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Case Example: Watershed Development in India

ERIN GRAY, KATHLEEN BUCKINGHAM, AND CRAIG HANSON

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SUMMARY

Out of India's 329 million hectares of land, 146 million hectares are degraded with reduced forest cover, reduced water table levels, and a shortage of drinking water, fuel, and fodder. Of this total, 35 million hectares were once forest lands (Government of India 2011).¹ Direct drivers of land degradation include deforestation; conversion of land for agriculture to help meet food security needs; and unsustainable agricultural, livestock, and forestry practices. Indirect drivers of degradation include population growth and a lack of government investment in these areas to promote sustainable land practices and manage natural resources (Government of India 2011). The majority of degraded areas are rainfed, which are often characterized by erratic, deficient, and delayed rainfall patterns. Rainfed areas comprise cultivable areas, wastelands,² and 100 percent of the country's forested area (NRAA 2013). Rainfed areas also lie mostly in hilly, mountainous regions representing 73 different agro-climatic zones. Rural populations living in these regions are some of India's poorest and are almost completely reliant on natural resources for their livelihoods (Ahmad et al. 2011; Government of India 2012).

Beginning in the 1970s, the government of India began turning its attention to the restoration of rainfed regions to help address national food security concerns. Post-colonization agricultural policy in India focused on improving agricultural yields in India's plains through high-yielding crop varieties, increased use of fertilizers and pesticides, and water-intensive irrigation technologies—this was India's "Green Revolution" period. While crop yields increased dramatically in these areas, production from these areas alone has not been sufficient to meet the country's food demands—partly because Green Revolution technologies have experienced diminishing returns, and also because India's plains represent less than 40 percent of the country's net sown area (Kalra and Pumar 2008).



TIME PERIOD: 1970s to present

AREA RESTORED: ~45 million hectares (as of 2005)

TYPE OF RESTORATION: Primarily active restoration

While rainfed areas are, on average, a third less productive in terms of crop yield than the national average, these regions represent the majority (65 percent) of arable area (Sharma et al. 2006). Over the past 40 to 50 years, watershed development³ has been the main national strategy for planning, development, and management of rainfed regions to meet objectives of enhancing food production and poverty reduction (Government of India 2012; Palanisami et al. 2009). While the strategy has evolved over time, today watershed development can be characterized as a participatory development approach rooted in rejuvenating ecosystems using a combination of



technical, landscape, and social interventions to harvest rainfall, reduce soil erosion, increase groundwater levels, and improve soil quality.

The national watershed development guidelines (Government of India 2011) promote a tiered approach to restoration, focusing on afforestation/ reforestation and grazing bans on the upper reaches of hillsides to reduce erosion and improve soil nutrient levels.⁴ On intermediate areas or the slopes of hillsides, projects promote agroforestry and horticulture. Sustainable agricultural intensification is promoted on plains and flat areas, which are most suitable for irrigation and easier to manage for agriculture and livestock. The government of India has other programs specifically devoted to addressing degradation of other forested areas, including the Integrated Afforestation and Eco-Development scheme from 1989 and the National Afforestation Programme from 2002–09 (for more information, see Gray and Srinidhi 2013). Recently at the national level, the Prime Minister’s Council on Climate Change approved the National Mission for a Green India, which aims to increase the cover and quality of India’s forests on 10 million hectares (Ministry of Environment and Forests 2011).

Watershed development projects have been implemented widely across rainfed regions in India. Palanisami et al. (2009) estimated that, as of 2005, more than 45 million hectares of rainfed and degraded lands have received restoration interventions through watershed development programs.

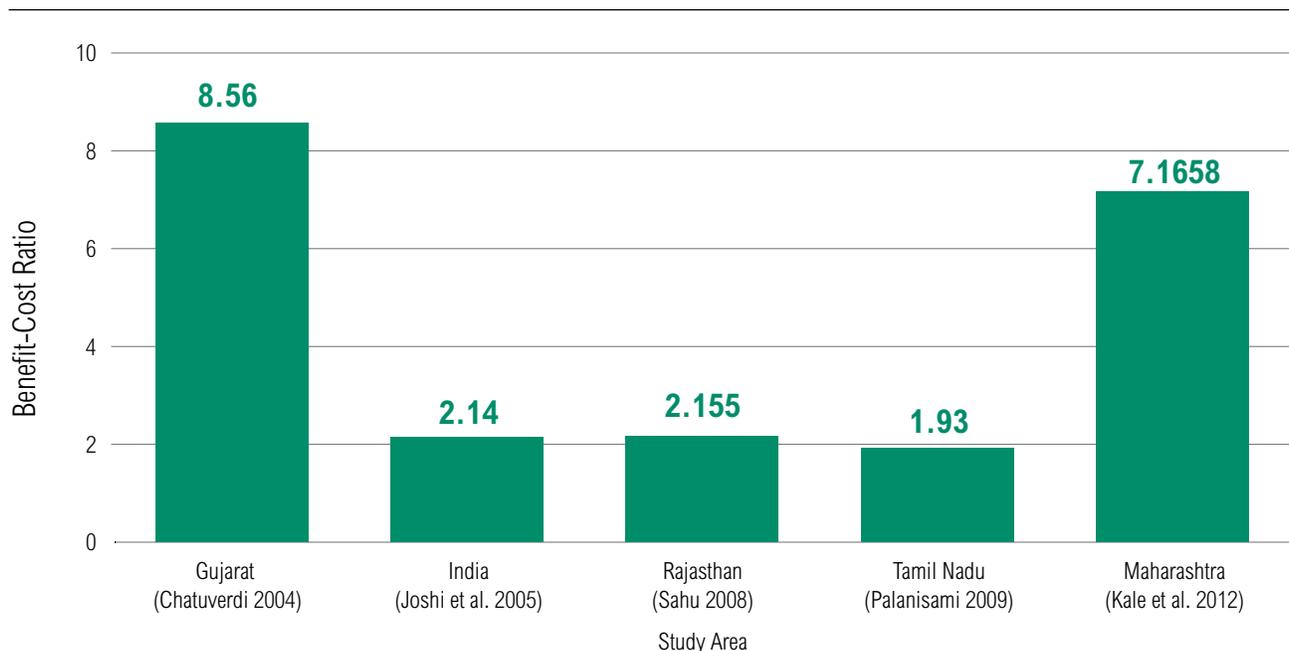
Watershed development in India has created a number of benefits, including:⁵

- **INCREASED FOOD SECURITY.** Farmers are now able to grow crops over more than one growing season per year, which has

doubled or tripled productivity. Farmers have been able to invest in more livestock and crossbred livestock, leading to improved milk production.

- **INCREASED HOUSEHOLD INCOME DIVERSITY.** The restored watersheds generate grains, legumes, vegetables, horticulture, and fodder for livestock. Many households have been able to expand their operations to include poultry operations and small business development.
- **INCREASED LAND VALUES.** Land values of treated watersheds have increased over time (Gray and Srinidhi 2013) and have been shown to be higher than control or nontreated watersheds (Palanisami et al. 2009).
- **IMPROVED BENEFITS TO WOMEN.** Restored watersheds can reduce the burden on women for water and fuelwood gathering. As part of the watershed development process, the promotion of female self-help groups has improved women’s participation in decision making (Gray and Srinidhi 2013).
- **IMPROVED NATURAL ENVIRONMENT.** Restoration efforts have led to increased afforestation/ reforestation and improvements in habitat and biodiversity counts (Gray and Srinidhi 2013). Watershed development interventions have had many benefits, including reduced erosion of hillsides, increased surface and groundwater levels, and improved soil health. In addition, watershed development projects have generated positive benefit-cost ratios (Figure 1).

Figure 1 | Selected watershed development project benefit-cost ratios



Source: Gray and Srinidhi 2013**

Notes: For selected states and at the national level. Benefit-cost ratio is an indicator of project success and is the ratio of present value benefits over present value costs. A benefit-cost ratio greater than one indicates a positive economic return. Note that these ratios focus only on market benefits—namely from improvements in land production—and do not include cobenefits such as improved opportunities for women and youth, improvements in biodiversity, and carbon sequestration.

WHICH FEATURES AND KEY SUCCESS FACTORS WERE EXHIBITED?

The watershed development restoration effort in India has been successful because it has exhibited a number of the key success factors for landscape restoration.

Motivate

Farmers were motivated to restore the watershed for several reasons:

- **BENEFITS.** The government of India and other stakeholders pursued watershed development as a restoration strategy because top-down sectoral approaches focused on soil and rainwater conservation were not producing needed results. With watershed development, however, stakeholders expected that doing so would yield numerous economic, social, and environmental benefits. Expected economic benefits included improved household incomes due to increased agricultural and livestock productivity and income diversification. Social benefits include female empowerment, reduced conflict, and improved dietary diversity and nutrition. Environmental benefits include reduced soil erosion, enhanced groundwater recharge, improved biodiversity, and carbon sequestration from agroforestry activities.
- **AWARENESS.** The government of India—and other stakeholders—have been instrumental in mapping opportunities for restoration in rainfed regions and in working with implementing agencies to restore watersheds. Implementing agencies also have been active in scaling up watershed restoration efforts through peer-to-peer learning and awareness programs that educate farmers on new technologies and restoration techniques.

Enable

Many enabling conditions were in place—or came into place—that facilitated restoration, namely:

- **ECOLOGICAL CONDITIONS.** The ecological conditions conducive for restoration—including rainfall, soil conditions, and fire regimes—were in place. While many parts of rainfed regions are arid or semi-arid, watershed development has been successful because degradation is largely attributed to unsustainable agricultural, forestry, and livestock practices, which can be reversed. In these regions, watershed development interventions focus on trapping and harvesting monsoon rainfall to regenerate groundwater supplies and reduce soil erosion.
- **POLICY CONDITIONS.** One of the most important key success factors for India's watershed development approach was a change in focus from technical, top-down approaches toward participatory projects that emphasized not only improvements in land productivity but also livelihoods. India's most recent Five-Year Plan and the national watershed development guidelines have been aligned to emphasize the importance of ecosystems, community participation, and project flexibility for promoting economic activity and addressing cultural differences and local needs (Gray and Srinidhi 2013). The government of India also is attempting to better converge national restoration and capacity building programs to reduce programmatic and funding redundancies and better target funding. For example, the government of India (2011) states that it should be a national priority to align the Mahatma Gandhi National Rural Employment Guarantee Act with afforestation and watershed development schemes.
- **SOCIAL CONDITIONS.** Participation by local communities is widely promoted in watershed development and has been cited as a key factor for success in national watershed development guidelines and planning efforts (Government of India 2011; Government of India 2012). For example, guiding principles of the national guidelines include gender and equity sensitivity, decentralization of project management, community participation, monitoring and evaluation, and capacity building (Government of India 2011). Watershed development interventions include ecosystem-based interventions (e.g., afforestation, agroforestry), technical interventions (e.g., human-built interventions for soil and water conservation and drought mitigation), and social interventions (e.g., women's self-help group development, capacity building for community resource groups).
- **INSTITUTIONAL CONDITIONS.** Village community groups—including female self-help groups, user groups, and watershed committees—provide a means of effective institutional coordination to work with implementing agencies and advance peer-to-peer learning (Gray and Srinidhi 2013; Government of India 2011).

Implement

Capacity and resources were in place to facilitate restoration in India, including:

- **LEADERSHIP.** Since the early 1970s, a number of champions of restoration via watershed development in India have emerged. Nongovernmental organization (NGO) activity was critical in promoting success and influencing national guidelines and actions (Kerr et al. 2002; Turton 2000). Early NGO-led projects and NGO-public sector projects were more successful than government-led projects because the former focused on capacity building and social and environmental interventions along with technical interventions, and were better able to manage community concerns (Kerr 2002; Joshi et al. 2005). In addition, donor agencies—such as the Swiss Agency for Development and Cooperation—have not only supported watershed development but have promoted partnerships among stakeholders (e.g., NGOs and government agencies) that have enabled success (Turton 2000).
- **FINANCE AND INCENTIVES.** The government of India, through various ministries and programs, has provided financial support for watershed development. The 2012–17 five-year plan emphasizes scaling up this funding (Government of India 2012). And current government, corporate, and bilateral funding to support NGOs and other implementing agencies for watershed development is estimated to be roughly \$4 billion USD per year (Gray and Srinidhi 2013).

LOOKING FORWARD

Some challenges for improving and scaling up effective watershed development in India include:

- **INSTITUTIONAL COORDINATION.** While there have been many successes with restoration via watershed development, many institutional challenges remain. Watershed development programs, policies, and funding are spread across multiple ministries and decisions are often made in departmental silos, with poor communication between silos. Hence, there is likely a lack of effective targeting to maximize social, economic, and environmental welfare gains (Gray and Srinidhi 2012). One of the most challenging issues in managing rainfed-area restoration in India has been designing institutions or working rules for collective action for watershed development. Ensuring an understanding of traditional institutional arrangements and expectations of the resource users are important factors for the success of restoration (Marothia 2005). Any transition of institutional arrangements and decentralization needs to be managed with care. Transition of institutional arrangements improves ecosystems only if the transition is designed with an understanding of the local social, political, and ecological context (Marothia 2010).
- **FINANCE AND INCENTIVES.** There is a need for greater financial investment to support watershed development intervention implementation and innovation. India's 12th Five-Year Plan states: "The flow of public investment and public subsidies on irrigation, power, fertilizer, and food has been highly biased against rainfed areas. Even though there are a number of programs affecting rainfed areas, their combined investment, both in per capita and per hectare terms, is abysmally low" (Government of India 2011).
- **KNOWLEDGE.** India's 12th Five-Year plan calls for financial support for new research and extension services, as well as new knowledge-sharing platforms to coordinate, aggregate, and disseminate research on rainfed areas from India's vast network of research institutions and universities (Government of India 2011). In India, adaptation to climate change is of particular importance in rainfed agricultural areas, where crops depend on monsoon rains (Appaduri et al. 2015). A better evidence base about the economic, social, and environmental benefits of using an ecosystem-based, landscape approach like watershed development is needed. There is little understanding of the long-term and distributional impacts of watershed development as well, and equity is a major concern (between genders and landowning classes). Techniques and strategies to enhance resource productivity, reduce vulnerability and stimulate regeneration have been successfully tried out by many NGOs, innovative farmers, and researchers in different parts of the country. However, there is a great need to better monitor and evaluate project success at both the household and landscape scale, in terms of near-term income gains and long-term resilience and adaptive capacity (Gray and Srinidhi 2012).

REFERENCES

- Ahmad, J., D. Alam, and S. Haseen. 2011. "Impact of climate change on agriculture and food security in India." *International Journal of Agriculture, Environment and Biotechnology* 4 (2): 129–137.
- Appadurai, A.N., M. Chaudhury, A. Dinshaw, N. Ginoya, H. McGray, L. Rangwala, and S. Srivatsa. 2015. *Scaling Success: Lessons from Adaptation Pilots in the Rainfed Regions of India*. Washington, DC: World Resources Institute.
- Chatuverdi, V. 2004. "Cost benefit analysis of watershed development: An exploratory study in Gujarat." Research Report. Bopal, Ahmedabad: Development Support Centre.
- Department of Land Resources. 2006. "From Hariyali to Neeranchal: Report of the Technical Committee on Watershed Programmes in India." Ministry of Rural Development, Government of India. Retrieved from: <<http://www.indiawaterportal.org/sites/indiawaterportal.org/files/ParthasarathyCommittee.pdf>>. (June 10, 2013)
- Government of India. 2011. "Common Guidelines for Watershed Development Projects—2008." (Revised edition 2011). New Delhi: National Rainfed Area Authority, Planning Commission.
- Government of India. 2012. *Final report of Minor Irrigation and Watershed Management for the Twelfth Five Year Plan (2012—2017)*. New Delhi: Planning Commission, Government of India, Minor Irrigation and Watershed Management Working Group.
- Gray, E., and A. Srinidhi. 2013. "Watershed Development in India: Economic valuation and adaptation considerations" Working Paper. Washington, DC: World Resources Institute.
- Joshi, P.K., A.K. Jha, S.P. Wani, L. Joshi, and R.L. Shiyani. 2005. "Meta-analysis to assess impact of Watershed Program and people's participation." Comprehensive Assessment of Water Management in Agriculture Research Report 8. Colombo, Sri Lanka: International Water Management Institute.
- Kale, G.D., V.L. Manekar, and P.D. Porey. 2013. "Watershed development project justification by economic evaluation: a case study of Kachhighati Watershed in Aurangabad District, Maharashtra." *ISH Journal of Hydraulic Engineering* 18 (2): 101—111.
- Kalra, B.S., and P. Pumar. 2008. "Enhancing the performance of grass root level institutions in watershed management." *Agricultural Situation in India*. 09-11B (2) 325-329
- Kerr, J., G. Pangare, and V.L. Pangare. 2002. "Watershed development projects in India: An evaluation." International Food Policy Research Institute Research Report 127. Washington, DC: IFPRI.
- Marothia, D.K. 2005. "Common Property Resources: Managing the Unmanaged." In B.R. Sharma, J.S. Samra, C.A. Scott, and S.P. Wani, eds. *Watershed Management Challenges: Improving Productivity, Resources and Livelihoods*. Colombo, Sri Lanka: International Water Management Institute.
- Marothia, D.K. 2010. "Decentralisation of Natural Resource Management." *Indian Journal of Agricultural Economics* 65 (1): 1–34.
- Ministry of Environment and Forests. 2011. "India finalises National Mission for a Green India with people-centric forestry at its core." Retrieved from: <<http://www.indiaenvironmentportal.org.in/content/324605/india-finalises-national-mission-for-a-green-india-with-people-centric-forestry-at-its-core/>>. (May 13, 2014)
- Ministry of Rural Development. 2014. *Integrated Wasteland Development Programme*. New Delhi: Government of India. Retrieved from: <<http://dolr.nic.in/iwdp1.htm>>. (May 13, 2014)
- NRAA (National Rainfed Area Authority). 2013. "Welcome." Retrieved from: <<http://nraa.gov.in/>>. (March 19, 2014)
- Palanisami, K., D.S. Kumar, S.P. Wani, and M. Giordano. 2009. "Evaluation of watershed development programmes in India using economic surplus method." *Agricultural Economics Research Review* 22: 197–207.
- Sahu, S. 2008. "Cost-benefit analysis of participatory natural resource management: A study of watershed development initiative in Indian village." Munich Personal RePEc Archive, Paper no. 17134.
- Sharma, Bharat R.; Rao, K. V.; Vittal, K. P. R.; Amarasinghe, Upali A. 2008. "Converting rain into grain: opportunities for realizing the potential of rain-fed agriculture in India." In Amarasinghe, Upali A.; Sharma, Bharat R. (Eds.) Strategic Analyses of the National River Linking Project (NRLP) of India, Series 2. Proceedings of the Workshop on Analyses of Hydrological, Social and Ecological Issues of the NRLP, New Delhi, India, 9-10 October 2007. Colombo, Sri Lanka: International Water Management Institute (IWMI)
- Sreedevi, T.K., S.P. Wani, R. Sudi, M.S. Patel, T. Jayesh, S.N. Singh, and S. Tushar. 2006. "On-site and Off-site Impact of Watershed Development: A Case Study of Rajasamadhiala, Gujarat, India." Global Theme on Agroecosystems Report No. 20, Patancheru 502 324. Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.
- Turton, C. 2000. "Enhancing livelihoods through participatory watershed development in India." Working Paper 131. London: Overseas Development Institute.

ENDNOTES

1. Estimates of the extent of degraded land in India vary depending on ministries and government reports. The 146 million hectare estimate is based on secondary data sources.
2. Wastelands are defined by the Ministry of Rural Development as: “Degraded land which can be brought under vegetative cover, with reasonable effort, and which is currently underutilized and land which is deteriorating for lack of appropriate water and soil management or on account of natural causes” (MoRD 2014).
3. The watershed programs in the country were undertaken with multiple objectives, ranging from rehabilitation of degraded areas to conversion of the resource base and improvement of productivity in agriculture. From the 1990s onward, the main emphasis has been on “poverty reduction,” so a number of farm as well as nonfarm activities were funded by governments/ donors (Kumar, C. 2014. pers comm., 12 September).
4. Forested land on hillsides is generally managed by the Ministry of Environment and Forests; the ministry works cooperatively on watershed development activities.
5. Based on the evaluation literature for Tamil Nadu (Palanisami et al. 2009), Andhra Pradesh, Maharashtra (Kerr et al. 2002; Kale et al. 2012; Gray and Srinidhi 2013), Rajasthan (Sahu 2008), Gujarat (Chaturvedi 2004; Sreedevi et al. 2006), and a meta-analysis by Joshi et al. (2005).

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ABOUT THE AUTHORS

Erin Gray is an Environmental Economist with WRI's Economics Center.

Contact: egray@wri.org

Kathleen Buckingham is a Research Associate for the Global Restoration Initiative in the Forests Program at WRI.

Contact: kbuckingham@wri.org

Craig Hanson is the Global Director of the Food, Forests & Water Programs at WRI.

Contact: chanson@wri.org

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