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# Gender and Asset Dimensions of Seasonal Water Insecurity in Urban Philippines

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# Gender and Asset Dimensions of Seasonal Water Insecurity in Urban Philippines

*Seasonal water insecurity is a social and climate-related problem of growing concern in many urban areas. From 2000 to 2050, the global urban population affected by seasonal water shortage is projected to increase from 312 million to 1.3 billion. This increase is due to a combination of drivers, including population growth, urbanization, and climate change. To advance understanding of the social dimensions of this problem, this study uses qualitative methods—archival research, informal interviews (N=7), and in-depth interviews (N=15)—to explore how gender and assets relate to water insecurity in the rainy and dry seasons in three urban neighborhoods in Baguio City, the Philippines. Analytic methods include memo production and qualitative text analysis. Key findings are that households manage complex water portfolios that change seasonally or more frequently; women and men have gendered roles in managing water portfolios, providing versus managing income for water purchases, and physically carrying water; and particular forms of physical, financial, and social assets seem to matter for reducing seasonal water insecurity in ways that may be gendered as well. Implications for more gender-sensitive and asset-focused research and policy are discussed.*

***Key words:*** *water security, climate change, urban, gender, Philippines*

## Introduction

Population growth, urbanization, and climate change threaten water security in countries worldwide (Kjellstrom & Mercado, 2008; Kundzewicz et al., 2007; Vairavamoorthy, Gorantiwar, & Pathirana, 2008). The consequences of water insecurity are numerous and well-documented, and include morbidity and mortality, economic loss, and social and political conflict (Aiga & Umenai, 2002; Allouche, 2011; Howard & Bartram, 2003; United Nations Development Programme, 2006). 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). This definition includes water for basic and non-basic needs, and recognizes multiple dimensions of water quantity, quality, and accessibility (Gleick, 1998; Hadley and Wutich, 2009; Satterthwaite, 2003).

In many urban areas, seasonal water insecurity is of growing concern due to (1) impacts of population growth on already stressed water sources, and (2) anticipated climate trends of increased rainfall during rainy seasons and longer dry spells during dry seasons (Cruz et al., 2007; Muller, 2007; Schneider et al., 2007; Yumul, Dimalanta, Servando, & Hilario, 2010; Yusuf & Francisco, 2009). Recent estimates, conservatively measured, are that the global population affected by seasonal water shortage in urban areas will increase from 312 million in 2000 to 1.3 billion in 2050 (McDonald et al., 2011).

During rainy seasons, increased precipitation may provide a valuable source of safe rainwater if harvested and stored appropriately, but may also increase flooding and landslides, which can 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, meanwhile, longer dry spells can lead to increased rationing of publicly piped water, and greater competition over other water sources such as privately delivered water, bottled water, and urban

springs or streams (Rosenberg, Talozi, & Lund, 2008; Vairavamoorthy, Gorantiwar, & Pathirana, 2008).

Despite the current scope and projections for seasonal water insecurity in urban areas, surprisingly little is known about the social dimensions of this problem (Hadjer, Klein, & Schopp, 2005; Wutich & Ragsdale, 2008). The extent and nature of rainy versus dry season insecurity have been little studied in urban water research to date. Among the few empirical and social or interdisciplinary studies on seasonal, urban water insecurity, one focuses on rainwater harvesting in informal settlements or "slums" in Dhaka City, Bangladesh (Islam, Chow, Kabir, & Liaw, 2010), a second is concerned primarily with water regulation for refugee populations in Amman, Jordan (Gerlach & Franceys, 2009), and two focus on water-related emotional distress (Wutich, 2009) and common pool resource management (Wutich & Ragsdale, 2008) in one neighborhood in Cochabamba, Bolivia.

This study, meanwhile, focuses on understanding the gender and asset dimensions of seasonal water insecurity in three urban neighborhoods in Baguio City, the Philippines. New, empirical research conducted in places such as Baguio City—where seasonal water insecurity has persisted for decades and individuals and households have developed coping and adaptation strategies—has potential to inform both local water policy and policy in places expected to experience seasonal water insecurity for the first time or to a greater extent than in the past (Adger et al., 2007; Kundzewicz et al., 2007). In addition, studying social dimensions of seasonal water insecurity among the population in three different neighborhoods allows a more nuanced look at what heterogeneity may exist in seasonal water insecurity among individuals, households, and neighborhoods located in the same larger urban context.

## Why Gender and Assets?

This study's focus on gender and asset dimensions of seasonal water insecurity draws on (1) gender and development and (2) social vulnerability scholarship. Gender describes "socially produced differences between being feminine and masculine," (Holmes, 2007, p.2). To wit, gender is the interaction of sex (being a woman or man) with formal and informal institutions or norms, to produce female or male conditions, behaviors, and rights (Deere & Doss, 2006; Lorber, 2010). Assets—broadly defined in the development literature, as here—are stocks of physical, financial, human, social, and natural capital, which people use to buffer crisis and advance their well-being (Moser, 1998, 2007).

On gender, we know that water access, needs, and use are shaped by gender roles and relations in every society (Ray, 2007; Wallace & Coles, 2005). We also know that women and female-headed households are often considered more vulnerable to climate-related consequences than men and male-headed households, and that gender roles and relations can be important explanatory factors (Demetriades & Esplen, 2010; Denton, 2002; MacGregor, 2009). We still have limited understanding, however, of the gender dimensions of urban water insecurity, generally or seasonally. Recent exceptions are Crow and Odaba (2010), Wutich (2009), and Truelove (2011). In urban Nairobi, Crow and Odaba (2010) find qualitative relationships between gender and water that recall findings from much gender and rural water research: that women are the primary water gatherers and that they use numerous strategies (e.g., postpone personal bathing and household laundry) to cope with water shortage. Examining gender and water disparities in Cochabamba, Bolivia, Wutich

(2009) finds that 19% of women lose income due to water scarcity in the study neighborhood, compared to 2% of men, due to women's time waiting in water tapstand lines, washing clothes in public streams, and pursuing water vendors who roam through the neighborhood. Most recently, Truelove (2011) applies a feminist political ecology framework to analyzing water inequality in Delhi, India, with findings on how gender is produced through the micropolitics of water management in everyday life, and with calls for more microlevel social research on gender and urban water issues.

On assets, we know that different forms of capital protect people from vulnerabilities of various kinds, by providing resources for short-term coping and long-term adaptation (Blaikie, Cannon, Davis, & Wisner, 1994; Drèze & Sen, 1989; Prowse & Scott, 2008). Physical and financial capital, for example, can be gendered in ways that limit women's ability to cope with food shortage (Brown & Lapuyade, 2001) and protect homes from disaster (Molua, 2009). For water security in some contexts, having physical assets such as water drums and other vessels are essential for accessing and storing water (Crow & Odaba, 2010). Social assets in the form of relations with neighbors may reduce water-related stress (Wutich & Ragsdale, 2008). In the broader climate literature, however, assets are more often studied in relation to climate phenomena (e.g., flooding, drought) rather than social and climate-related outcomes (e.g., water insecurity). The distinction matters, as the latter—which is this study's approach—is arguably more useful to policymakers seeking to understand the scope and determinants of particular social problems, in order to target resources and interventions (Ribot, 2010).

## Study Setting

Located in Southeast Asia, the Philippines is a rapidly urbanizing nation, with total population of 92 million. By 2050, the Philippines is projected to rank 10th in urban population size and 20th in urban population percentage worldwide (United Nations Population Division, 2010). The country has an overall medium level of human development that varies substantially across and within regions (Philippine Human Development Network, 2009; United Nations Development Programme, 2009).

The consequences of climate change are of growing concern in the Philippines (Cruz et al., 2007; Pajuelas, 2000; Philippine Institute for Development Studies, 2009). Since 2004 alone, the Philippines has experienced several years of either extreme rainfall or prolonged dry periods (Yumul, Cruz, Servando, & Dimalanta, 2011). Further, seasonal rainfall variation, population growth, and urbanization mean than people in many urban areas routinely experience water insecurity (Rola & Francisco, 2004). While national estimates of access to an improved water source range from 70% to 85% (Gleick, 2009; National Statistics Office and ICF Macro, 2009), such measures are limited. Their benchmark for water quantity is arguably low, water quality from improved sources may still be poor, and water may be inaccessible to families on a regular basis (Bradley, 2004; Hadley & Wutich, 2009; Satterthwaite, 2003).

Compared to many developing countries, the status of women in the Philippines is relatively high. Life expectancy, literacy rates, and education enrollment ratios for women exceed those for men (United Nations Development Programme, 2009). Gender relations are often described as egalitarian (Eder, 2006). Gendered division of labor within and outside of the home, however, is still common (Illo & Pineda Ofreneo, 1999), and the ratio of female to male earned income is 0.61 (United Nations Development Programme, 2007). Given these characteristics, the Philippines is an

innovative study setting, as the broader gender, water, and development literature has often relied on scholarship on countries with more traditional gender relations.

The study site, Baguio City, is located in the mountainous Cordillera Administrative Region in northern Philippines and has a total population of 302,000 (National Statistics Office, 2007). As much urban water scholarship has focused on megacities with populations of 10 million or more, research in non-megacities like Baguio City is also innovative and productive, as these cities are growing rapidly and already house one-quarter of the global total population, and over half of the global urban population (Biswas, 2006; United Nations Population Division, 2010).

Baguio City is in a region with two distinct seasons: a rainy season from May to November (average peak precipitation of 900 mm each August), and dry season from December to April (average monthly precipitation close to 0 mm) (Pajuelas, 2000). The Baguio Water District (BWD) manages the municipal water system, sourcing groundwater from over 60 deep wells in the metropolitan area, and reaching an estimated 50% of Baguio City homes through piped connections (author's calculation based on data provided by BWD). Threats to water security in Baguio City include overpopulation, poorly financed and maintained infrastructure, pollution of local waterways, seasonal rainfall variation, and drought (Asian Development Bank, 2006).

The BWD water supply is rationed year round. Each neighborhood has a water schedule of three days per week, for four hours each day. During the dry season, this schedule is often interrupted in unpredictable ways. For example, water may arrive on scheduled days for only one hour each day, or water may not arrive at all for a week or longer, with little or no notification to households of the change in schedule. Also, the quality of BWD water, while classified as an improved source, is suspect due to mining pollution, poorly maintained water treatment facilities, aging delivery infrastructure, and contaminants that can enter pipes when water pressure is low due to rationing (Asian Development Bank, 2006).

## Methods

This study combines qualitative methods of archival research, informal interviews, and in-depth interviews in three Baguio City neighborhoods—Dominican Hill, Irisan, and Hillside—to examine how gender and assets relate to seasonal water insecurity. Neighborhoods were chosen after reviewing Baguio City demographic data and consulting with key informants and local officials to obtain variation in population and neighborhood characteristics, including available household water sources. Field research occurred in March 2011.

### Archival Research

I conducted archival research at the Baguio City Planning Office, reviewing profile reports for the three study neighborhoods, which are only accessible in person. Each profile describes neighborhood history, demographics, topography, social and economic concerns, and development priorities. Profiles are produced by the locally elected neighborhood council and updated upon election of a new neighborhood captain who serves as council head. The three profiles retrieved for this study are Dominican-Mirador Barangay Council (2010), Irisan Barangay Council (2010), and Hillside Barangay Council (2010).

### Informal Interviews

I conducted seven informal interviews with local leaders and agency officials to understand the broader context of water insecurity in each neighborhood and Baguio City as a whole, and as relevant to this study's focus on gender, assets, and seasonal water insecurity. Interviews were conducted in person and in English (one of two official languages in the Philippines), and lasted from 30 minutes to one hour. I recorded interviews through notetaking and, after each interview was complete, produced same day field notes reflecting on interview content and themes.

### In-Depth Interviews

I conducted in-depth interviews with a sample of 15 individuals: five from Dominican Hill, three from Irisan, and seven from Hillside. Assisted by a translator and key informants in each neighborhood, I used purposive sampling to obtain variation among participants by gender and household structure, income, and household water sources. See Table 1 for participant characteristics by neighborhood. With the exception of one case (an adult daughter in an extended family), I interviewed the person considered most knowledgeable and/or responsible for household water management. Due to time constraints, I interviewed fewer individuals in Irisan than the other two neighborhoods. Interviews with the three Irisan participants, however, still reflect some variation in demographic characteristics and household water sources.

In-depth interviews were conducted in person and in the participant's preferred language (Ilocano, Tagalog, or English) with translation assistance when not in English. Participants consented to the study and received a small incentive of dry goods (e.g., rice, sugar) at the end of the interview. Interviews used an open-ended topic guide with eight inquiry areas: household demographics; household water sources and uses; perceptions of water insecurity by source; strategies for coping with water insecurity; gender dimensions of water insecurity; asset dimensions of water insecurity; seasonal aspects of water sources, uses, and insecurity; and ways to address household water insecurity. Interviews were recorded either through extensive notetaking or through audiotaping and transcription.

Table 1. In-Depth Interview Sample Characteristics by Neighborhood

| Characteristic | Dominican Hill (N=5) | Irisan (N=3) | Hillside (N=7) | All (N=15) |
|---|---|---|---|---|
| Gender | | | | |
| Female | 3 | 3 | 5 | 11 |
| Male | 2 | 0 | 2 | 4 |
| Age | | | | |
| Minimum | 35 | 22 | 30 | 22 |
| Maximum | 44 | 40 | 60 | 60 |
| Mean | 39 | 31 | 46 | 41 |
| Marital Status | | | | |
| Single | 1 | 0 | 2 | 3 |
| Married, resident spouse | 3 | 3 | 3 | 9 |
| Married, NR spouse | 1 | 0 | 2 | 3 |
| HH Size | | | | |
| Minimum | 2 | 4 | 2 | 2 |
| Maximum | 7 | 7 | 12 | 12 |
| Mean | 5 | 6 | 6 | 6 |
| Monthly HH Income, PhP (USD) | | | | |
| Minimum | 3,936 (90) | 9,132 (210) | 800 (18) | 800 (18) |
| Maximum | 60,000 (1,379) | 13,000 (299) | 80,000 (1,839) | 80,000 (1,839) |
| Mean | 19,594 (450) | 10,422 (240) | 19,050 (438) | 17,506 (402) |
| Monthly HH Income, Per Capita, PhP (USD) | | | | |
| Minimum | 562 (13) | 1,305 (30) | 363 (8) | 363 (8) |
| Maximum | 8,571 (197) | 2,283 (52) | 11,429 (263) | 11,429 (263) |
| Mean | 4,295 (99) | 1,815 (42) | 3,067 (71) | 3,226 (74) |

Note: NR is non-resident. HH is household. Income conversion is $1 (USD or U.S. dollars) to ₱43.5 (PhP or Philippine pesos).

### Analysis

Qualitative analytic methods included study data review, memo production, and text analysis (Charmaz, 2006; Strauss &Corbin, 1998). First, I reviewed all field notes, archival research notes, informal and in-depth interview notes, and in-depth interview transcripts. I then produced memos to record initial observations and themes emerging from the data. For in-depth interview notes and transcripts, I also generated a coding scheme and performed text analysis with NVIVO 8, coding interview content and looking for themes of similarity and difference across all interviews, and among and within interviews by neighborhood.

## Results

### Study Neighborhoods

Dominican Hill (officially, Dominican-Mirador) has an estimated population of 4,182 people. Originally settled by Baguio City "millionaires," Dominican Hill now houses many middle-income

and poor families, including numerous squatters. The neighborhood is one of Baguio City's most developed for electricity and paved roads, but one of the least developed for BWD piped connections due to its rocky terrain. Households generally rely on private delivery water (from private companies that sell and deliver water via tanker trucks) year round, bottled water year round (purchased in 5-gallon jugs), and rainwater in the rainy season. Per one local leader, the proliferation of private delivery water companies has encouraged people to live "in every corner" of Baguio City as well as Dominican Hill, regardless of whether the land is hospitable to BWD connections or not. In some cases, these migration patterns to and within the city have reportedly contributed to local conflicts between more established and more recently settled residents.

Irisan is Baguio City's largest neighborhood, with a population of 18,827. This study recruited participants from one district in the neighborhood, where a city dumpsite is located. In this area, household income is also mixed, with many families scavenging from the dumpsite for their livelihood. In general, households rely on different combinations of BWD water, private delivery water, piped water from a protected (but contaminated) spring, bottled water, and (in the rainy season) rainwater. According to a local leader, about half of district households have BWD connections, another 45% are connected to spring water, and the rest primarily use private delivery water. Of note, the protected spring was initiated by a non-governmental foundation in 2000. Water is piped from the spring to a holding tank. Households then opt in to have a piped connection from the tank to their home and pay monthly water charges. Due to contamination from the dumpsite, the spring does not currently meet Baguio City Health Office standards for a safe water source.

Hillside has an estimated population of 1,735, with families of all income levels. The neighborhood is adjacent to a Baguio City watershed, and 20% of its land is forested. Hillside also has two protected springs which are used by almost all residents year round, to varying degrees. Spring water is publicly available at no cost, with Hillside residents making optional contributions to a spring water association for a maintenance fund. In 2010, these funds were used to build a flood wall, further protecting the spring from rainy season and typhoon damage. Per local leaders, the spring water has tested safe for drinking. Like in the other two neighborhoods, Hillside households tend to rely on more than one water source, including the spring, BWD, private delivery water, bottled water, and (in the rainy season) rainwater.

**Household Water Portfolios**

As suggested by the neighborhood descriptions above, each household in this study composes and holds what I call a "water portfolio" out of one or more sources to meet its domestic water needs (Table 2). Households adjust these portfolios seasonally or more frequently, including weekly and daily, in response to changing individual, household, and contextual conditions. These portfolios also reflect very deliberate household decisions about which water source to allocate to which use. These decisions seem to depend on multiple factors, including availability of rainwater; quantity, perceived quality, and accessibility of water from BWD, private delivery companies, and springs; and the amount of income available or budgeted for water purchases.

Table 2. All Household Water Sources, by Neighborhood (N=15)

| Water Source | Dominican Hill (N=5) | Irisan (N=3) | Hillside (N=7) | All (N=15) |
|---|---|---|---|---|
| Baguio Water District (BWD) | 1 | 1 | 2 | 4 |
| Private delivery water | 5 | 2 | 1 | 8 |
| Bottled water | 5 | 2 | 3 | 10 |
| Protected spring | 0 | 1 | 7 | 8 |
| Unprotected spring or stream | 0 | 0 | 1 | 1 |
| Rainwater | 4 | 3 | 7 | 14 |

Note: Households may report more than one water source.

In Dominican Hill, most in-depth interview participants (hereafter, participants) rely heavily on private delivery water for cooking, bathing, sanitation, and domestic cleaning, since BWD connections and springs are rare. During the rainy season, most participants substitute rainwater for some or all of their needs. As one female and low-income participant, who is married and responsible for most domestic tasks, describes:

> In the rainy season, we have a good life. We can do anything we want. We can even clean our cement floors, our chairs. We wash everything….In the dry season, there's limited water. You can't do whatever you want. We have to be very thrifty with water. With chairs and floors, we just wipe with a wet cloth. The C.R. [bathroom] smells bad because we are using laundry water. But you have to live with that. During rainy season, at least the C.R. has clean water.

In this neighborhood, each of the five participants reports bottled water as the primary household drinking source, in both rainy and dry seasons. Only one Dominican Hill participant reports drinking rainwater during the rainy season, and only as a non-preferred source if the household budget for bottled water and private delivery water has been consumed.

This year round consumption of bottled water is common across the three neighborhoods, and in Baguio City generally, among households of all income levels. This preference is one reason that household water expenses can, in some cases in this study, reach as high as 25.6% of monthly household income, as bottled water is much more expensive per unit than BWD, private delivery water, or spring water. Not surprisingly and consistent with research in other locations (Anthony, 2007; Gerlach & Franceys, 2009), lower-income households in this study tend to spend higher percentages of their monthly income on water than higher-income households.

Indeed, although some participants in Dominican Hill have very low incomes, they prioritize money for water (BWD, private delivery, and/or bottled water) in both seasons because they "have to." Several participants describe choosing to spend money on water instead of food for themselves and their families, in part because they have developed coping strategies to meet their other needs. As one female participant, in a low income household, states:

> Do I have to choose between water and food or other things? Every time! I choose water first. If there is no gas, I can use wood. For food, I can use my food stock [snacks sold at the school as a small business]…Even if I don't have money for water, I have to find it.

A male participant who buys private delivery water also notes:

> If I'm on a tight budget, water is the priority, because we can get food on credit from the *sari-sari* store. But with water, you cannot get a loan from the company. You have to pay up front. Water comes first.

For low-income families in the rainy season, one reason these critical decisions must be made is that men's informal income—often from manual labor—becomes more irregular as construction projects slow; hence, total household income often drops. In the dry season, meanwhile, households often need more money for water purchases, as they no longer have rainwater to substitute for some of their basic needs. Of note, this intersection of water and food insecurity may also relate to other assets and liabilities: the female participant above reports having to deplete stock from her small business as a coping strategy, and the male participant reports taking on debt with a local store in order to cope.

In Irisan, the three participants have very different water portfolios from each other. One relies primarily on a neighbor's BWD supply, another on private delivery water, and the third on private delivery water and piped spring water. On the safety of spring water, this latter participant notes:

> In the rainy season, you can see the Foundation [spring] water is brown. There's no problem with safety though, because of what we use it for.

Like others, this third participant deliberately allocates water sources for specific uses, in part due to perceived quality of each source: bottled water for drinking, private delivery water for cooking, and piped spring water for all other needs.

Interestingly, the participant who pays to use the neighbor's BWD supply is the only one in this study to report BWD water as the household's primary drinking water source. This seemingly uncommon decision may be because this household has very little income and cannot afford bottled water. At the same time, however, the household is relatively new to Irisan and Baguio City. While other poor households in this study may budget for bottled water in their portfolios because of long-held perceptions about BWD quality, this newer household may be less influenced by such perceptions. Instead, the participant (who is the female spouse and household water manager) seems to base her decision to consume BWD water on the fact that her family:

> …has not gotten sick from it. While people who drink the Foundation [spring] water say they get stomach problems and have to boil it.

In Hillside, many participants benefit year round from the protected spring previously described, which is publicly accessible with no user charges. At the spring, participants collect water in buckets and 5-gallon or smaller jugs for drinking, cooking, bathing, sanitation, and domestic cleaning. While Hillside participants of all incomes levels use the spring, some use it as a primary source for all water needs while others use it for emergencies (e.g., when their water tank runs out). Two Hillside participants also rely heavily on BWD water, which is the cheapest water source per unit in this study other than the Hillside spring, but both complain about decreasing supply over time and the current state of BWD as irregular and unpredictable, particularly in the dry season. One of these participants, a long-time female Hillside resident, describes:

> …our water supply…is scheduled for three times a week, not necessarily comes three times a week….When it's raining, then usually it comes. When the pump, the water station breaks down, or there is rotating brownouts, which we have during the summer, and then if the rotating brownouts occurs on Tuesdays, Thursdays, and Saturdays [our scheduled days], we don't have water.
>
> For summer, it would be a good week if we got even water once a week….If I get to fill [my tank] up full, even one day, then trying to, among us, conserving water, we're able to manage. But that means not flushing the toilet every time you go to the toilet, you know, and bathing with maybe one pail of water, and not every day.

Like the participant above, all study participants across the three neighborhoods describe numerous ways in which they "maximize" or conserve water, which also reflects how household water portfolios are constructed and adjusted: bathe less, wash dishes once per day, wash laundry once per week, reuse dish or laundry water for other purposes (e.g., sanitation, backyard gardening), collect used bath water in a basin for other purposes, and collect (in large water tanks, 55-gallon drums, or sometime any available vessel) and use rainwater for "everything other than drinking." These water portfolios seem to be carefully managed so that, for example, a household that relies mostly on private delivery water knows how to stretch two drums of water for one week during the dry season, and also knows how to use rainwater so that only one drum of private delivery water is needed per week during the rainy season. As described further in Section 5c, this also relates to gender dimensions of water, as women tend to be the household water managers.

Of note, none of the participants in this study report harvesting rainwater for the purpose of storing it until the dry season. By contrast, some participants report using rainwater in drums for a few days, then discarding the water and recollecting it, to try and minimize the spread of mosquitoes near their homes.

### Gender Roles and Relations

*Portfolio management*

Among married households in this study, in which the spouse resides in the home, the wife is considered the person responsible for managing the household water portfolio year round. This is consistent with the gendered division of household labor in many Philippine families, as mentioned above (Illo & Pineda Ofreneo, 1999).

Married female participants describe several ways in which they manage water portfolios, from regularly checking on the household supply of various sources, to reminding their husbands to place water delivery orders, to deliberately performing certain domestic tasks themselves (i.e., not letting other household members perform them) because they as women are the ones who "know how to maximize water," particularly during the dry season when water supplies from each source must be carefully managed. In some cases, women describe these responsibilities in terms of caring for their children, such as the following female participant who is from a higher-income family:

> In our family, it's always me. He's more on the financial end. I'm always the one who sees to it that we have enough. We have many kids, so water is very important to us. Especially drinking water. I always make sure there's enough in reserve.

Married women also tend to be the ones to stay home and wait for private delivery water or BWD to arrive, which is in part due to (and potentially a cause of) different labor market participation between these women and their spouses (i.e., men tending to have formal or more regular informal work, women tending to have informal and irregular work). In some cases, however, women negotiate with other women to secure their water delivery, such as the following individual:

> Someone needs to be home, yes, from each family when water is delivered. Usually this is the woman. If I can't be home because I'm selling [snacks at the local school], then I ask my neighbor to do my part, to make sure my drum gets filled. Then, next time, I'll be the one to stay home if she needs to go out when delivery comes.

During the dry season, private delivery water is ordered more frequently whereas BWD arrives more unpredictably. Due to both conditions, women's schedules may be more prone to water-related interruptions in the dry versus rainy seasons.

When a wife does not reside in the home, or two male relatives live together, the men assume water portfolio management by default.

*Money for purchasing water*

In this study, most household income comes from men—namely, male participants or the male spouses or extended relatives of female participants. While it is primarily men's income that seems to be used for water purchases, women in married couples are considered the money managers, responsible for budgeting for all household needs including water. This is consistent with research on gender and household budgeting in the Philippines in prior studies (Eder, 2006).

Several married female participants describe how their husbands "give all" their salary to their wives, keeping an "allowance" for themselves for transportation and other personal use. Women are then expected to manage the salary and make it last. While in some ways this may be a source of power and autonomy for women, women in lower-income families must often choose between spending on water and other necessities such as food, which may also become a source of stress. In general, women do not discuss such daily purchases with their husbands; they make the decisions themselves.

One male participant however, whose wife works overseas and who thus is responsible for water portfolio management, comments:

> If my wife were here, I would still be the one to decide these things, because I am the head of the family.

While not frequently mentioned in this study due to the gender distribution and marital status of participants (of the four male participants, only this one is married), the above comment seems to reflect more prevalent domestic gender relations in the Philippines. Namely, while relations are often

described as egalitarian and women have discretion over many daily decisions including water management, men may still perceive themselves as the final decision makers for their families.

*Carrying water*

Physically carrying water is one water management role that seems reserved for men in this setting. Men are routinely identified as the carriers of 5-gallon jugs of bottled water, and the primary carriers of buckets of water from springs. These men may be husbands, sons, nephews, and other relatives who carry water voluntarily (i.e., uncompensated, but often at the request of women who manage the household water portfolio), or even neighbors who are paid for transporting water back and forth.

The most common explanation for why men carry water more frequently than women is that "it is harder for women," especially if water needs to be carried up hill. While the *sari-sari* stores that sell bottled water are usually no more than a 5-10 minute walk from female participants' homes, male spouses are often asked to carry 5-gallon jugs back, for example, on their way home or after returning from work.

For spring water, all household members are expected to carry at least a small container or one bucket back from the spring if, for example, they go to the spring to bathe. So called "pitching" of water to fill a drum back at the house, however, which would require 10-20 round trips, tends to be a male responsibility. On this, one participant expressed concern for her teenage daughters' physical safety, if water needed to be carried back from the spring at night.

**Asset Types and Accumulation: Physical, Financial, and Social Capital**

In this study, participants describe several types of physical, financial, and social capital that are relevant for household water portfolio management and water insecurity reduction. Table 3 summarizes each asset discussed, its level of ownership, its role in helping families address their water insecurity, and any seasonal aspects of the asset or its function.

As the summary suggests, several forms of physical capital can help households obtain, store, and more readily use water, from all potential water sources. These assets are important in both seasons. In the dry season, for example, pipe connections, water tanks, drums, and/or buckets and smaller containers are essential for all households in this study. In the rainy season, these assets take on particular significance for storing water and increasing household supply of rainwater, as one male participant notes:

> When it's rainy, we are rich in water because we collect rainwater from the roof. We fill up everything that we can to catch water.

Further, both physical and financial capital can interact with social capital in interesting ways, to address household water security needs in either season. For example, in Dominican Hill, some participants must order private delivery water with a group of other families (social capital), providing a critical mass for the delivery company to sell them one tank of water, which is equivalent to 10-15 drums of 55 gallons each. Since purchasing one tank is beyond the means of any particular family in the group, the families pool their money so that each receives 1-3 drums of water per

order, also lending money to each other if a family is unable to pay. On the importance of lending money, several participants echoed the sentiment expressed by one low-income female:

> If one suffers, everyone suffers.

To store the water, however, participants or households must have their own drums (physical capital), acquired either through savings (financial capital) or through a neighbor or employer (social capital). In some cases, hoses (physical capital) are also needed to connect the delivery truck to the drums, if the group lives too far from a main road for the truck's hose to reach the drums. Individual families then use either buckets or hoses (physical capital) to transport water from the drums to their homes.

Not surprisingly, acquiring physical assets often requires savings, a form of financial capital. While prices vary, participants provided sample costs of key physical assets at ₱260 ($6) for a 10-meter hose, ₱600 ($14) for one drum (standard size, 55-gallon), ₱12,000 ($276) for one tank (varying size), and ₱15,000 ($345) for a BWD piped connection.

Since monthly household income in this study ranges from ₱800 ($18) to ₱80,000 ($1,839; see Table 1), saving for an asset such as a hose can require one-third of a poor household's monthly income. For some families, purchasing a drum—crucial for water collection and storage for most participants in this study in both seasons—can consume almost an entire month's income. And while BWD water is the most affordable source per unit of water (other than free spring water), the relatively expensive connection fee is a barrier for most families who may otherwise prefer BWD access.

As several families already report having to choose between daily water and food expenses, saving for assets that would help reduce water insecurity in either season seems challenging at best. Indeed, participants in this study describe a range of savings periods for different assets, from paying outright, to saving for weeks or years to purchase a hose, drum, or tank. Further, these physical assets deteriorate over time, requiring periodic reinvestment of savings to purchase or restore these assets anew.

Finally, the gendered nature of income among households in this study may also relate to gendered decisions about asset purchase. While married women report making everyday decisions about water purchases independently, they also report having to discuss larger water-related asset purchases with their husbands, asking or encouraging them to save for a particular purchase that would alleviate household seasonal water insecurity or the woman's own role in portfolio management. The practice of such joint discussion and decision-making is not itself surprising, particularly since men's income in this study would be the primary source of savings. Rather, the point calls for further research into how women and men may bargain over saving for water-related asset purchases, instead of using income or savings for other individual or household needs or preferences.

Table 3. Assets Relevant for Water Insecurity, with Seasonal Aspects of Each Asset or Function

| Asset | Ownership | Function(s) | Seasonal Aspect(s) |
|---|---|---|---|
| *Physical Capital* | | | |
| Cell phone | Private | Order private delivery water | More deliveries, dry |
| | | Call BWD to complain about irregular or insufficient supply | More complaints, dry |
| Modern stove | Private | More easily boil water than with traditional stove | More boiling, rainy |
| Bucket, other small container | Private | Store private delivery water, when drum needed for rainwater | More used, rainy |
| | | Store drinking water separate from other water | None |
| | | Store cooking water separate from other water | None |
| | | Transport water from spring to home | None |
| Hose | Private | Connect from spring/stream to home | None |
| | | Connect from water delivery truck to drum/home | None |
| | | Connect from drum to home | None |
| | | Connect from neighbor's roof to own drum | More used, rainy |
| | | Connect from neighbor's BWD to own drum | None |
| | | Connect rainfall collection system to water tank | More used, rainy |
| | Shared | Connect from water delivery truck to drum/home | None |
| Drum (55 gallon) | Private | Receive and store private delivery water | More deliveries, dry |
| | | Collect and store rainwater | Only rainy season |
| Water tank (10-15 drums) | Private | Receive and store private delivery water | More deliveries, dry |
| | | Receive and store BWD water | More consumption, dry |
| | | Collect and store rainwater | Only rainy |
| | Communal | Receive and store private delivery water | More deliveries, dry |
| Pipe connection | Private | Receive, store, and easily use BWD water | More consumption, dry |
| | | Receive, store, and easily use spring water | None |
| Home | Private | Motivate saving for BWD connection, since home is permanent | More consumption, dry |
| Wall | Communal | Further protect spring from creek flooding, typhoon damage | Only rainy |
| *Financial Capital* | | | |
| Savings | Private | Purchase specific form(s) of physical capital needed for water ordering, collection, storage, and use: cell phone, modern stove, bucket, other small container, hose, drum, water tank, pipe connection, home | Varies |
| | | Contribute funds for spring protection | None |

| | | | |
|---|---|---|---|
| *Social Capital* | | | |
| Neighbor relations | Private | Provide connection to BWD water via hose | More consumption, dry |
| | | Provide critical mass for ordering private delivery water as a group | More deliveries, dry |
| | | Lend money for purchasing private delivery water | More deliveries, dry |
| | | Lend or give water | More frequent, dry |
| | | Lend or give drums or tanks | None |
| | | Provide employment by paying for carrying water | More frequent, dry |
| | | Provide motivation to contribute funds for spring protection | None |
| Employer relations | Private | Lend or give drums or tanks | None |

Note: Private means owned by one individual or household. Shared means jointly owned by two or more households. Communal means owned by a community association or considered communal property.

## Discussion and Future Research

This study is one of few in the empirical literature to date that focuses on social dimensions of seasonal water insecurity in urban areas, and particularly in non-megacities, which are growing rapidly in many countries worldwide. While the study's purposive sampling methods and small sample sizes do not permit generalization to the study neighborhoods or Baguio City at large, findings do suggest that individuals and households in this study manage complex water portfolios. Everyday, women and men make critical decisions about water collection, purchase, allocation, and consumption in response to changing individual, household, and broader contextual factors. Seasonality can also affect urban water supply, safety, and accessibility in complex and non-uniform ways.

While survey-based, nationwide measures of access to an improved source of water are essential for assessing some basic human right and public health aspects of water security (Gleick, 1998; United Nations Development Programme, 2006), such measures cannot capture the complexity of water sources, uses, and decisions that individuals and households regularly manage (Satterthwaite, 2003), and which can only be understood through more fine grained, microlevel research such as the approach here. Indeed, while all participants in this study had some access to a water source that national measures would consider improved (BWD, a protected spring, or rainfall), most chose to purchase a non-improved source for their drinking water (bottled water), due in part to concerns about water quality. In addition, access to improved sources may vary seasonally, which is not captured by most national or even regional aggregated statistics: BWD is irregular and unpredictable during the dry season, protected springs may become flooded and potentially unsafe during rainy seasons, and rainwater is only available during rainy seasons since, in this study, it is not harvested and stored for longer periods of time.

Often, female spouses are responsible for managing water portfolios—ensuring that households have enough water from particular sources based on safety, affordability, and accessibility—which is consistent with broader domestic gender roles often found in the Philippines (Illo & Pineda Ofreneo, 1999). Responsibility for portfolio management, however, seems to depend on overall household structure. In addition, lower-income household water managers—regardless of gender—often face difficult decisions that pit household water security against food security. In Baguio City, while there are some public programs that provide food assistance, there are no current programs, according to the leaders and officials interviewed for this study, that provide water-related assistance. At a minimum during the dry season, such water-related support could be considered by the same agency that administers emergency food support: the Baguio City Department of Social Welfare and Community Development.

While calls for integrating gender into water and/or climate research often, understandably, call for greater recognition of women's voice and experience (e.g., Denton, 2002; Wallace & Porter, 2010), this study also highlights the importance of understanding both women's and men's water-related needs, roles, and responsibilities, as gendered similarities and differences may be informative for policy and program development. Further, such gender analysis should carefully consider how gender interacts with other characteristics such as income, marital status, and household structure, avoiding the tendency to discuss women and men as two homogenous groups. This conclusion echoes those in more recent gender and feminist scholarship, which call for more gender disaggregated data in the area of water and climate, and for analysis of gender's intersection with

other key demographic characteristics with regards to any social problem or phenomena (Demetriades & Esplen, 2010; Lorber, 2010; O'Reilly, Halvorson, Sultana, & Laurie, 2009; Ray, 2007).

On assets, this study identifies specific forms of physical, financial, and social capital that seem to matter for reducing household water insecurity in the study neighborhoods. In addition, the study hints at possible gendering of assets, as most household income (the source for financial savings and physical asset acquisition) here comes from male employment. Also, it may be that women are more responsible for building and maintaining social capital with neighbors, whereas men may have more social capital with employers in this study. Assets and gendered assets for water insecurity are areas ripe for more research, given the potential public policy role in strengthening and addressing inequalities in asset ownership and distribution.

As water and climate-related policies are shaped, local context and variation among and within households should be considered, with attention to everyday water experiences and coping strategies of different women and men, and the influence of gender roles and relations on household water insecurity in both rainy and dry seasons. To inform such policies, promising questions for future research include:

1. For urban areas like Baguio City, what would a resilient household "water portfolio" for the rainy season look like? How might this resemble or differ from a resilient water portfolio for the dry season?

2. As individuals and households construct water portfolios, what are the relative contributions to their decision-making of individual, household, and broader contextual factors; and of quantity, perceived quality, and accessibility of water by source?

3. How can public policies support the tradeoffs and tensions that households may face in ensuring both water and food security for their families?

4. How can public policies support those assets identified as critical to reducing water insecurity in the rainy season, and in the dry season, respectively? In what ways are those assets gendered, and how might such gendering matter for effective public policy design and implementation?

New empirical research on questions like these is necessary if we are to develop and implement water, climate, and development policies that are responsive to people's lived experience of seasonal water insecurity and effective at helping them thrive under changing social and climate conditions.

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