Annexes—Overview

A. Case studies

B. Methodology

C. Additional details on results

D. Bibliography

C.1 Financial returns by use
C.2 Poverty impacts
C.3 Market mapping

C.1 Financial returns: home gardens

Estimated annual income generated per m2 of home garden: $0.03 - $3.30/m2

- Median: $0.67/m2
- Mean: $1.08/m2
- St. Dev: $1.06/m2

For traditional or seasonal gardens or where home consumption is very high, the annual returns may be reduced by 60-70% or more

Amount of income generated depends on a number of factors:

- Extent of home consumption
- Intensity of production
  - traditional garden to highly developed garden
  - seasonal –vs.- year round garden
  - availability of water and method of water application
  - availability, cost and quality of other inputs (land, fertilizer, seeds)
- Market access and local prices

Water use and returns:
Home gardens require between 3 - 8 liters per m^2 per day during the growing season.

Estimated returns: $0.01 - $1.82/$m^3$ of water
Median: $0.37
Mean: $0.61
St. Dev: $0.58

C.1 Financial returns: home gardens

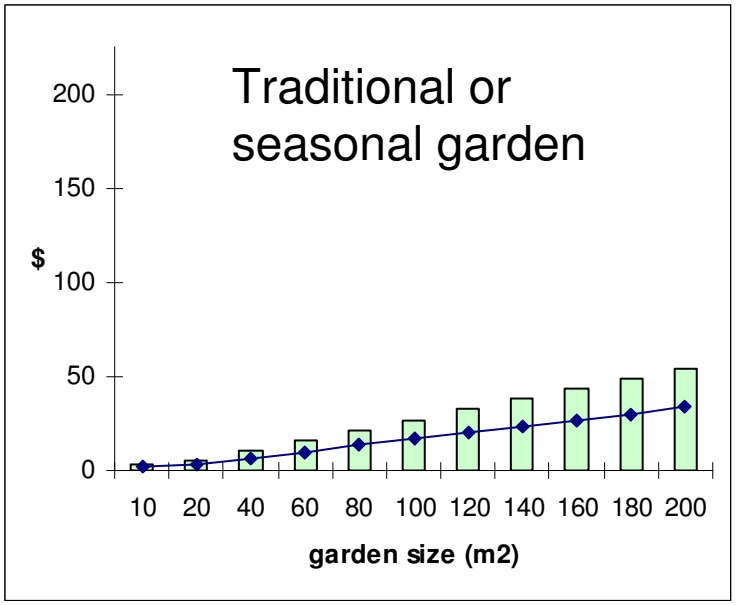
Home gardening has the potential to generate income to pay for water services while improving food security and nutrition.

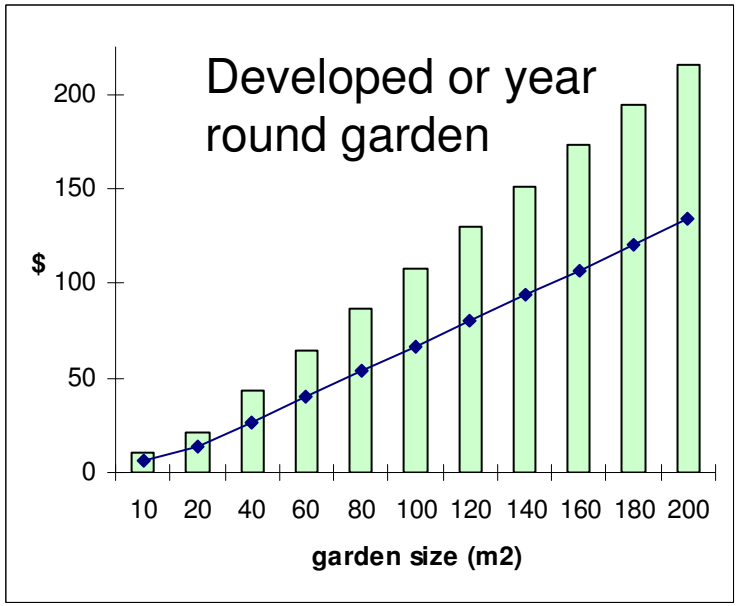
In many areas, home gardening is a seasonal activity, while in others it's a year round activity.

Access to water influences the extent and productivity of a home garden:

- Vietnam: 48% of households in water secure villages (Basic MUS service level) had household gardens, while only 11% in water scarce villages had them.
- South Africa: 45% of households in water secure villages (intermediate MUS service level) had households gardens while only 14% in water scarce villages had them.

In a survey of over 45,000 households in Bangladesh, Heller Keller International found that an average-sized home garden of 40 m2 generated $16 income per 2 months ($96/year) plus provided for home consumption. The average cost per garden was $3 per year (plus, if needed, an additional $12 for water-related investments such as treadle pumps)





Sources: Bangladesh: HKI (2001)
Vietnam: Noel (2007))
South Africa: Perez de Mendiguren (2003)

C.1 Financial returns: Water service levels and home gardens

Bushbuckridge, South Africa:

Characteristics	**Basic domestic**: Unreliable public taps, some distant and w/ long waits Average use: 23.3 lpcd	**Basic/Intermediate MUS**: Reliable household and yard taps, some communal taps Average use: 40.4 lpcd
Percent of households with home gardens	14%	45%
Average annual gross returns to home gardens & fruit trees	$0.60 m2	$1.08 m2

In Bushbuckridge, improved access to water increased both the number households with home gardens and average return (see Annex A for further details)

Uda Walawe Irrigation scheme, Sri Lanka

Characteristics	**Intermediate MUS**: Mostly shallow groundwater wells in yard recharged from irrigation system
Percent of households with home gardens	28% (estimated)
Average annual gross returns to home gardens & fruit trees	$0.11 m2 ($435/yr for typical .405 homestead area)

In Uda Walawe irrigation scheme, water from unlined irrigation canals provide both the opportunity for shallow homestead wells. These wells combined with sub-surface drainage from the irrigation system provide water for homestead gardens, generating an average of $400/yr of additional income. This income is under the control of women, who use it for education, health care and to generate savings for major expenditures such as dowries. (see Annex A for further details)

Sources: Sri Lanka: Molle and Renwick (2005)
South Africa: Perez de Mendiguren (2003)

C.1 Financial returns: Livestock

Estimated annual income generated for livestock based on a review of the literature:

	Mixed cattle, sheep & goats	Goats	Chickens
Range	-$8-61	$1.30-$3.4	$6-$10
Median	$18	$1.30	$7.60
Mean	$25	$2.00	$7.60
StDev	$21	$1.20	$2.00

Amount of income generated depends on a number of factors:

- Intensity of production
  - extensive vs. intensive production
  - availability, cost and quality of other inputs (including water)
- Market access and local prices
- Extent of home consumption

Water use and returns:

Type	water use	mean ($/m3)	median($/m3)
Mixed cattle/	**25 lpcd**		
Goats/sheep	**5 lpcd**	**1.11**	**0.67**
Goats		**0.45**	**0.29**
Poultry	**0.3 lpcd**	**26.22**	**26.33**

C.1 Financial Returns: Water service levels for livestock

Gujarat, India:

Avg. net returns (excluding non-cash costs for labor and fodder)	**Basic/ Intermediate MUS**	**No Service**
Dairy cow:	109/yr	5/yr
Dairy buffalo:	317/yr	89/yr

In Gujarat, India, access to water was a critical determinate in income generation for dairy production. Households with better access to water generated returns more than 300% greater than those without.

Access to water may increase productivity and income generation potential, however, the evidence on linkages between access to water and livestock holdings is mixed.

For irrigated areas, the density of livestock holdings is higher than rainfed areas. However, among communities relying on domestic schemes for water, the picture is less clear. Two examples typify the findings. A survey of productive uses of water in Vietnam reveal that 53% of households in water secure villages had livestock versus only 22% in water scarce villages (Noel, 2007). However, in similar type of study in South Africa, both water secure and unsecured households were equally likely to have cattle (20%) but water insecure households were more likely to have goats (31% of households) than water secure (20%).

Sources: India: Upadhyay, 2004
South Africa: Perez de Mendiguren (2003)
Vietnam: Noel (2007)

C.1 Financial returns: Small scale enterprises

Estimated annual income from small scale enterprises*

- Range: $21-150
- Median: $67
- Mean: $76
- St. Dev: $41

Small scale enterprises tend to be seasonal and generate low returns, but they are crucial for income security, especially for the poorest

Income for example small scale enterprises

- Beer brewing: $90 – 120/yr
- Ice block making: $22 – 56/yr
- Tea making: $34 – 113/yr
- toddy tapping $150/yr
- Rice wine/cakes: $4-7/day
- Brick making: $90 – 122+/yr

Income generation and small scale enterprises:

- Tend to be informal seasonal (2-4 month/yr) or intermittent (weekly or monthly) activities, although some year round that provide supplemental income
- Usually require limited investments, relying heavily on non-cash inputs (such as labor, feral materials) and generally operate at a loss if non-cash costs are included
- Based on case studies reviewed, 5-15% of households were engaged in small-scale water dependent activities
- Higher returns per unit of water than livestock or home gardens

* Estimated returns should be interpreted with caution as they are based on a very small sample

Bushbuckridge, South Africa:

Water service level	**Basic domestic**: Unreliable public taps. Average use: 23.3 lpcd	**Basic/Intermediate MUS**: Reliable household and yard taps, some communal taps. Average use: 40.4 lpcd
% of households engaged in SSEs		
Brewing	2%	2%
Ice blocks	6%	13%
Brick making	40%	57%
Water use (avg lpcd)		
Brewing	17	28
Ice blocks	1.3	0.5
Brick making	3.3	5.5
Income generation (yr)		
Brewing	$91	$122
Ice blocks	$56	$22
Brick making	$34	$57

Sources: South Africa: Perez de Mendiguren (2003);
Vietnam: Noel (2007)

Income Benefits: Vietnam

•Basic MUS villages make higher profits from water-dependent micro-enterprise such as griddle cakes and rice wine. Although these profits are still small they are crucial to income security and use labour that would otherwise be idle.

•Griddle cakes: profits from US$4.83 to US$11.17/day

•Rice wine: profits from US$3.50 to US$6.52/ day

Livelihood Benefits

Presence of water source of adequate quantity and quality almost quadrupled the number of water-dependent micro enterprises. On average:

- •Basic MUS villages have 4.6% of HHs involved in micro-enterprises
- •No Service villages have 1.2% of HHs involved in micro-enterprises

Examples of types of businesses:

- •Food Items: rice-based wine, noodles, cakes; tofu and tofu juice, tea, ice
- •Services: hairdressers, motorbike washing, tea shops and small eateries

C.2 Poverty Impacts: Home Gardens Example Evidence

Food Security	Home gardens increase total consumption, improve nutrition, reduce the duration of periods of under-consumption, and otherwise improve food security. ➢'Improved' home gardens **meet more than 50% of household vegetable and fruit needs** (Marsh, 1998). ➢Assured irrigation and/or integration with livestock rearing multiplies the food security and nutrition value of home gardens (HKI, 2001; Pant et. al., 2005). ➢In Nepal, daily vegetable **consumption increases by 70%** in poor households with less than 0.5 ha of land that participate in MUS by Design schemes (Pant et. al., 2005). ➢Irrigated communal gardens improve food security in drought prone areas in Zimbabwe with large numbers of HIV-AIDS affected and/or landless households: member households **consume vegetables 5.5 days a week as compared to 2 days** prior to the scheme (Waughray et. al., 1998; Matthew, 2003). ➢In Vietnam, home gardens enable a more balanced diet and ensure minimum food availability ,especially in pre-harvest "hungry" seasons or when field crops fail (Noel et. al., 2007).
Livelihoods Diversification	Water services upgrades for home gardens free up labor inputs for other productive activities. ➢In Nepal, 43% of women who received upgraded water technologies for home gardens used the time they saved in other production activities (Pant, 2005; WI, ongoing) ➢In South Africa, the poorest households in 13 villages doubled the number of economic activities they participated in when they upgraded to intermediate-level multiple-use schemes (Perez de Mendiguren, 2003; Perez de Mendiguren and Mabalane, 2001; Soussan et. al., 2002) ➢Communal gardens are a **critical source of livelihood** for the landless poor, especially in sub-Saharan Africa, where communal farming is a common practice (Waughray et. al., 1998; Marsh, 1998)

C.2 Poverty Impacts: Home Gardens Example Evidence

Health & Nutrition	➢In Nicaragua, households with the smallest farms (0-0.70 ha) and the lowest incomes (US$102.80/capita) achieved the greatest benefits in food security and nutrition (Alberts and van der Zee, 2003). ➢Income from improved home gardens in Zimbabwe provides enough income for a family of five to purchase **83% of the recommended cereal ration** for a month (Mathew, 2003). ➢Home gardens integrated with poultry production improve nutrition and increase consumption of micro-nutrient rich foods in the most vulnerable and food insecure regions in Bangladesh (HKI, 2001). ➢In multiple-use services project areas in Bangladesh, year-round **dietary diversity increased by 20% for women and 29% for children** under 5 and **night blindness decreased by about 50% for children** under 5 (HKI, 2001).
Social Equity & Empowerment	Home gardens provide the greatest benefits to women, poor households, and other vulnerable groups. ➢In Nicaragua, the poorest households consume the most home garden produce and save the most on household food expenditures. In sub-Saharan Africa and Bangladesh, home gardens provide the greatest benefits to marginal farmers (those with less than 0.5 ha), the elderly with grandchildren (in HIV/AIDS-affected households in South Africa and Zimbabwe), and women in poor households (Alberts and van der Zee, 2003; Mathew, 2003; HKW, 2001; Waughary et. al., 1998; Marsh, 1998). ➢Household food security and income from home gardens lead to positive gender outcomes. Women in Zimbabwe said: “If I give up my plot, I’d be giving up my future” (Waughary et. al., 1998). ➢Improved community ownership and management of garden systems is both a process and achievement in social empowerment. In Zimbabwe, 80% of project participants identified themselves as decision-makers regarding water scheduling and allocation and maintenance requirements (Waughary et. al., 1998).

C.2 Poverty Impacts: Livestock Example Evidence

Food Security	Livestock activities improve food security, especially during periods of food deficits. ➢In Nepal, dairy buffalo rearing supported by improved water supplies **reduced periods of food deficits from eight months to two months** per year, and **inadequate food intake for villagers fell from 50% to 18%** during the year (Thomas-Slayer and Bhatt, 1994). ➢ Providing water to support livestock-keeping enhances food security during lean times in Ethiopia (Ravnborg et. al., 2007). ➢In Bangladesh, 40% of children in households with integrated home gardens and livestock rearing consumed eggs on three or more days per week, 25% higher than the national average (HKI, 2001).
Livelihoods Diversification & Well-Being	Livestock activities made possible by water services improve women's well-being and diversify their livelihoods. ➢Improved access to higher quality water increases livestock productivity and reduces the amount of time women spend fetching water. In Ethiopia, improved water systems **saved women four to six hours**, enabling them to organize into women's milk groups and conduct business in the market (van Hoeve and van Koppen, 2005). ➢Female heads of households use livestock to cover larger expenditures like medical care, school fees, or bride prices for marrying daughters (van Hoeve and van Koppen, 2005). ➢In India, families use extra money from livestock to upgrade basic living conditions (Upadhyay, 2004).

C.2 Poverty Impacts: Livestock Example Evidence

Health & Nutrition	➢Multiple-use approaches that provide separate livestock water supplies **reduce the incidence of diarrhea among children** in Ethiopia by eliminating cross-pollution of water sources (van Hoeve, 2004). ➢When pasteurized, the milk of cows, goats, sheep, and camels provide an **important source of nutrition** for people in Ethiopia, improving physical health (van Hoeve and van Koppen, 2005). ➢Evidence from India suggests that cash income from livestock has a multiplier effect in its use for children's medical needs, thus improving their health (Upadhyay, 2004).
Social Equity & Empowerment	➢Experience from women's dairy cooperatives in India demonstrates that livestock rearing **can increase household bargaining power**, leading to self-empowerment. Women, however, continue to bear a disproportionate share of the livestock rearing burden (Upadhyay, 2004). ➢In Nepal, close proximity of the water tap has led to men starting to fetch water and manage livestock. Previously, women had to fetch water even for use by men (Pant, et. al., 2006). ➢Where livestock is the only asset of the poor, animal water provisions **benefit the poor disproportionately** and contribute significantly to poverty reduction (Ali, 2000)**.**

Livelihoods Diversification	➢In India, women use extra income from SSEs for household expenses, education, childcare, and to serve as a buffer during crisis times (James et. al., 2002). ➢Irrigation water stored in tanks in Morocco (Boelee and Laamrani, 2003), and yard taps in South Africa (Perez de Mendiguren, 2003) increases the number of small-scale brick-making enterprises, which provides housing construction and repair services that would otherwise have to be bought ➢Improved water supply in India **saves 1.1 hours of women's time** in the summer and **3.6 hours** in non-summer, freeing up time for livestock rearing, garment making and other micro-enterprises (James, 2003). ➢Intermediate-level multiple-use services in South Africa enables households to conduct high-productivity small-scale home enterprises and rely less on poor-production livelihoods (Soussan et. al., 2002). ➢SSEs often use labor that would otherwise be idle. In Vietnam , SSEs **provide livelihoods for 9 months** out of the year (Noel et. al., 2007). ➢Higher service levels enable households to engage in **more micro-enterprises**. In Vietnam, villages with basic-level water services have four times as many micro-enterprises as villages with no services (Noel et. al., 2007). ➢Storage tanks added to irrigation canals allow **diversification of agricultural activities** (fisheries, duck rearing, social forestry, etc.) in India (Palanisami and Meinzen-Dick, 2001). ➢In India, local brick-making is a **predominant livelihood for the asset-less rural poor**, especially during periods when agriculture requires little or no labor. Brick-making requires low cash investments and has assured returns (Palanisami and Meinzen Dick, 2001). ➢Higher service levels in Zimbabwe led to the traditional revolving fund being used for **200 livelihood and income diversification initiatives** like tree-growing, pottery, knitting, and clothing sales. Originally, the fund was used only for basic needs (Waughray et. al., 1998) ➢Some SSEs (such as beer brewing in South Africa) are perceived as an **indication of poverty**, so households would only conduct them if no other income option existed (Perez de Mendiguren, 2001).

C.2 Poverty Impacts: Small-scale Enterprises Example Evidence

Health & Nutrition	➢Safe water for food-based SSEs **has multiplier effects on household and community health** in South Africa. For example, sorghum porridge, made and sold by women, provides good nutrition at low cost (Perez de Mendiguren, 2001).
Social Equity & Empowerment	➢Women gain proportionally more from SSEs made possible by improved water services. In Zimbabwe, most women involved in SSEs such as beer-brewing, brick making and food shops are family heads or widows (Matthew, 2003). In Malawi, women heads of household conduct brick making and beer making activities (Mulwafu, 2003). ➢Women in enterprise households in India are more involved in the management of community water resources and have greater control of financial and social resources. Small-scale enterprise production also encourages **social networking** (Verhagen et. al., 2004)

Distance to water source is an important determining factor for multiple uses. As distance increases, the quantity of water used for productive activities decreases.

Service level	sub-Saharan Africa	South Asia
	(population by 1,000s)	
Water source w/in 15 minutes roundtrip (improved and unimproved sources)	153,297	654,778
Total rural population	467,135	1,068,873
Percent of rural population within 15 minutes roundtrip	(33%)	(61%)

Source: DHS, various years

- DHS survey data show the percent of households with access to their primary domestic source within 15 minutes round trip (including any waiting time to fill)—less than 500 m.
- Percentages for rural populations based on DHS survey data were used in conjunction with 2004 rural populations to estimate populations
- **These data suggest that distance may be a significantly more limited factor for multiple uses in sub-Saharan Africa than South Asia.**

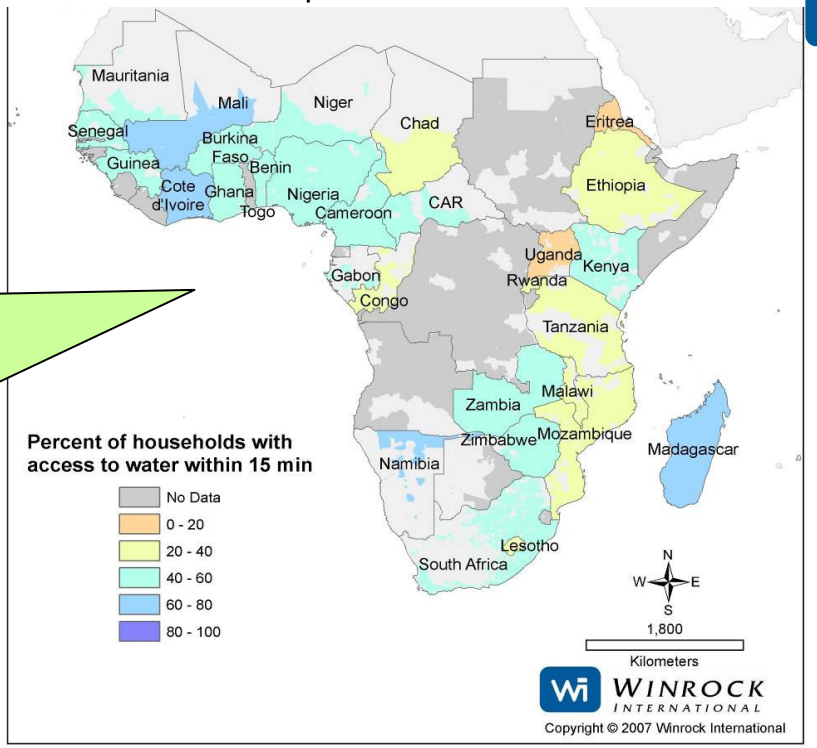
Note: DHS data don't distinguish between improved and unimproved sources, so these data are not directly comparable to JMP data.

C.3 Market Mapping: Domestic+ time to source

While in South Asia, over 60% of households have water within 15 minutes (and median time to source 5 minutes), in sub-Saharan Africa, 30% of households have access to water within 15 minutes (< 500 m). Overall, there is much more variability in median time to source in sub-Saharan Africa. As distance increases, multiple uses of water will decrease. Transporting 200 liters/day takes 50 minutes at distance of 5 minutes RT and 200 minutes at a distance of 15 minutes RT.

A significant knowledge gap is a good understanding of how much water people are willing to haul to support productive activities.

Percent of households with access to water within 15 minutes roundtrip



Median time to source (minutes)