The Implications of Environmental Degradation for Human Capital: Children's Time Fetching Water and Firewood in Tanzania

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Introduction. Cross-sector analysis and collaboration is a goal of governments and major funders of development projects in low-income countries, yet many connections across sectors remain to be made. We argue that in many poor countries there is a substantial connection between human capital accumulation – via children's educational success – and environmental degradation. We use a case study involving residents of two villages in rural Tanzania to explore whether children's responsibilities for fetching water and firewood are a link in a chain connecting human capital and environmental conditions or natural capital.

Background. Water is the most basic of all human necessities, and firewood or charcoal for cooking is a close second in many parts of the world, including much of sub-Saharan Africa. As populations increase, demands for firewood and water grow along with them. As populations aspire to better lives and greater comfort, demands for water and wood for a variety of purposes grow even faster. Forests are degraded or destroyed, and, as the ecosystem is affected, nearby water sources dry up for all or part of the year.

Tanzania is experiencing one of the highest population growth rates in the world, at 2.9 percent as of 2012. Combining this with the large population size and youthful age structure, it is expected that Tanzania will continue to experience a fairly high population growth rate for the foreseeable future. This, along with a continued high incidence of poverty despite relatively strong economic growth in recent years (GDP growth of 5 to 7% since 2000), exacerbates water scarcity by placing additional pressure on limited water resources, land and forests.[1] Many children in rural areas of Tanzania spend an inordinate amount of time fetching water and firewood. While increasing attention is being paid to water scarcity problems and the depletion of Tanzania's wood fuel sources, the interaction between natural resource scarcity and human capital development has, in large part, been overlooked. Yet, as Frances Vavrus writes,

> For people living on or near the margins, anything that makes life more difficult can push schooling further out of reach. In a community largely dependent upon agriculture, scarce or expensive water can do exactly that. Water can have the indirect effects of cutting into enrollment and attendance, of blunting the power of schooling, in other words, before that power has had a chance to work. If we want to more fully understand what schooling can and cannot accomplish in the Third World, then we have to appreciate more fully the relevance of something as unrelated as water.[2]

The importance of education to economic development and improved quality of life is widely acknowledged. During the early post-colonial period, the government of Tanzania placed

[1] Falkenmark, M. and C. Widstrand. (1992). "Population and Water Resources: A Delicate Balance," *Population Bulletin* 47(3); Poverty and Human Development Report (2009).
[2] Vavrus, Frances (2003) Desire and Decline: Schooling Amid Crisis in Tanzania, NY: Peter Lang, p. 109.

considerable emphasis on education with enrollment rates, especially at the primary school level, increasing substantially. In contrast, the 1980s and 1990s witnessed a sizeable decline in school enrollment rates, with the gross primary school enrollment rate falling to about 63 percent by 2000 from nearly universal at its peak. The country still recognizes that provision of quality education is central to achieving socioeconomic development and, like other countries, has made commitments to meeting targets set by Education for All (EFA) and the Millennium Development Goals (MDGs).[3] As a result of these efforts, progress has been made in increasing the primary school enrollment rate in recent years. Nonetheless, there is growing concern about late age of school entry, school dropout, and the quality of education received.[4]

While there are numerous factors contributing to these concerns, many of which have been studied, little attention has been given to the potential impact of the value of children's time to the household economy as fetchers of water and fuel, especially in rural areas where basic infrastructure is less well developed and natural resources are spread increasingly thinly. Household demand for child labor related to meeting water and fuel needs may interfere with school attendance, with study time and, ultimately, with the ability to learn and progress through school. Moreover, children's valuable time at school is sometimes spent gathering water for their school. As the authors have observed, even urban children in Tanzania may be required to go to school with a bucket or jug, to be used later during the school day as they set out for the nearest ditch or stream with running water. This is one more way that water scarcity may lead to decreased learning. All of these dynamics could become increasingly important contributing factors to poor educational outcomes in Tanzania, as high rates of population growth place increasing pressure on the natural environment. While human capital development is a critical component in addressing the threats to the natural environment it, at the same time, may be compromised because of them.

Data and Methodology. We rely on data from four sources. First, we use data collected in 2010 as part of the Whole Village Project (WVP), a partnership between the University of Minnesota and Savannahs Forever Tanzania (a Tanzanian NGO engaged mainly in survey research). One of the authors of this proposal, Deborah Levison, was a collaborator on the 2010 data collection. These data provide a wide variety of descriptive baseline information on a random sample of households in 13 villages in northern Tanzania but did not include detailed questions about children's schooling or how the household's water and fuel needs are met.[5] Second, we returned to two of those villages in 2011 (Kelema Kuu and Mnenia), chosen purposively in part to generate variation in access to water and firewood, and re-interviewed selected members of all households with youth ages10-17. Specifically, we interviewed youth ages 10-17 and their mothers or female guardians in August 2011.[6] The re-interviews served both to update basic information about the sample households (the 2010 and 2011 data can be linked), and also to collect data not gathered in the 2010 survey, including information about

[3] United Republic of Tanzania (2006) *Education Sector Review.* Dar es Salaam, Tanzania.
[4] Bommier, Antoine and Sylvie Lambert (1997) "Education Demand and Age at School Enrollment in Tanzania," manuscript; Kondylis, Florence and Marco Manacorda (2006) "Distance to School, School Attendance and Child Labor Evidence from Rural Tanzania," manuscript; Mason, Andrew D. and Shahidur R. Khandker (1996) "Household Schooling Decisions in Tanzania," manuscript; URT (2006); Vavrus 2003.
[5] The Whole Village Project data are available via the Minnesota Population Center.
[6] The authors thank the University of Minnesota for funding from an OIP 2010 International Collaborative Seed Grant for small-scale exploratory projects to support the 2011 data collection.

children's enrollment in and experience at school, and their participation in the collection of water and wood for their households. We used parallel modules on these key topics that asked comparable questions of the mothers about the children and of the children themselves. In addition, mothers were asked summary questions regarding the household's collection of water and wood. The sample size for the more detailed 2011 survey is 57 households and 117 children ages 10-17. Third, we conducted gender- and age-specific focus groups in each of the two villages, using guided but open-ended questions about children's experiences related to schooling, about why children leave school, and about children's roles as fetchers of water and wood. Finally, we visited the schools in the sample villages and collected information about the children's attendance and rank in class for all enrolled children with records available.[7]

Using these various data sources, we aim to ascertain whether there are patterns in the data regarding three issues: 1) which children are enrolled in school, and how do they differ from those who are not enrolled; 2) which children participate in the fetching of water and gathering of wood (and, if so, to what extent); and 3) are there systematic relationships between these two behaviors? We are particularly interested in identifying the challenges that rural Tanzanian children face to staying in school, and whether the demands on children's time to provide water and fuel wood for their households (or schools) appears to be an important aspect of these dynamics. We will employ simple statistical techniques to measure bivariate associations across variables, for the total sample and within each village separately. In addition, we plan to estimate very simple (because of the small sample size) multivariate regression models to further explore patterns in the data. Finally, we have used the NVIVO software to help isolate themes in the focus group discussions.

Preliminary Findings. Preliminary analysis of the 2011 survey data shows that nearly 80 percent (78.07%) of our sample of 10-17 year-olds are currently enrolled in school. Enrollment rates are higher for younger children (90% for 10-14; 50% for 15-17) and for girls (85.71% for girls; 68.63% for boys). The data also show substantial involvement of children in the collection of water and wood for household use. A large majority of the sample children (78.07%) fetched water on at least one day during the week prior to the survey. Of these children, the most common responses were to fetch water on two or three days in the past week (57.31%), but with somewhat more than one-quarter (26.97%) doing so on five or more days. The data also show that on days during the past week when children fetched water, they typically made more than one trip to their primary water source. Some water sources are relatively close by, with a typical round trip taking half an hour or less for 44.19 percent of children. However, for others it is a considerably more time-consuming chore, with 31.4 percent taking approximately one hour, and the remaining 24.42 percent taking at least two hours per trip. Accounting for total trips to a water source in the past week, the average time spent fetching water during the week for those children who participated in this activity was about 10 hours (9.97 hours), but with substantial variation (std. dev. of 14.59 hours). Approximately one-third of the sample (33.72%) allocated only two or fewer hours to this task during the past week, while nearly one-quarter (24.42%) spent 10 or more hours fetching water.

[7] Unfortunately, the school records are not complete, so we have the school-based information for only a sub-set of our sample.

Regarding the collection of wood for household use, nearly three-quarters (73.4%) of sample children participate in this activity in general. Of those who take on this chore, 65.22 percent (or 47.87% of the total sample) collected wood during the week prior to the survey. Because gathering fuel is a more sporadic activity than fetching water, we used a reference period of the past four weeks to obtain information about the usual amount of time required for one round-trip. The most common response, at 31.75 percent, is three hours per trip, with approximately one-quarter (26.98%) indicating that it takes less than three hours per trip and another one-quarter (25.4%) taking five or more hours per trip. Combining this information on usual time per round-trip with the number of trips made in the past week, we derive an estimate of time spent on gathering wood in the past week. Here we also see evidence that this is a time-consuming activity for many children, with an average of nearly eight hours per week (7.71 hours) among those who engaged in this activity during the reference week. There is also considerable variation in time allocated to this chore during the week (std. dev. of 5.96 hours), with 18.6 percent at two hours or less and 27.9 percent at ten or more hours.

The descriptive statistics cited here suggest that the children in our sample devote considerable and varying amounts of time to fetching water and gathering firewood for household use. Our ongoing research will explore whether these patterns correlate with school enrollment or selected schooling outcomes. In addition, the qualitative data from the focus group discussions speak to the potential negative consequences of environmental pressures for human capital development. While children felt positively about contributing to their households by performing these chores, as exemplified in the following quote,

> *I do like fetching water and collecting firewood because if we do not collect firewood we will not get firewood for cooking so we will not eat. In addition, if we do not fetch water we will not have water for cooking, washing, etc.,*

a number of children pointed to the time-consuming nature of this work when asked what they would change to make it easier to be in school:

> *Firewood should be brought closer or substitute of firewood so as I don't get tired…*

Similarly, the following quotes (one from each village) are representative of views expressed by several children, primarily boys, about expectations to perform these chores for their schools.

> *It is true that we bring water and firewood to the school from our homes. We are punished if we fail to do that.*

and

> *Some students do not attend school because of the failure to bring to school water and firewood. When we fail to bring water and firewood to school, we are caned or sent to fetch water during the class hours.*

Closing. This analysis is exploratory, based on a relatively small sample, but the topic is large and potentially very important. Presenting the findings of this exploratory analysis at the 2014 meetings of the Population Association of America would provide valuable feedback to our efforts to understand the patterns in our current sample data, and to our thinking about possible directions for building on this research.