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Spreading the water wealth

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Spreading the Water Wealth: Making Water Infrastructure Work for the Poor*

Patrick McCully and Lori Pottinger**

Want of clean water, decent sanitation, and adequate food and energy strips people of their dignity and their most basic rights. Inequitable access to water, especially for growing crops, is a major factor in global poverty and a death sentence for millions each year.

According to the World Bank, “[t]he ‘easy and cheap’ options for mobilizing water resources for human needs have mostly been exploited.”¹ If the World Bank were right, this would be a depressing message for the 1.1 billion people without easy access to safe water.² The good news is, the Bank is wrong. Many technologically easy and relatively cheap options for water provision exist that can help lift hundreds of millions of people out of poverty, end widespread hunger, and reduce the daily workload of women and children. The bad news is that the World Bank-led large-dam lobby is aggressively supporting a resurgence in water mega-projects.³

“Modern” water management for most of the twentieth century has meant huge, capital-intensive river-engineering projects that sought to transform entire regions through the generation of hydropower for industries and diversion of water to irrigate commercial farms. While these projects provide around one-sixth of the world’s output of both food and electricity,⁴ this “big is

* This piece is an adaptation of PATRICK MCCULLY, INT’L RIVERS NETWORK, SPREADING THE WATER WEALTH (2006), available at <http://internationalrivers.org/files/WaterWealth2006.pdf>.

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1. See PATRICK MCCULLY, INT’L RIVERS NETWORK, AVOIDING SOLUTIONS, WORSENING PROBLEMS 7 (2002) (quoting WORLD BANK, WATER RESOURCES SECTOR STRATEGY—STRATEGIC DIRECTIONS FOR WORLD BANK ENGAGEMENT, DRAFT FOR DISCUSSION OF MARCH 2002 at 3 (Apr. 2002)), available at <http://www.internationalrivers.org/files/0205.wrsscritea.pdf>.

2. U.N. DEV. PROGRAMME [UNDP], HUMAN DEVELOPMENT REPORT 2006 at 2 (2006), available at <http://hdr.undp.org/en/reports/global/hdr2006/>.

3. See PATRICK MCCULLY, INT’L RIVERS NETWORK, SPREADING THE WATER WEALTH 3–4 (2006); see generally WORLD BANK, *supra* note 1.

4. See WORLD COMM’N ON DAMS, DAMS AND DEVELOPMENT: A NEW FRAMEWORK FOR DECISION-MAKING 13–14 (2000), available at <http://www.dams.org/docs/report/wcdreport.pdf>; JOSÉ GOLDEMBERG & THOMAS B. JOHANSSON, U.N. DEV. PROGRAMME ET AL., WORLD ENERGY ASSESSMENT OVERVIEW 2004 UPDATE 28 (2004), available at <http://www.energyandenvironment.undp.org/undp/indexAction.cfm?module=Library&action=GetFile&DocumentAttachmentID=1010>.

beautiful” form of water management has been intensively criticized in recent years for its technical and economic failures, for benefiting the well-off at the expense of the poor, and for its massively negative impacts on ecosystems.⁵ Dams and diversions have altered 60 percent of the flow in the world’s major rivers; displaced 40 to 80 million people; destroyed wetlands and farmland; and left aquatic species struggling to survive.⁶

This global-scale destruction of river, wetland and lake ecosystems has also taken a huge human toll. As argued by the UN Millennium Ecosystem Assessment:

[T]he harmful effects of the degradation of ecosystem services... are being borne disproportionately by the poor, are contributing to growing inequities and disparities across groups of people, and are sometimes the principal factor causing poverty and social conflict.... Rural poor people tend to be the most directly reliant on ecosystem services and most vulnerable to changes in those services.⁷

Generating enough economic growth to lift the world’s poorest people out of poverty and meet their basic water, food, and energy needs can only happen if investments are redirected away from conventional water mega-projects and towards affordable, decentralized and environmentally sustainable technologies. The primary obstacle to this necessary solution is not a lack of appropriate technologies or methods, but generation of the political will and institutional capacities to implement these options. However, large-scale investment in low-cost, decentralized and community-based water projects represents the only chance of reaching the Millennium Development Goal of halving the number of people in extreme poverty by 2015.

THE REALITY: THE EASY AND CHEAP OPTIONS ARE UNDEREXPLOITED

The great majority of the world’s extreme poor are small farmers in sub-Saharan Africa and South Asia. While the number of urban poor is rising rapidly, roughly three-quarters of the world’s poorest people live in rural areas.⁸ The UN Millennium Project describes the world’s 525 million small farms as the “global epicenter of extreme poverty.”⁹ Most poor rural farmers live on arid lands and are dependent upon rain-fed farming for their livelihoods. While most agricultural investment in developing countries has gone into major irrigation projects, 60 to 70 percent of the world’s food is produced from the 80

5. See, e.g., PATRICK McCULLY, *SILENCED RIVERS* (2001).

6. See WORLD COMM’N ON DAMS, *supra* note 4, at 13–14.

7. MILLENNIUM ECOSYSTEM ASSESSMENT, *ECOSYSTEMS AND HUMAN WELL-BEING: SYNTHESIS REPORT 17* (2005).

8. U.N. MILLENNIUM PROJECT, *INVESTING IN DEVELOPMENT: A PRACTICAL PLAN TO ACHIEVING THE MILLENNIUM DEVELOPMENT GOALS 17* (2005). The situation is different in Latin America and the Caribbean where 60 percent of the extreme poor live in urban areas.

9. *Id.* at 65.

percent of cropland that is rain-fed.¹⁰ Malin Falkenmark of the Stockholm International Water Institute and Johan Rockström of the Stockholm Water Institute estimate that providing a decent diet to everyone in the world by 2050 will require increasing the productivity of rain-fed farming.¹¹

Partly because the lion's share of investment in agricultural infrastructure and research has gone to large-scale irrigation, rain-fed yields in semi-arid areas currently tend to be very low, especially in sub-Saharan Africa. Fortunately, a combination of better soil and water management could significantly increase yields in savannah lands. According to Falkenmark and Rockström, "there are numerous examples of affordable, socially and environmentally appropriate water management strategies that can double and even triple yield levels in rainfed savanna farming systems."¹²

Savannas cover two-fifths of the world's land surface, and, while arid, are not devoid of rain. Dryland water scarcity occurs not from the overall quantity of annual rainfall, but from its variability and unpredictability. Savannah farmers do not need a year-round supply of water from an irrigation canal, but require methods to trap rain when it falls on their farms, to recharge and pump groundwater when it is needed, to increase the ability of soil to hold moisture, and to increase the efficiency of the small-scale irrigation methods they use.

Rainwater harvesting involves trapping rainwater behind small dams built across seasonally flooded gullies or depressions, or catching it on surfaces such as roofs and storing it in tanks or jars. In addition to storing water for later use, such rainwater-harvesting structures serve the important function of recharging groundwater by allowing collected rainwater to percolate down into the ground. A number of groups are working to spread rainwater harvesting to the world's poor farmers, including:

- The Rainwater Harvesting Implementation Network (RAIN) focuses on field implementation of small-scale rainwater-harvesting projects, capacity building of local organizations, and knowledge exchange on a global scale. During its first two years of operations, RAIN helped create a total storage capacity of approximately 19,983 cubic meters in Ethiopia, Senegal and Nepal. The group also sets up Rainwater Harvesting Capacity Centres in the countries where it works.¹³
- In the past five years, a program called Mother's Underground Water Tank has built more than 90,000 underground water tanks in China's most water stressed regions, benefiting about one million rural residents. Each water tank has a capacity of thirty-five cubic meters. The program also has built 1100 minor centralized water supply

10. MALIN FALKENMARK & JOHAN ROCKSTRÖM, *BALANCING WATER FOR HUMANS AND NATURE: THE NEW APPROACH IN ECOHYDROLOGY* 9, 67 (2004).

11. *See generally id.*

12. *Id.* at 177.

13. *See generally* RAINWATER HARVESTING IMPLEMENTATION NETWORK, *RAIN FACTS & FIGURES* (2007), available at http://www.rainfoundation.org/fileadmin/PublicSite/Facts_Figures/RAIN_Facts_Figures_DEC_2007_-150.jpg.pdf.

facilities. A project of the China Women Development Foundation, it has now expanded from the drought-stricken northwestern part of China to include rural communities in the southwestern Carst region.¹⁴

- In India, the group Tarun Bharat Sangh has helped farmers in the dry state of Rajasthan build thousands of water-catchments devices to restore groundwater and provide drinking water.¹⁵
- In Brazil's dry northeast, where millions live without regular access to clean drinking water, a community-driven initiative is building low-cost cisterns for the poor. The Million Cisterns Project aims to provide drinking water to five million people in the next decade.¹⁶

Rainwater harvesting is particularly beneficial when coupled with affordable technologies. For example, simple drip irrigation kits drastically reduce the quantity of water needed to irrigate crops and human-powered treadle pumps efficiently withdraw recharged groundwater. International Water Management Institute (IWMI) researchers cite studies claiming three- to four-fold yield increases for farmers in Burkina Faso, Kenya and Sudan using drip irrigation and hand-watering made possible by rainwater harvesting.¹⁷ Across South Asia, the group International Development Enterprises (IDE) introduced an effective, low-cost drip system that resisted clogging and sold for one-fifth the price of conventional equipment. Families can invest as little as three dollars to buy a kit that irrigates a forty square-meter kitchen garden. These systems provide a 300 percent annual return on investment, which can be reinvested to expand the system's coverage by an acre or more. In 2004, farmers in India purchased enough IDE equipment to irrigate 20,000 acres. The group's founder, Paul Polak, expects that within ten years low-cost drip systems will irrigate several million hectares in India alone, an amount larger than the total worldwide area under drip irrigation today.¹⁸

A RICE REVOLUTION

Boosting water productivity—achieving more “crop per drop”—is essential for feeding the world's growing population while protecting freshwater ecosystems and stopping aquifers from being sucked dry. A set of principles and methods called the System of Rice Intensification (SRI) holds

14. Emails from Ma Jun, Director, Institute of Public and Environmental Affairs (Jan. 2007). For more information, see <http://www.cwdf.org.cn/> (Chinese language only).

15. For more information, see www.tarunbharatsangh.org/.

16. Phillip Wagner, *Bringing Water and Hope to Brazil's Backlands*, RHYTHM OF HOPE (2004), www.rhythmofhope.org/article_cisterns.php.

17. A. INOCENCIO, H. SALLY & D. J. MERREY, INT'L WATER MGMT. INST., INNOVATIVE APPROACHES TO AGRICULTURAL WATER USE FOR IMPROVING FOOD SECURITY IN SUB-SAHARAN AFRICA (2003).

18. See generally Paul Polak, *The Big Potential of Small Farms*, SCI. AM. MAG., Sept. 2005. For more information, see <http://www.ideorg.org/>.

the promise of a dramatic improvement in water productivity of rice and, potentially, other water-intensive crops.¹⁹

While rice is one of the world's most important staple crops, traditional growing methods require significant amounts of water. According to Ismail Serageldin, Chairman of the World Bank Consultative Group on International Agricultural Research and World Bank Vice President for Special Programs, "It takes twice as much water to produce rice than any other cereal crop—more than 2,000 tons of water is used to grow one ton of rice."²⁰ Agricultural scientists have made huge breakthroughs in reducing the amount of water needed to grow rice, while improving yields. SRI reduces water use by 50 percent, increases yields by 50 to 100 percent, and does not require expensive chemical inputs or hybrid seeds.²¹ An estimated 90 percent of agricultural water use in Asia is currently for rice production, so the savings could be huge.²²

A common argument used by the backers of high-risk mega-projects is that, while small-scale technologies can provide benefits on a small-scale in marginal areas, interventions on a scale large enough to significantly increase food production and boost economic growth can only come from large water storage infrastructure. In reality, the dam lobby has its arguments reversed—large water infrastructure is limited in the areas where it can expand. Large dam-and-canal irrigation schemes are generally suitable only for broad alluvial plains alongside major rivers. In Africa and Asia, there are few appropriate sites left on which to expand irrigation mega-projects.²³ And too often the cost of such development is prohibitive.

In contrast, small-scale technologies can be applied across the world's croplands. Paul Polak of IDE believes it would cost 20 billion dollars to reach the Millenium Development Goals of bringing 100 million small farming families in Africa and Asia out of extreme poverty between 2005 and 2015 through low-cost water technologies.²⁴ This is less than one-tenth of the investment on large dams in developing countries between 1990 and 2000.²⁵ Frank Rijsberman of IWMI calculates the total economic benefit of lifting these 100 million families out of poverty as 300 to 600 billion dollars.²⁶ Polak's numbers indicate that every billion dollars invested in a mega-dam could have

19. Ass'n Tefy Saina & Cornell Int'l Inst. for Food, Agric. & Dev't, Origins of SRI, <http://ciifad.cornell.edu/SRI/origins.html> (last visited Apr. 3, 2009).

20. Press Release, World Bank Consultative Group on Int'l Agric. Research, New Rice Techniques Promise up to 25 Percent Less Water Usage (May 17, 1999), *available at* <http://www.worldbank.org/html/cgiar/press/pres0599.html>.

21. Ass'n Tefy Saina & Cornell Int'l Inst. for Food, Agric. & Dev't, SRI System of Rice Intensification, <http://ciifad.cornell.edu/SRI/advant.html> (last visited Apr. 3, 2009).

22. Press Release, World Bank Consultative Group on Int'l Agric. Research, *supra* note 20.

23. *See, e.g.*, INTERACADEMY COUNCIL, REALIZING THE PROMISE AND POTENTIAL OF AFRICAN AGRICULTURE 50–51 (2004).

24. *See* Polak, *supra* note 18.

25. WORLD COMM'N ON DAMS, *supra* note 4, at 11.

26. FRANK RIJSBERMAN, COPENHAGEN CHALLENGE, THE WATER CHALLENGE 21 (2004).

lifted 5 million farming families out of poverty via treadle pumps, drip irrigation and rainwater harvesting.²⁷

Improving yields for the world's small farms would have significant economic impacts at the national and global levels. Not only would increased yields enable farmers to feed their families, but benefits would cascade through the broader economy. The improved yields would provide low-cost food for the rest of the economy and support growth in businesses supplying inputs to farmers and in food processing. The implications of these benefits can be monumental. Michael Lipton of the Poverty Research Unit at the University of Sussex states that, "[t]here are virtually no examples of mass dollar poverty reduction since 1700 that did not start with sharp rises in employment and self-employment income due to higher productivity in small family farms."²⁸

STORAGE FOR THE POOR

The ability to store water for when it is most needed is also vital, especially for farmers in those regions of the world where rainfall varies widely between seasons and years. Global warming is making the ability to store water even more important. Large reservoir, however, are not the only form of water storage. Water stored in small reservoirs, in groundwater and in wetlands generally provides much greater economic benefits—and benefits that are more likely to reach the poorest people—than that stored in large reservoirs.

Small reservoirs and rainwater-harvesting structures (such as the 300,000 agricultural "tanks" in South India and the seven million ponds in China)²⁹ are more likely to benefit poorer farmers as they are widely dispersed and more likely to be built and controlled at the community level. Large reservoirs, in contrast, mainly provide benefits to the relatively wealthy minority of large farmers that live in the fertile plains and receive canal water.³⁰

In many respects, the best way of storing water is underground. Groundwater does not evaporate, is well protected from biological contamination, is geographically dispersed, and can be accessed whenever needed, provided labor or energy is available for pumping. Crop yields in areas irrigated by groundwater are often double those on large dam-and-canal irrigation schemes, in part because farmers rather than irrigation agencies control when groundwater is supplied to crops.³¹ However, in some cases,

27. See Polak, *supra* note 18.

28. MICHAEL LIPTON, INT'L FOOD POLICY RESEARCH INST., *THE FAMILY FARM IN A GLOBALIZING WORLD* viii (2005).

29. See IWMI-Tata Water Policy Program, *The Challenges of Integrated River Basin Management in India*, WATER POLICY BRIEFING, June 2002, at 2.

30. See, e.g., RIJSBERMAN, *supra* note 26, at 7.

31. See MARCUS MOENCH, JACOB BURKE & YARROW MOENCH, U.N. FOOD & AGRIC. ORG., *RETHINKING THE APPROACH TO GROUNDWATER AND FOOD SECURITY* (2003), available at <http://www.fao.org/DOCREP/005/Y4495E/Y4495E00.HTM>.

governments have tried to restrict new water harvesting for groundwater recharge, by claiming government ownership of water below ground.³²

The downside of groundwater use is that in many areas it is being used at a much faster rate than it is replenished via rainfall and floods. In some areas of India, overuse of groundwater has led to the collapse of agriculture and the contamination of drinking water supplies with saline water.³³ However, from the perspective of food production and poverty alleviation, it is far more important to implement policies to manage groundwater extraction and practices to recharge aquifers than to invest in additional big dam projects.

Wetlands, which store large amounts of water, have greater ecological, economic, and societal value per cubic meter of water stored than reservoirs. Wetlands provide water storage and purification, absorb floods, irrigate crops, and produce economic and livelihood resources such as game, fruits and vegetables, fodder for grazing, fuel, fish, building materials, and tourist attractions.

A study of the proposed Kano River irrigation project in arid northern Nigeria, which would have diverted water from the large Hadejia-Nguru wetland, shows that water is more valuable when stored in a wetland than in an irrigation reservoir. The study predicted that every 1000 cubic meters of water used on the irrigation scheme would generate net economic benefits of four US cents.³⁴ Meanwhile the net economic benefits of traditional uses of the floodplain were calculated as at least thirty-two dollars per 1000 cubic meters of water—800 times greater than using the water for irrigation.³⁵ Another estimate puts the total global economic value of wetlands at 70 billion dollars per year.³⁶

THE WAY FORWARD

Intelligent water infrastructure development alone cannot solve the scandal of global poverty and inequality. Many policy and institutional changes are needed, including land reform, changes to subsidy and trade policies, debt cancellation, a stronger role for local communities in decision making, and an end to the ill-advised privatization and deregulation policies of the past two decades. In addition, some local water laws will need to be analyzed to ensure they encourage rather than hinder water regimes that benefit the world's poor.

32. Colorado, for example, restricts rainwater harvesting. See Nicholas Riccardi, *Who owns Colorado's rainwater?*, L.A. TIMES, Mar. 18, 2009, available at <http://www.latimes.com/news/nationworld/nation/la-na-contested-rainwater18-2009mar18,0,5585599.story>.

33. See, e.g., BRITISH GEOLOGICAL SURVEY & WATERAID, GROUNDWATER QUALITY: NORTHERN INDIA 2–4 (2004), available at www.wateraid.org/documents/nindia.pdf; D.K. Saha and K. Choudhury, *Saline Water Contamination of the Aquifer Zones of Eastern Kolkata*, 9 J. INDIAN GEOPHYS. UNION 241 (2005), available at <http://www.igu.in/9-4/2saha.pdf>.

34. See INT'L UNION FOR CONSERVATION OF NATURE, DECIDING THE FUTURE OF WETLANDS (2002).

35. See *id.*

36. KIRSTEN SCHUYT & LUKE BRANDER, WORLD WILDLIFE FUND, THE ECONOMIC VALUES OF THE WORLD'S WETLANDS 5 (2004).

In particular, water rights may need refining to ensure that rainwater-harvesting structures can be built. But without a transformation of priorities in the water sector none of the solutions above can make a significant contribution to reducing poverty on a global scale.

Changing water sector priorities will require the World Bank to stop acting as the lobbying arm for the global big-dams industry. Aid funds need to be redirected to the research, development, and implementation of small-scale projects. Unfortunately, the institutional limitations of the World Bank and other multilateral donors mean they are not well positioned to directly finance such projects. As such, the bulk of funding will need to come from bilateral institutions and non-governmental organizations. The World Bank needs to encourage a policy environment in which decentralized, small-scale solutions are supported rather than discouraged. It also needs to acknowledge the superior potential of small-scale solutions in its needs and options assessments and to desist from undermining them by promoting megaprojects.

Although not all big dams are inherently bad, water strategies focused on big dams cannot significantly reduce poverty and they divert money away from approaches that can. The hundreds of billions of dollars that the big-dam lobby is encouraging to be sunk into the “hard path” for water infrastructure could be put to work helping spread pro-poor technologies. If they were, the impacts could be nothing short of revolutionary.