | | | | | Completely clean |
| Saan pulos nga nadalus | | | | | | | | | | Nadalus la unay |
| Hindi malinis | | | | | | | | | | Lubos na malinis |

E37. During a typical dry season week, how easy is it for your household to get the water it needs?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Not easy at all | | | | | | | | | | Extremely easy |
| Saan pulos nga nalaka | | | | | | | | | | Nalaka la unay |
| Hindi madali | | | | | | | | | | Napakadali |

E38. During a typical dry season week, does your household ever have to choose between spending money on water instead of on food?

0 No…**SKIP TO E40**
1 Yes

E39. About how many times during a typical dry season week does your household have to choose between spending money on water instead of on food?

Number of times: _____
99 Not applicable

***Now, I have some questions which water you use for specific purposes.***

E40. During a typical dry season week, what is your household's main source of water for…

E41. Drinking? _____
E42. Cooking? _____
E43. Bathing? _____
E44. Washing dishes? _____
E45. Laundry? _____
E46. Washing floors/walls? _____
E47. Flushing the C.R.? _____

E48. During a typical dry season week, are there any times that your household does not have enough water for…

| | | | | If Yes, on how many days does this happen per week? |
|---|---|---|---|---|
| E49. | Drinking? | 0 No | 1 Yes | _____ |
| E50. | Cooking? | 0 No | 1 Yes | _____ |
| E51. | Bathing? | 0 No | 1 Yes | _____ |
| E52. | Washing dishes? | 0 No | 1 Yes | _____ |
| E53. | Doing laundry? | 0 No | 1 Yes | _____ |
| E54. | Washing floors/walls? | 0 No | 1 Yes | _____ |
| E55. | Flushing the C.R.? | 0 No | 1 Yes | _____ |

E56. During a typical dry season week, how would you describe how clean your water is for each specific purpose? Please use the scale below:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Not clean at all | | | | | | | | | | Completely clean |
| Saan pulos nga nadalus | | | | | | | | | | Nadalus la unay |
| Hindi malinis | | | | | | | | | | Lubos na malinis |

| | | |
|---|---|---|
| E57. | Drinking? | _____ |
| E58. | Cooking? | _____ |
| E59. | Bathing? | _____ |
| E60. | Washing dishes? | _____ |
| E61. | Doing laundry? | _____ |
| E62. | Washing floors/walls? | _____ |
| E63. | Flushing the C.R.? | _____ |

**SECTION F OMITTED FROM HOUSEHOLD SURVEY**

**G. Other Household Resources**

***Next, I have a few questions about borrowing water, or money for water, from other households.***

G1. Have you ever borrowed water from another household?

0 No…**SKIP TO G5**

1 Yes

G2. How many different households have you borrowed water from in the past?

Number of different households: _____

99 Not applicable

G3. When you borrowed water in the past, about how much water did you borrow at a time?

Volume **(SPECIFY UNITS)**: _____

99 Not applicable

G4. When was the last time that your household borrowed water from another household?

Month and Year: _____

99 Not applicable

G5. If you ever needed to borrow water in the future, how many different households could you ask to borrow water from?

Number of different households: _____

G6. Have you ever borrowed money from another household to pay for water?

0 No…**SKIP TO G10**

1 Yes

G7. How many different households have you borrowed money from to pay for water in the past?

Number of different households: _____

99 Not applicable

G8. When you borrowed money in the past to pay for water, about how much did you borrow at a time?

Amount (PhP): _____

99 Not applicable

G9. When was the last time that your household borrowed money from another household, to pay for water?

Month and Year: _____

99 Not applicable

G10. If you ever needed to borrow money to pay for water in the future, how many different households could you ask to borrow money from?

Number of different households: _____

**H. Household Socioeconomic Status**

***Now, I would like to ask some questions about your household income, and items that your household may have or own. Please remember that all of your responses are confidential and are asked solely for the purpose of this study.***

H1. Overall, what is your total household income each month, from all sources?

| | |
|---|---|
| 1 | 0 – 5,000 PhP |
| 2 | 5,001 – 10,000 PhP |
| 3 | 10,001 – 15,000 PhP |
| 4 | 15,001 – 20,000 PhP |
| 5 | 20,001 – 30,000 PhP |
| 6 | 30,001 – 40,000 PhP |
| 7 | More than 40,000 PhP |

H2. Does anyone in your household earn or receive income from:

| Item | Income Source | Response | If Yes, Who Earns/Receives, and How Much per Week or Month? | Does this Amount Change between the Rainy and Dry Seasons?<br><br>If Yes, Describe How Much Earned/Received in Each Season, per Week or Month. |
|---|---|---|---|---|
| H3. | A salaried job? | 0 No<br>1 Yes | If Yes, Who:<br>_____<br>Amount per Week/Month:<br>_____ | 0 Does not vary by season<br>1 Varies by season<br>If Varies, by How Much?<br>_____ |
| H4. | A small business? | 0 No<br>1 Yes | If Yes, Who:<br>_____<br>Amount per Week/Month:<br>_____ | 0 Does not vary by season<br>1 Varies by season<br>If Varies, by How Much?<br>_____ |
| H5. | An OFW, or someone in another part of the country? | 0 No<br>1 Yes | If Yes, Who:<br>_____<br>Amount per Week/Month:<br>_____ | 0 Does not vary by season<br>1 Varies by season<br>If Varies, by How Much?<br>_____ |
| H6. | Manual labor or construction? | 0 No<br>1 Yes | If Yes, Who:<br>_____<br>Amount per Week/Month:<br>_____ | 0 Does not vary by season<br>1 Varies by season<br>If Varies, by How Much?<br>_____ |
| H7. | Selling goods (door-to-door, market)? | 0 No<br>1 Yes | If Yes, Who:<br>_____<br>Amount per Week/Month:<br>_____ | 0 Does not vary by season<br>1 Varies by season<br>If Varies, by How Much?<br>_____ |
| H8. | Any other source?<br>**SPECIFY:**<br>_____ | 0 No<br>1 Yes | If Yes, Who:<br>_____<br>Amount per Week/Month:<br>_____ | 0 Does not vary by season<br>1 Varies by season<br>If Varies, by How Much?<br>_____ |

H9. Does your household or anyone in your household have/own: *(PNDHS 2008)*

H10. Electricity?

1 Yes 0 No

H11. A radio/radio cassette?

1 Yes 0 No

H12. A television?

1 Yes 0 No

H13. A landline telephone?

1 Yes 0 No

H14. A cellular phone?

1 Yes 0 No

H15. A personal computer or laptop?

1 Yes 0 No

H16. A washing machine?

1 Yes 0 No

H17. A refrigerator or freezer?

1 Yes 0 No

H18. A CD or VCD or DVD player?

1 Yes 0 No

H19. A component or karaoke?

1 Yes 0 No

H20. Does your household or anyone in your household have savings set aside in a bank account?

0 No…**SKIP TO H22**

1 Yes

H21. About how much does your household or anyone in your household have saved in bank accounts?

Amount (PhP): _____

99999 Not applicable

H22. Does your household or anyone in your household have savings kept at home?

0 No…**SKIP TO H24**

1 Yes

H23. About how much in savings does your household or anyone in your household have kept at home?

Amount (PhP): _____

99999 Not applicable

H24. Does your household or anyone in your household have savings kept in some other way?

0 No…**SKIP TO H27**

1 Yes

H25. In what way are those other savings kept?

Describe: _____

99 Not applicable

H26. About how much in other savings does your household or anyone in your household have?

Amount (PhP): _____

99999 Not applicable

H27. What type of fuel does your household mainly use for cooking? *(PNDHS 2008)*

1 Electricity
2 Liquid petroleum gas (LPG)
3 Natural gas
4 Biogas
5 Kerosene
6 Coal, lignite
7 Charcoal
8 Wood
9 Straw/shrubs/grass
10 Agricultural crop/biomass (sawdust, hull, etc.)
11 Animal dung
12 No food cooked in household
13 Other **(SPECIFY)**: _____

H28. What is the main material of the floor in your home? *(PNDHS 2008 slightly modified)*

Natural floor
1 Earth/sand

Rudimentary floor
2 Wood planks
3 Palm/bamboo

**RESPONSE OPTIONS CONTINUED ON NEXT PAGE**

Finished floor
4 Parquet or polished wood
5 Vinyl, linoleum
6 Ceramic tiles
7 Cement
8 Carpet
9 Marble
10 Other **(SPECIFY)**: _____

H29. What is the main material of the roof in your home? *(PNDHS 2008 slightly modified)*

Natural roofing

1 No roof

2 Thatch/palm leaf (nipa)

3 Sod/grass (cogon)

Rudimentary roofing

4 Rustic mat

5 Palm/bamboo

6 Wood planks

7 Makeshift/cardboard

Finished roofing

8 Galvanized iron/aluminum

9 Finished wood

10 Calamine/cement fiber

11 Ceramic tiles

12 Cement

13 Roofing shingles

14 Other **(SPECIFY)**: _____

H30. What is the main material of your home's exterior walls? *(PNDHS 2008 slightly modified)*

Natural walls

1 Cane/palm/trunks

2 Dirt

Rudimentary walls

3 Bamboo

4 Stone with mud

5 Uncovered adobe

6 Plywood

7 Makeshift/cardboard/reused material

Finished walls

8 Cement

9 Stone with lime/cement bricks

10 Cement blocks

11 Covered adobe

12 Wood planks/shingles

13 Galvanized iron/aluminum

14 Other **(SPECIFY)**: _____

H31. What is the status of your home?

1 Owned/being amortized by respondent's household

2 Rented by respondent's household…**SKIP TO H33**

3 Rent-free with owner consent…**SKIP TO H33**

4 Rent-free without owner consent…**SKIP TO H33**

H32. What is the status of your title?

1 Awarded
2 Applied, not yet awarded
3 Not yet applied, will apply in the future
4 Not yet applied, do not plan to apply in the future
5 Other **(SPECIFY):** _____

H33. How many rooms in this household are used for sleeping? *(PNDHS 2008)*

Number of rooms: _____

H34. What kind of toilet facility do members of your household usually use? *(PNDHS 2008)*

**IF FLUSH OR POUR FLUSH TOILET**

**PROBE:** ***Do you have a septic tank?***

**IF YES, PROBE:** ***Does your septic tank have concrete lining, that is, walls and flooring?***

**IF NO, PROBE:** ***Where does your wastewater flow?***

1 Flush or pour flush toilet, to piped sewer system
2 Flush or pour flush toilet, to septic tank
3 Flush or pour flush toilet, to pit latrine
4 Flush or pour flush toilet, to somewhere else
5 Flush, don't know to where
6 Pit latrine, ventilated improved
7 Pit latrine, with slab
8 Pit latrine, without slab/open pit
9 Composting toilet
10 Bucket toilet
11 Drop/hanging toilet
12 No facility/bush/field/river
13 Other **(SPECIFY)**: _____

H35. Does your household or anyone in your household own: *(PNDHS 2008, slightly modified)*

H36. A bicycle or trisikad?

1 Yes 0 No

H37. A motorcycle or tricycle?

1 Yes 0 No

H38. An animal-drawn cart?

1 Yes 0 No

H39. A car or jeep or van?

1 Yes 0 No

H40. A tractor?

1 Yes 0 No

H41. A boat or banca with motor?

1 Yes 0 No

H42. Does your household rent rooms to boarders?

0 No…**SKIP TO SECTION J**

1 Yes

H43. How many boarders do you usually have (i.e., how many different tenants)?

Number: _____

99 Not applicable

**SECTION I OMITTED FROM HOUSEHOLD SURVEY**

**CONTINUE ON NEXT PAGE WITH SECTION J**

**J. Water Security in the Rainy Season**

***This final section asks about your household's water situation during the rainy season. Many of these questions will be just like those I asked a few minutes ago about the dry season, except that I will ask you to think about a typical rainy season week instead. Please take a moment to think about a typical rainy season week for your household.***

J1. During a typical rainy season week, on how many days does it rain?

Days: _____ (1 to 7)

J2. On those days, about how many hours does it rain per day?

Hours per day: _____ (0 to 24)

J3. During a typical rainy season week, does your household use water from the Baguio Water District?

0 No…**SKIP TO J9**
1 Yes

J4. What does your household use Water District water for, during a typical rainy season week?

**CHECK ALL THAT APPLY. ASK ABOUT EACH SPECIFIC USE IF RESPONDENT SAYS "EVERYTHING" OR SOMETHING SIMILAR.**

| | | | |
|---|---|---|---|
| ____ | Drinking | ____ | Laundry |
| ____ | Cooking | ____ | Flushing the C.R. |
| ____ | Washing hands/face | ____ | Other household cleaning (wash floors/walls, etc.) |
| ____ | Bathing | ____ | Other use: _____ |
| ____ | Washing dishes | | |
| 99 | Not applicable | | |

J5. During the rainy season, about how much water does your household consume each month from the Water District?

**SPECIFY UNITS AS PRECISELY AS POSSIBLE. FOR EXAMPLE, IF RESPONDENT SAYS, "HALF A TANK" REFER TO TABLE ON PAGE 7 TO CALCULATE AND CONFIRM HOW MANY CUBIC METERS (OR GALLONS) ARE IN "HALF A TANK."**

**IF RESPONDENT UNSURE, ASK HOW MANY CUBIC METERS ARE ON THE HOUSEHOLD WATER BILL DURING A TYPICAL RAINY SEASON MONTH.**

**IF RESPONDENT IS STILL UNSURE, CHECK HERE __ AND ASK IF RESPONDENT THINKS HOUSEHOLD CONSUMES MORE OR LESS THAN THE "MINIMUM" CHARGE OF 10 CUBIC METERS PER MONTH.**

Total Volume **(SPECIFY UNITS):** _____

99 Not applicable

J6. During the rainy season, about how much is your Water District bill each month?

**IF RESPONDENT DOES NOT RECEIVE A BILL (E.G., PAYS A NEIGHBOR FOR THE WATER), CHECK HERE _____ AND ASK HOW MUCH RESPONDENT SPENDS ON THIS WATER DURING A TYPICAL RAINY SEASON MONTH)**

Amount in Pesos: _____

99 Not applicable

J7. During a typical rainy season week, on how many days does your household receive water from the Water District?

Days: _____ (1 to 7)

99 Not applicable

J8. On those days, how many hours per day is the water supplied?

Hours per day: _____ (0 to 24)

99 Not applicable

J9. During a typical rainy season week, does your household use delivery water, (i.e., water from a tanker truck)?

0 No…**SKIP TO J15**
1 Yes

J10. Does your household usually...

1 Order a delivery on its own,
2 Order a delivery with one or more other households, or
3 Get delivery water in some other way **(SPECIFY)**?: _____
99 Not applicable

J11. What does your household use this delivery water for, during a typical rainy season week?

**CHECK ALL THAT APPLY. ASK ABOUT EACH SPECIFIC USE IF RESPONDENT SAYS "EVERYTHING" OR SOMETHING SIMILAR.**

____ Drinking
____ Cooking
____ Washing hands/face
____ Bathing
____ Washing dishes
99 Not applicable

____ Laundry
____ Flushing the C.R.
____ Other household cleaning (wash floors/walls, etc.)
____ Other use: _____

J12. About how much delivery water does your household use during a typical rainy season week?

**SPECIFY UNITS AS PRECISELY AS POSSIBLE. FOR EXAMPLE, IF RESPONDENT SAYS, "TWO DRUMS" REFER TO TABLE ON PAGE 8 TO CALCULATE AND CONFIRM HOW MANY GALLONS ARE IN "TWO DRUMS."**

Total Volume **(SPECIFY UNITS):** _____
99 Not applicable

J13. How much does this amount of water cost your household?

Cost (PhP): _____

99 Not applicable

J14. During a typical rainy season week, how long does it take for water to arrive once you have ordered it?

Number of Hours and/or Days: _____

99 Not applicable

J15. During a typical rainy season week, does your household use mineral water?

0 No…**SKIP TO J19**

1 Yes

J16. What does your household use mineral water for, during a typical rainy season week?

**CHECK ALL THAT APPLY. ASK ABOUT EACH SPECIFIC USE IF RESPONDENT SAYS "EVERYTHING" OR SOMETHING SIMILAR.**

____ Drinking

____ Cooking

____ Washing hands/face

____ Bathing

____ Washing dishes

____ Laundry

____ Flushing the C.R.

____ Other household cleaning (wash floors/walls, etc.)

____ Other use: _____

99 Not applicable

J17. How much mineral water does your household use during a typical rainy season week?

**SPECIFY UNITS AS PRECISELY AS POSSIBLE. FOR EXAMPLE, IF RESPONDENT SAYS, "5 JUGS" FIND OUT IF 1 JUG IS THE STANDARD 5-GALLON SIZE OR SOME OTHER SIZE, AND WHETHER ENTIRE JUG WAS CONSUMED OR PARTIAL JUG. ETC.**

Total Volume **(SPECIFY UNITS)**:_____

99 Not applicable

J18. How much does your household pay per 5-gallons of mineral water?

Cost (PhP): _____

99 Not applicable

J19. During a typical rainy season week, does your household use water from a spring?

0 No…**SKIP TO J26**

1 Yes

J20. Where is this spring located?

Location: _____

99 Not applicable

J21. Is the spring protected or unprotected?

1 Protected

2 Unprotected

99 Not applicable

J22. What does your household use water from the spring for, during a typical rainy season week?

**CHECK ALL THAT APPLY. ASK ABOUT EACH SPECIFIC USE IF RESPONDENT SAYS "EVERYTHING" OR SOMETHING SIMILAR.**

____ Drinking

____ Cooking

____ Washing hands/face

____ Bathing

____ Washing dishes

____ Laundry

____ Flushing the C.R.

____ Other household cleaning (wash floors/walls, etc.)

____ Other use: _____

99 Not applicable

J23. About how much water does your household pitch from the spring (carry from the spring back to your home) during a typical rainy season week?

**SPECIFY UNITS AS PRECISELY AS POSSIBLE. FOR EXAMPLE, IF RESPONDENT SAYS, "10 BUCKETS" PROBE FOR HOW MANY GALLONS EACH BUCKET HOLDS, SO TOTAL VOLUME CAN BE CALCULATED AND LISTED IN THE SPACE BELOW.**

Total Volume **(SPECIFY UNITS)**:_____

99 Not applicable

J23A. About how much water does your household use at the spring during a typical rainy season week?

**ASSIST THE RESPONDENT AS NEEDED TO ESTIMATE VOLUME OF WATER USED AT THE SPRING. FOR EXAMPLE, IF RESPONDENT WASHES LAUNDRY AT THE SPRING ONCE PER WEEK, PROBE TO HELP ESTIMATE HOW MANY BUCKETS (AT WHAT TOTAL VOLUME) ARE USED FOR LAUNDRY. DO SIMILAR PROBING FOR ACTIVITIES SUCH AS BATHING, WASHING DISHES, ETC. THAT MAY BE DONE AT THE SPRING ITSELF.**

Total Volume **(SPECIFY UNITS)**:_____

99 Not applicable

J24. Please complete this sentence by choosing a number on the scale to represent your answer.

During a typical rainy season week, the spring has…

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| No water at all | | | | | | | | | | Abundant water |
| Awan pulos ti danum na | | | | | | | | | | Nabuslon ti danum |
| Walang tubig | | | | | | | | | | Masagana ang tubig |

99 Not applicable

J25. How many minutes does it take to walk from your house to the spring?

Minutes: _____

99 Not applicable

J26. During a typical rainy season week, does your household use rainwater?

0 No…**SKIP TO J29**

1 Yes

J27. What does your household use rainwater for, during a typical rainy season week?

**CHECK ALL THAT APPLY. ASK ABOUT EACH SPECIFIC USE IF RESPONDENT SAYS "EVERYTHING" OR SOMETHING SIMILAR.**

____ Drinking

____ Cooking

____ Washing hands/face

____ Bathing

____ Washing dishes

____ Laundry

____ Flushing the C.R.

____ Other household cleaning (wash floors/walls, etc.)

____ Other use: _____

99 Not applicable

J28. About how much rainwater does your household use during a typical rainy season week?

**SPECIFY UNITS AS PRECISELY AS POSSIBLE. FOR EXAMPLE, IF RESPONDENT SAYS, "TWO DRUMS" REFER TO TABLE ON PAGE 8 AND CONFIRM HOW MANY GALLONS EACH DRUM HOLDS, ETC.**

Total Volume **(SPECIFY UNITS)**: _____

99 Not applicable

J29. During a typical rainy season week, does your household collect used water from activities like washing dishes, bathing, or doing the laundry, and later recycle it for other household use?

0 No…**SKIP TO J33**

1 Yes

J30. From which activities does your household collect used water, during a typical rainy season week?

**CHECK ALL THAT APPLY**

| | | | |
|---|---|---|---|
| ____ | Cooking | ____ | Laundry |
| ____ | Washing hands/face | ____ | Other household cleaning (wash floors/walls, etc.) |
| ____ | Bathing | ____ | Other activity: _____ |
| ____ | Washing dishes | | |
| 99 | Not applicable | | |

J31. What does your household use this recycled water for, during a typical rainy season week?

**CHECK ALL THAT APPLY**

| | | | |
|---|---|---|---|
| ____ | Drinking | ____ | Laundry |
| ____ | Cooking | ____ | Flushing the C.R. |
| ____ | Washing hands/face | ____ | Other household cleaning (wash floors/walls, etc.) |
| ____ | Bathing | ____ | Watering plants |
| ____ | Washing dishes | ____ | Other use: _____ |
| 99 | Not applicable | | |

J32. About how much recycled water does your household use during a typical rainy season week?

**SPECIFY UNITS AS PRECISELY AS POSSIBLE. FOR EXAMPLE, IF RESPONDENT SAYS, "5 BUCKETS" PROBE FOR HOW MANY GALLONS OR LITERS THESE BUCKETS HOLD.**

Total Volume **(SPECIFY UNITS)**: _____

99 Not applicable

J33. During a typical rainy season week, does your household use water from any other source, such as a private deep well, a community deep well, a creek, or any other source that we have not yet talked about?

0 No…**SKIP TO J35**

1 Yes **(SPECIFY SOURCES):** _____

J34. Please tell me about those sources:

J34A. Source: _____

Household Uses: _____

Total Volume **(SPECIFY UNITS AND IF WEEKLY/MONTHLY):** _____

Cost of Water **(SPECIFY IF WEEKLY/MONTHLY):** _____

Availability of Water (**E.G., EVERYDAY? ALL DAY?):** _____

Other details: _____

J34B. Source: _____

Household Uses: _____

Total Volume **(SPECIFY UNITS AND IF WEEKLY/MONTHLY):** _____

Cost of Water **(SPECIFY IF WEEKLY/MONTHLY):** _____

Availability of Water (**E.G., EVERYDAY? ALL DAY?):** _____

Other details: _____

J35. Now, thinking about all the water your household uses during a typical rainy season week, does your household: *(USDA Food Sufficiency single item, modified)*

1 Always have enough water,
2 Sometimes not have enough water, or
3 Often not have enough water for household needs?

*Ilocano:*

1 Kanayon nga adda usto nga danum,
2 No maminsan ket kurang ti danum, wenno
3 Kanayon nga kurang ti danum nga maususar idiay balay yo?

*Tagalog:*

1 Laging may katamtamang tubig,
2 Paminsan minsan ay kulang ang tubig, o
3 Kadalasang kinukulang ang tubig para sa pangangailangan ng sambahayan?

J36. Please complete this sentence by choosing a number on the scale to represent your answer.

Overall, the water that my household uses during a typical rainy season week is…

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Not clean at all | | | | | | | | | | Completely clean |
| Saan pulos nga nadalus | | | | | | | | | | Nadalus la unay |
| Hindi malinis | | | | | | | | | | Lubos na malinis |

J37. During a typical rainy season week, how easy is it for your household to get the water it needs?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Not easy at all | | | | | | | | | | Extremely easy |
| Saan pulos nga nalaka | | | | | | | | | | Nalaka la unay |
| Hindi madali | | | | | | | | | | Napakadali |

J38. During a typical rainy season week, does your household ever have to choose between spending money on water instead of on food?

0 No…**SKIP TO J40**
1 Yes

J39. About how many times during a typical rainy season week does your household have to choose between spending money on water instead of on food?

Number of times: _____
99 Not applicable

***Now, I have some questions about which water you use for specific purposes.***

J40. During a typical rainy season week, what is your household's main source of water for…

J41. Drinking? _____
J42. Cooking? _____
J43. Bathing? _____
J44. Washing dishes? _____
J45. Laundry? _____
J46. Washing floors/walls? _____
J47. Flushing the C.R.? _____

J48. During a typical rainy season week, are there any times that your household does not have enough water for…

| | | | | If Yes, on how many days does this happen per week? |
|---|---|---|---|---|
| J49. | Drinking? | 0 No | 1 Yes | _____ |
| J50. | Cooking? | 0 No | 1 Yes | _____ |
| J51. | Bathing? | 0 No | 1 Yes | _____ |
| J52. | Washing dishes? | 0 No | 1 Yes | _____ |
| J53. | Doing laundry? | 0 No | 1 Yes | _____ |
| J54. | Washing floors/walls? | 0 No | 1 Yes | _____ |
| J55. | Flushing the C.R.? | 0 No | 1 Yes | _____ |

J56. During a typical rainy season week, how would you describe how clean your water is for each specific purpose? Please use the scale below:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Not clean at all | | | | | | | | | | Completely clean |
| Saan pulos nga nadalus | | | | | | | | | | Nadalus la unay |
| Hindi malinis | | | | | | | | | | Lubos na malinis |

| | | |
|---|---|---|
| J57. | Drinking? | _____ |
| J58. | Cooking? | _____ |
| J59. | Bathing? | _____ |
| J60. | Washing dishes? | _____ |
| J61. | Doing laundry? | _____ |
| J62. | Washing floors/walls? | _____ |
| J63. | Flushing the C.R.? | _____ |

***That was the last question in this survey. Thank you very much for your participation.***

**RECORD INTERVIEW END TIME: _____ A.M. / P.M**

**Interviewer Observations**

**1. The respondent was:**

| 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| Able to understand questions easily | | | | Hardly able to understand questions |

**2. The respondent was:**

| 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| Cooperative | | | | Uncooperative |

**3. Rapport with the respondent was:**

| 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| Excellent | | | | Very poor |

**4. The respondent seemed to answer questions about household water in the <u>dry season</u>:**

| 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| With certainty | | | | With uncertainty |

**5. The respondent seemed to answer questions about household water in the <u>rainy season</u>:**

| 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| With certainty | | | | With uncertainty |

**6. This survey was conducted in the following language: _____**

**7. Would you recommend the respondent for an in-depth interview? Why or why not?**

_____

_____

**8. Do you have other comments about the respondent or interview?**

_____

_____

## Appendix C. Individual Subsurvey Instrument

# Gender, Resources, and Seasonal Water Insecurity in Urban Philippines

## Individual Subsurvey

Lisa Reyes Mason
Center for Social Development
George Warren Brown School of Social Work
Washington University in St. Louis

**Contact Log**

Household ID Number: _____

Individual ID Number: _____

Purok Number: _____

Interviewer's Name: _____

Date of 1st contact: _____ Time of 1st contact: _____

Survey completed? ___ Yes ___ No

If not completed, why not? _____

Day/time/how to recontact: _____

Date of 2nd contact: _____ Time of 2nd contact: _____

Survey completed? ___ Yes ___ No

If not completed, why not? _____

Day/time/how to recontact: _____

Date of 3rd contact: _____ Time of 3rd contact: _____

Survey completed? ___ Yes ___ No

If not completed, why not? _____

Day/time/how to recontact: _____

Date of 4th contact: _____ Time of 4th contact: _____

Survey completed? ___ Yes ___ No

If not completed, why not? _____

Day/time/how to recontact: _____

Date of 5th contact: _____ Time of 5th contact: _____

Survey completed? ___ Yes ___ No

If not completed, why not? _____

Day/time/how to recontact: _____

**A. Introduction and Consent**

A1. First name of prospective subsurvey participant **[FILL FROM HOUSEHOLD SURVEY]**

First Name: _____

A1. Prospective participant is:

1 Household survey respondent
2 Spouse of household survey respondent

**IF HOUSEHOLD SURVEY RESPONDENT, READ:**

***Thank you for completing the household survey. We are also conducting short individual surveys, which ask about your own personal water experiences during the rainy and dry seasons. If you are married, we will also invite your spouse to participate in a separate individual survey. Like the first survey, any information you provide will be confidential. You are free to skip any questions that you do not want to answer, and are free to discontinue the survey at any time. The individual survey will last about 30 minutes, and you will receive a small incentive for participating. Do you have any questions? Do you agree to participate in this survey?***

**IF SPOUSE OF HOUSEHOLD SURVEY RESPONDENT, READ:**

***Hello. My name is _____. I'm with a research team from Washington University in St. Louis. We are conducting short individual surveys about personal water experiences during the rainy and dry seasons. I would like you to know that any information you provide will be confidential. You are free to skip any questions that you do not want to answer, and are free to discontinue the survey at any time. The individual survey will last about 30 minutes, and you will receive a small incentive for participating. Do you have any questions? Do you agree to participate in this survey?***

A2. Agreement to participate:

4 Yes…**THANK RESPONDENT AND PROCEED TO NEXT PAGE.**
5 No, not at this time…**ASK BEST DAY/TIME TO RETURN. FILL CONTACT LOG.**
6 No, refuse to participate…**THANK RESPONDENT.**

**RECORD INTERVIEW START TIME: _____ A.M. / P.M.**

**IF SPOUSE OF HOUSEHOLD SURVEY RESPONDENT, BEGIN WITH SECTION B.**

**IF HOUSEHOLD SURVEY RESPONDENT, BEGIN WITH SECTION C.**

**B. Demographic Information**

B1. **RECORD GENDER AS OBSERVED**

0 Male
1 Female

***I'd like to begin by asking you a few questions about yourself.***

B2. How old are you?

Age in years: _____

B3. Since what year have you lived in this house?

Year: _____

B4. Since what year have you lived in Pinget?

Year: _____

B5. And since what year have you lived in Baguio City?

Year: _____

B6. What is your place of origin?

Province: _____

B7. To what group do you belong, if any? For example, are you a Kankana-ey, Kalinga, Pangasinense, Ilocano, Ifugao, or something else?

10 Ilocano
11 Ifugao
12 Kalinga
13 Kankana-ey
14 Pangasinense
15 Tagalog
16 More than one group **(SPECIFY)**: _____
17 Other **(SPECIFY)**: _____
9 Do not belong to a group

B8. How much schooling did you complete?

Verbatim Response: _____

0 None
1 Some elementary
2 Elementary graduate
3 Some high school
4 High school graduate
5 Some postsecondary, not college
6 Postsecondary graduate, not college
7 Some college
8 College graduate
9 Some post-baccalaureate (e.g., toward Master's, MD, Law, PhD)
10 Post-baccalaureate graduate (e.g., completed Master's, MD, Law, PhD)

**SECTIONS C AND D OMITTED FROM INDIVIDUAL SUBSURVEY**

**E. Water Security in the Dry Season**

***Now, I'd like to ask about your <u>personal</u> water use during the dry season or "summer." Please remember that these questions ask specifically about <u>you</u>, and not about anyone else in your household.***

E1. What is your main source of drinking water, during a typical dry season week?

1 Baguio Water District
2 Delivery water (i.e., from tanker truck)
3 Mineral water
4 Protected spring
5 Unprotected spring
6 Creek
7 Rainwater
8 Some other source **(SPECIFY)**: _____

E2. During a typical dry season week, are there any times that you do not have enough water to drink?

0 No…**SKIP TO E4**
1 Yes

E3. On how many days do you not have enough water to drink, during a typical dry season week?

Number of days: _____ (1 to 7)
99 Not applicable

E4. Please complete this sentence by choosing a number on the scale to represent your answer.

During a typical dry season week, the water that I drink is…

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Not clean at all | | | | | | | | | | Completely clean |
| Saan pulos nga nadalus | | | | | | | | | | Nadalus la unay |
| Hindi malinis | | | | | | | | | | Lubos na malinis |

***Next, let's talk about water for bathing.***

E5. What is your main source of water for bathing, during a typical dry season week?

1 Baguio Water District
2 Delivery water (i.e., from tanker truck)
3 Mineral water
4 Protected spring
5 Unprotected spring
6 Creek
7 Rainwater
8 Some other source **(SPECIFY)**: _____

E6. During a typical dry season week, are there any times that you do not have enough water to bathe?

0 No…**SKIP TO E8**
1 Yes

E7. On how many days do you not have enough water to bathe, during a typical dry season week?

Number of days: _____ (1 to 7)
99 Not applicable

E8. Please complete this sentence by choosing a number on the scale to represent your answer.

During a typical dry season week, the water that I use for bathing is…

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Not clean at all | | | | | | | | | | Completely clean |
| Saan pulos nga nadalus | | | | | | | | | | Nadalus la unay |
| Hindi malinis | | | | | | | | | | Lubos na malinis |

***Next, I have some questions about things you may or may not do during a typical dry season week concerning water. Please remember that there are no right or wrong answers.***

E9. During a typical dry season week, do you personally:

E10. Conserve water by drinking less?

1 Yes 0 No

E11. Conserve water by using less for bathing?

1 Yes 0 No

E12. Save water from bathing for other household purposes?

1 Yes 0 No

E13. Spend time collecting, buying, or waiting for water?

1 Yes 0 No**...SKIP TO E17**

E14. About how much time do you personally spend collecting, buying, or waiting for water, during a typical dry season week?

**IF RESPONDENT ANSWERS IN DAYS (E.G., 3 HOURS PER DAY), PROBE TO FIND OUT HOW MANY DAYS PER WEEK IN THE DRY SEASON (E.G., EVERYDAY, 4 DAYS PER WEEK, ETC.) TO CALCULATE WEEKLY TOTAL**

Hours per Week: _____

99 Not applicable

E15. During a typical dry season week, do you personally change your schedule to be at home and wait for water?

1 Yes 0 No 99 Not applicable

E16. During a typical dry season week, do you personally lose income because of time spent collecting, buying, or waiting for water?

1 Yes 0 No 99 Not applicable

E17. During the dry season in general, do you ever personally contact a barangay official, water provider or vendor, or anyone else to make a complaint about water?

1 Yes 0 No**…SKIP TO SECTION F**

E18. Who do you contact?

**CIRCLE ALL THAT APPLY**

1 Barangay official (e.g., Captain, Kagawad, Purok Leader)
2 Baguio Water District
3 Water delivery company
4 Water refilling station
5 Neighbor
6 Other **(SPECIFY)**: _____
99 Not applicable

E19. How often do you make such complaints?

Frequency: _____
99 Not applicable

**F. Water Security in the Rainy Season**

***Now, I'd like you to think about a typical week in the rainy season. Many of these next questions will be like those I just asked, except that I will ask you to think about a typical rainy season week. Please remember that these questions ask specifically about you, and not about anyone else in your household.***

F1. What is your main source of drinking water, during a typical rainy season week?

1 Baguio Water District
2 Delivery water (i.e., from tanker truck)
3 Mineral water
4 Protected spring
5 Unprotected spring
6 Creek
7 Rainwater
8 Some other source **(SPECIFY)**: _____

F2. During a typical rainy season week, are there any times that you do not have enough water to drink?

0 No…**SKIP TO F4**
1 Yes

F3. On how many days do you not have enough water to drink, during a typical rainy season week?

Number of days: _____ (1 to 7)
99 Not applicable

F4. Please complete this sentence by choosing a number on the scale to represent your answer.

During a typical rainy season week, the water that I drink is…

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Not clean at all | | | | | | | | | | Completely clean |
| Saan pulos nga nadalus | | | | | | | | | | Nadalus la unay |
| Hindi malinis | | | | | | | | | | Lubos na malinis |

***Next, let's talk about water for bathing.***

F5. What is your main source of water for bathing, during a typical rainy season week?

1 Baguio Water District
2 Delivery water (i.e., from tanker truck)
3 Mineral water
4 Protected spring
5 Unprotected spring
6 Creek
7 Rainwater
8 Some other source **(SPECIFY)**: _____

F6. During a typical rainy season week, are there any times that you do not have enough water to bathe?

0 No…**SKIP TO F8**
1 Yes

F7. On how many days do you not have enough water to bathe, during a typical rainy season week?

Number of days: _____ (1 to 7)
99 Not applicable

F8. Please complete this sentence by choosing a number on the scale to represent your answer.

During a typical rainy season week, the water that I use for bathing is…

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Not clean at all | | | | | | | | | | Completely clean |
| Saan pulos nga nadalus | | | | | | | | | | Nadalus la unay |
| Hindi malinis | | | | | | | | | | Lubos na malinis |

***Next, I have some questions about things you may or may not do during a typical rainy season week concerning water. Please remember that there are no right or wrong answers.***

F9. During a typical rainy season week, do you personally:

F10. Conserve water by drinking less?

1 Yes 0 No

F11. Conserve water by using less for bathing?

1 Yes 0 No

F12. Save water from bathing for other household purposes?

1 Yes 0 No

F13. Spend time collecting, buying, or waiting for water?

1 Yes 0 No**…SKIP TO F17**

F14. About how much time do you personally spend collecting, buying, or waiting for water, during a typical rainy season week?

**IF RESPONDENT ANSWERS IN DAYS (E.G., 3 HOURS PER DAY), PROBE TO FIND OUT HOW MANY DAYS PER WEEK IN THE RAINY SEASON (EVERYDAY, 4 DAYS PER WEEK, 2 DAYS PER WEEK, ETC.) IN ORDER TO CALCULATE WEEKLY TOTAL**

Hours per Week: _____

99 Not applicable

F15. During a typical rainy season week, do you personally change your schedule to be at home and wait for water?

1 Yes 0 No 99 Not applicable

F16. During a typical rainy season week, do you personally lose income because of time spent collecting, buying, or waiting for water?

1 Yes 0 No 99 Not applicable

F17. During the rainy season in general, do you ever personally contact a barangay official, water provider or vendor, or anyone else to make a complaint about water?

1 Yes 0 No **…SKIP TO SECTION G**

F18. Who do you contact?

**CIRCLE ALL THAT APPLY**

1 Barangay official (e.g., Captain, Kagawad, Purok Leader)
2 Baguio Water District
3 Water delivery company
4 Water refilling station
5 Neighbor
6 Other **(SPECIFY)**: _____
99 Not applicable

F19. How often do you make such complaints?

Frequency: _____
99 Not applicable

**G. INCOME**

***Next, I'd like to ask about your own personal income. Please remember that this information is confidential and will be used only for this study.***

G1. Overall, how much total income do you personally earn each month, from all sources?

| | |
|---|---|
| 1 | 0 – 2,500 PhP |
| 2 | 2,501 – 5,000 PhP |
| 3 | 5,001 – 7,500 PhP |
| 4 | 7,501 – 10,000 PhP |
| 5 | 10,001 – 15,000 PhP |
| 6 | 15,001 – 20,000 PhP |
| 7 | More than 20,000 PhP |

## H. ENVIRONMENTAL PERCEPTIONS AND ATTITUDES

***Thank you. Now, I have some questions about the weather, and about how your household's water situation may or may not have changed over time. Please remember that there are no right or wrong answers to these questions. We are interested in your own thoughts and opinions.***

H1. Please think back to the last rainy season that seemed rainier than usual to you in Baguio City. What year was that?

*Ilocano*: Panunoten yo kadi ti naudi nga panawen ti panagtutudo nga napigpigsa ngem ti nakadawyan ditoy Baguio City. Ania kadi nga tawen diay?

*Tagalog*: Isipin niyo ang huling panahon ng tag-ulan na mas maulan pa sa nakagawian niyo dito sa Baguio City. Anong taon iyon?

Year: _____

H2. Please briefly describe in what ways, if any, your household was affected during that time.

**IF PROBES ARE NEEDED, <u>USE GENERAL PROBES</u> SUCH AS "YOUR HOUSEHOLD'S DAY-TO-DAY ROUTINE" OR "YOUR HOUSEHOLD ACTIVITIES." <u>DO NOT</u> GIVE SPECIFIC EXAMPLES.**

_____

_____

_____

_____

_____

H3. Now, please think back to the last dry season that seemed drier or longer than usual to you in Baguio City. What year was that?

*Ilocano*: Itatta, panunoten yo ti naudi nga panawen ti tikag nga nabaybayag ngem diay nakadawyan ditoy Baguio City. Ania kadi nga tawen daytoy?

*Tagalog*: Ngayon naman, isipin niyo ang huling panahon ng tag-araw na mas tuyo at mahaba kaysa nakagawian dito sa Baguio City. Anong taon ito?

Year: _____

H4. Please briefly describe in what ways, if any, your household was affected during that time.

**IF PROBES ARE NEEDED, <u>USE GENERAL PROBES</u> SUCH AS "YOUR HOUSEHOLD'S DAY-TO-DAY ROUTINE" OR "YOUR HOUSEHOLD ACTIVITIES." <u>DO NOT</u> GIVE SPECIFIC EXAMPLES.**

_____

_____

_____

_____

_____

H5. Over the past few years, has your household's water situation:

1 Improved,
2 Stayed the same, or
3 Become worse?

H6. Please briefly explain your response.

H7. Over the past few years, has the overall water situation in Pinget:

1 Improved,
2 Stayed the same, or
3 Become worse?

H8. Please briefly explain your response.

H9. Over the next few years, do you think the water situation in Pinget will:

1 Improve,
2 Stay the same, or
3 Become worse?

H10. Please briefly explain your response.

H11. In your view, how much does the Buyog watershed affect the well-being of people in Pinget? Please use the following scale.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Does not affect at all | | | | | | | | | | Affects completely |
| Saan pulos nga makaapekto | | | | | | | | | | Makaapekto unay |
| Walang apekto | | | | | | | | | | Labis na makaapekto |

H12. How well protected is the Buyog watershed from encroachment by new settlers?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Not protected at all | | | | | | | | | | Completely protected |
| Saan pulos nga protektado | | | | | | | | | | Protektado unay |
| Hindi protektado | | | | | | | | | | Labis na protektado |

H13. In your view, how polluted is the Buyog watershed from trash?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Not polluted at all | | | | | | | | | | Completely polluted |
| Saan pulos nga narugit/polluted | | | | | | | | | | Narugit/polluted unay |
| Hindi marumi/polluted | | | | | | | | | | Masyadong marumi/polluted |

H14. In your view, how polluted is the Buyog watershed from human and animal sewage?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Not polluted at all | | | | | | | | | | Completely polluted |
| Saan pulos nga narugit/polluted | | | | | | | | | | Narugit/polluted unay |
| Hindi marumi/polluted | | | | | | | | | | Masyadong marumi/polluted |

H15. In your view, how much does Pinget's water supply depend on the Buyog watershed?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Does not depend at all<br>Saan pulos nga nakasanggir<br>Hindi umaasa | | | | | | | | | | Depends completely<br>Nakasanggir unay<br>Lubos na umaasa |

H16. How much does your household's water supply depend on the Buyog watershed?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Does not depend at all<br>Saan pulos nga nakasanggir<br>Hindi umaasa | | | | | | | | | | Depends completely<br>Nakasanggir unay<br>Lubos na umaasa |

H17. In your view, how much do people in your purok care about protecting the Buyog watershed?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Do not care at all<br><br>Saan pulos nga ayaywanan<br><br>Walang pagpapahalaga | | | | | | | | | | Care about it more than they care about anything else<br><br>Ayaywanan unay, surok pay ti panangaywan ti dadduma nga banag<br><br>Pinapahalagahan ng higit pa sa pagpapahalaga sa ibang bagay |

H18. In your view, how much do the people of Pinget care about protecting the Buyog watershed?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Do not care at all | | | | | | | | | | Care about it more than they care about anything else |
| Saan pulos nga ayaywanan | | | | | | | | | | Ayaywanan unay, surok pay ti panangaywan ti dadduma nga banag |
| Walang pagpapahalaga | | | | | | | | | | Pinapahalagahan ng higit pa sa pagpapahalaga sa ibang bagay |

**SECTION I OMITTED FROM HOUSEHOLD SURVEY**

**CONTINUE ON NEXT PAGE WITH SECTION J**

**J. SCENARIOS**

***Next, I will read you two hypothetical scenarios. Please think about each scenario and try to imagine yourself in the situation. I'll then ask how you might respond if you were in that situation. Again, please remember that there are no right or wrong answers.***

J1. Ten years from now, the rainy seasons have become much wetter than usual. Typhoons are stronger and more frequent. During rainy seasons, there is more rain than you remember there being in the past.

*Ilocano*: Sanggapulo nga tawen mangrugi tatta, kumarkaru ti panawen ti pinagtutudo, pumigpigsa ken kanayon ti bagyo. Adaddu ti tudo kumpara iti malagip yo idi.

*Tagalog*: Sampung taon simula ngayon, ang panahon ng tag-ulan ay magiging mas maulan pa sa nakagawian. Mas malakas at mas madalas ang mga bagyo. Mas maulan kumpara sa maalala niyo noon.

In what ways, if any, do you think your household would be affected by these circumstances?

**IF PROBES ARE NEEDED, <u>USE GENERAL PROBES</u> SUCH AS "YOUR HOUSEHOLD'S DAY-TO-DAY ROUTINE" OR "YOUR HOUSEHOLD ACTIVITIES." <u>DO NOT</u> GIVE SPECIFIC EXAMPLES.**

J2. Imagining yourself in this situation—10 years from now, when rainy seasons are much wetter than usual—how likely would you be to use rainwater as a source of drinking water?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Not likely at all | | | | | | | | | | Extremely likely |
| Saan nga mabalin | | | | | | | | | | Mabalin unay |
| Hindi posible | | | | | | | | | | Napakaposible |

J3. Please briefly explain your choice:

_____

_____

_____

J4. In the second scenario, it's again 10 years in the future. This time, the dry seasons are much drier and longer than usual. Rains do not start until later and later each year.

*Ilocano*: Ditoy maikadua nga posible nga maaramid nga pasamak, sanggapulo nga tawen mangrugi tatta, nakarkaru ken atatiddug ti panawen ti tikag ngem diay nakadawyan. Naladaw ti pinagrugi ti pinagtutudo kada tawen.

*Tagalog*: Sa pangalawang scenario, sampung taon muli sa panghinaharap, ang panahon nga tag-araw ay mas tuyo at mahaba kesa nakagawian, nahuhuli ang pag-umpisa ng tag-ulan kada taon.

In what ways, if any, do you think your household would be affected by these circumstances?

**IF PROBES ARE NEEDED, <u>USE GENERAL PROBES</u> SUCH AS "YOUR HOUSEHOLD'S DAY-TO-DAY ROUTINE" OR "YOUR HOUSEHOLD ACTIVITIES." <u>DO NOT</u> GIVE SPECIFIC EXAMPLES.**

_____

_____

_____

_____

_____

J5. Imagining yourself in this situation—10 years from now, when dry seasons are much drier than usual—how likely would you be to store rainwater from the rainy season so that it lasts until the dry season?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Not likely at all | | | | | | | | | | Extremely likely |
| Saan nga mabalin | | | | | | | | | | Mabalin unay |
| Hindi posible | | | | | | | | | | Napakaposible |

J6. Please briefly explain your choice:

_____

_____

_____

J7. **IF J5 CHOICE WAS 6 OR HIGHER (FROM 6 TO 10), ASK:**
How do you think you would store this water, so that it lasts until the dry season?

_____

_____

_____

J8. That was the last question in this survey. Do you have any additional comments about the topics we have discussed?

_____

_____

_____

_____

_____

***Thank you very much for your participation.***

**RECORD INTERVIEW END TIME: _____ A.M. / P.M.**

**Interviewer Observations**

**1. The respondent was:**

| 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| Able to understand questions easily | | | | Hardly able to understand questions |

**2. The respondent was:**

| 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| Cooperative | | | | Uncooperative |

**3. Rapport with the respondent was:**

| 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| Excellent | | | | Very poor |

**4. The respondent seemed to answer questions about personal water in the <u>dry season</u>:**

| 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| With certainty | | | | With uncertainty |

**5. The respondent seemed to answer questions about personal water in the <u>rainy season</u>:**

| 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| With certainty | | | | With uncertainty |

**6. This survey was conducted in the following language: _____**

**7. Would you recommend the respondent for an in-depth interview? Why or why not?**

_____

_____

**8. Do you have other comments about the respondent or interview?**

_____

_____