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Water Policy Research

HIGHLIGHT

Unlocking Value out of India's Rainfed Farming Areas

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Low and uncertain crop yields and concentrated poverty in the vast rainfed regions, diminishing returns from the public irrigation systems, climate change induced chaotic fluctuations in the hydrologic regimes and a large demand-supply gap in non-cereal food items are all compelling reasons for the need to realise the production potential of rainfed farming areas. Little control over the rainfall and absence of suitable mechanisms for storing or conserving surplus rain to meet the critical water needs is the major cause for low yields and high distress in rainfed regions. 'The dominant rainfed districts' covering 27.5 million ha of rainfed farms and contributing about 85 percent of the rainfed production in India, also generate 114 billion cubic metre (BCM) of harvestable surplus rainfall. A small fraction of this water when harvested in suitable structures and applied as life-saving supplementary irrigation shall produce average increase of 50 percent in total production, besides setting into motion several other multiplier effects. The proposal is economically viable at national level especially for rainfed rice, pulses and oilseeds. This discourse also needs to include the rainfed regions of the East and North East though with a different program matrix.

Recent success stories in Gujarat, Madhya Pradesh and West Bengal are testimony to the potential of enhanced productivity under rainfed farming. A new paradigm comprising 'flexible strategies' for selection of the interventions; setting up of 'Innovation Platforms' for wider stakeholder participation, communication and decision making; and integration of technologies, institutions and policies has been suggested for successful implementation of the proposed plan to unlock the value out of rainfed farming areas of India and elsewhere.

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Unlocking Value out of India's Rainfed Farming Areas[1]

Research highlight based on a paper with the same title[2]

Introduction

Water resources and the way they are used are central to the challenge of improving food security, rural livelihoods and the general economy. 'Too little' and 'too much' water has always been a cause for concern for those whose livelihoods depend upon the randomness in the behaviour of rainfall. In spite of major efforts under the public-funded programs on rainwater harvesting, watershed management and National Rural Employment Guarantee Scheme, rainfed livelihoods in India's countryside remain perennially at risk. Thanks to limited livelihood opportunities, higher landlessness and low land and labour productivity, rural poverty levels are high in rainfed regions. The populations are vulnerable to debt, dry spells, droughts and even floods. The incidence, depth, and severity of rural poverty tend to be much higher in the rainfed ecosystems than in irrigated areas. Providing even a minimal degree of water control is a powerful instrument for reducing rural poverty in the rainfed regions.

India ranks first among the countries that practice rainfed agriculture both in terms of the extent (86 million ha) of area and the value of rainfed farm production. Yield gap analyses for major rainfed crops show that farmers' yields under rainfed conditions are about one-half to one-quarter of achievable yields (Figure 1; Table 1; Amarasinghe et al. 2010). Unfortunately, several of the low performing districts in terms of rainfed crop yields are located in the high poverty central tribal belt of India. Grain yields vary from 1 to 2 tons per hectare (t/ha) in many rainfed areas compared to attainable yields of more than 4 t/ha under ideal rainfed conditions.

Temporal variation in precipitation - and their impacts on crops yields - tends to be high in areas of low rainfall than in areas of high aggregate rainfall precipitation. A decrease of one standard deviation from the mean annual rainfall often leads to complete loss of the crop and related enterprises. Dry spells or monsoon breaks, which generally involve 2-4 weeks of no rainfall during critical crop growth stages, can cause partial or complete crop failures. In many rainfed areas, such dry spells often occur every cropping season. With no mechanisms for storing or conserving the surplus rain to use during the scarcity or deficit periods, meteorological conditions resulting in long dry spells and droughts, unseasonal rains and extended moisture stress periods, comprise the major cause of low yields and heightened distress in rainfed regions. Significantly, in many areas, yields are low and yield gaps are large not due to lack of water per se, but rather due to inefficient management of water, soil, and crops (Pathak et al. 2009). These constraints are further aggravated by weak access to enablers - availability of credit, knowledge, and markets. Improving water security is of paramount importance for unlocking value out of rainfed farming areas and to achieve inclusive growth in a sustained manner.

Development of small and dispersed water resources to provide supplemental irrigation and meet other critical needs is a key strategy, so far underutilised on a regional

Figure 1 Yield gap of food grains in rainfed districts of India

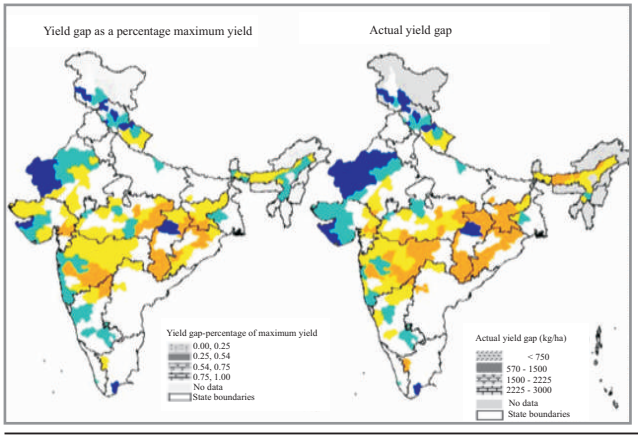


Table 1 Distribution of districts according to percentage gap between maximum and prevailing yield of food grains in rainfed districts of India

Yield gap (percent)	Number of districts (percent)
>75	25 (16)
50-75	86 (57)
25-50	30 (20)
<25	10 (7)
Total	151

[1]This IWMI-Tata Highlight is based on research carried out with support from the CGIAR Challenge Program on Water and Food (CPWF) and International Water Management Institute (IWMI), Colombo. It is not externally peer-reviewed and the views expressed are of the author alone and not of IWMI or its funding partners.

[2]This report is available on request from p.reghu@cgiar.org

basis, to unlock rainfed yield potentials. The existing evidence indicates that small inputs of life-saving irrigation, ranging from 50 to 200 mm/season (50 to 200 m^3 /ha), is often sufficient to counter the moisture stress caused by yield reducing dry spells in most years. Since productivity of irrigation water is higher when used conjunctively with rainwater, it is logical that under limited water and financial resources, priority in water allocation may be given to supplementary life-saving irrigation. On a well-targeted regional basis, collecting small amounts of runoff using limited macro-catchments during the rainy season, using this resource for supplementary irrigation and adopting improved practices can realise agricultural potential of India's rainfed areas.

THE PROPOSAL

Based on IWMI-CRIDA collaborative research (Sharma et al. 2010) a proposal for national level improvement of priority rainfed crops/ districts is presented below:

i. Identification of dominant rainfed districts for different crops: Small areas of almost all rainfed crops are scattered in most of the districts but each crop has an agro-climatic niche and its cultivation is concentrated in a subset of total districts. 'Dominant rainfed districts' for a given crop are those cumulatively contain 85 per cent of the rainfed production area within India (Table 2). Rainwater harvesting and other development activities related to the specific crop should be taken up first in these districts to ensure a major impact on productivity and poverty. Most of these districts also figure in the list of 'disadvantaged' districts of India.

ii. Assessment of available surplus runoff for water harvesting and supplemental irrigation: As total rainfall is spread over a few rainy days with fewer rain events, local harvesting of a small part of the surplus rainfall and utilising the same to mitigate the impacts of devastating dry spells (or to opt for high value farming enterprise) offers a good opportunity in the rainfed regions. To assess water availability for harvesting during the rainy season, crop water balances for the season and the whole year, for each of the selected crops in each of the 'dominant rainfed district' was performed (Figure 2; Figure 3). This showed that from about 8.5 million ha in the 'dominant rainfed districts', the total estimated runoff surplus for various rainfed crops is about 114 BCM, which could be considered for water harvesting (Figure 4). Allocation of 100 mm of irrigation water is adequate for supplemental irrigation. Estimates indicate that harvesting only about 28 BCM (19.4 percent) of the available run off is needed for covering an area of 25 million ha with life saving protective irrigation during normal monsoon year thus leaving about 86 BCM (80.6 percent) to meet river/ environmental and other requirements. Even during drought years 20.6 million ha can be safely protected with supplemental irrigation.

iii. Rainfed production improvement: With such life-saving supplemental irrigation and improved associated management practices an average increase of 50 percent in total production cutting across drought and normal seasons are realisable from the rainfed area of 27.5 million ha. Water alone accounts for an average of 12 percent increase in production. Secured crop water supply (though of a limited amount) reduces the risks of crop failures thereby increasing farmers' incentives to invest in farm inputs, such as fertilisers, improved seeds, crop protection and diversification.

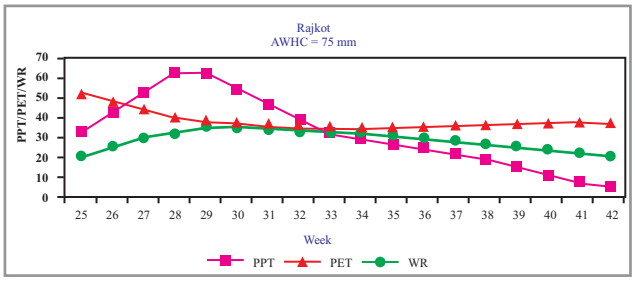
iv. Economics of water harvesting and supplemental irrigation: Simple analysis based on the national average cost of lined dug out ponds and check dams suggest that an estimated Rs. 50.9 billion is annually required to cover the 27.5 million ha in the rainfed regions and about half of that amount is required for the production of rice and coarse cereals only. The net benefits from such an investment become positive for all crops except pearl millet. However, the net benefits improve by about three times for rice, four times for pulses and six times for oilseeds. Droughts appear to have a very mild impact when farmers are equipped with supplemental irrigation and the net benefits remain stable even when runoff during a drought is reduced by 50 percent. Rainwater harvesting and its use as supplemental irrigation in the properly targeted districts are economically viable, even at the regional scale.

v. Rainfed farms of the East - need to correct the historical neglect: A large part of the discourse on rainfed agriculture and the development efforts have naturally focussed on scarcity and deficits. But vast rainfed areas in the Eastern plains and plateaus and North-Eastern hilly regions also have the low productivity, concentrated poverty, and water-induced vulnerability and stress. The annual display of unregulated huge disgorges from the Himalayan and plateau rivers and heavy rains in the monsoons followed by extreme water scarcity are a cause of chronic poverty, trauma and low agricultural productivity. The water requirements of the rainfed farmers in the Eastern region are small, seasonal but highly critical. Even in areas with annual rainfall of 3500 mm (such as North Sikkim), water scarcity was identified as the most serious constraint, and the lack of even small amounts of water during the non-rainy season negatively impacted their well-being. A recent study by the author indicated that modest investments in

Table 2 Total and 'dominant districts' cultivating important rainfed crops in India

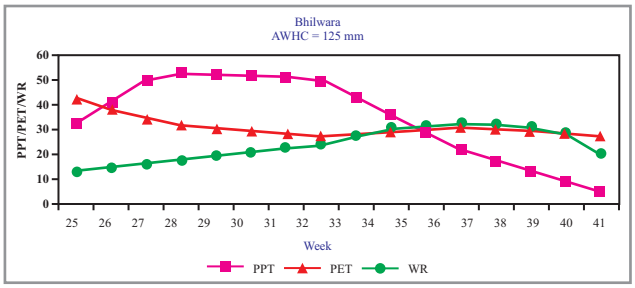
Rainfed crop	Total number of districts cultivating rainfed crop	Dominant districts
Sunflower	224	11
Soybeans	202	21
Mustard	265	29
Groundnut	316	50
Cotton	296	30
Sorghum	346	71
Maize	346	67
Pigeon pea	266	83
Chick pea	346	85

Figure 2 Average water balance of groundnut growing season in Rajkot, Gujarat



Note for legend: PPT - Precipitation, PET - Potential evapotranspiration, WR - Water requirement

Figure 3 Average water balance of maize growing season in Bhilwara, Rajasthan



small water infrastructure here can increase average annual household farming income from $ 712/annum by $ 533. And this increase of 75 percent in annual income occurs due to assured crops, diversification of the agricultural enterprise, and the baby steps taken by increasingly confident farm households towards high value agriculture. An appropriate strategy shall then be adopted to transform 'the East' to the 'South East' by following its small and productive farming systems dependent largely on local innovation, skilled manpower, regulated and supportive water resources, tiny but hugely productive land holdings, and vibrant market systems. Such a paradigm shift has the potential to unshackle the persistent water-land-poverty nexus and create a pathway out of poverty, towards improved nutrition and health for agrarian poor.

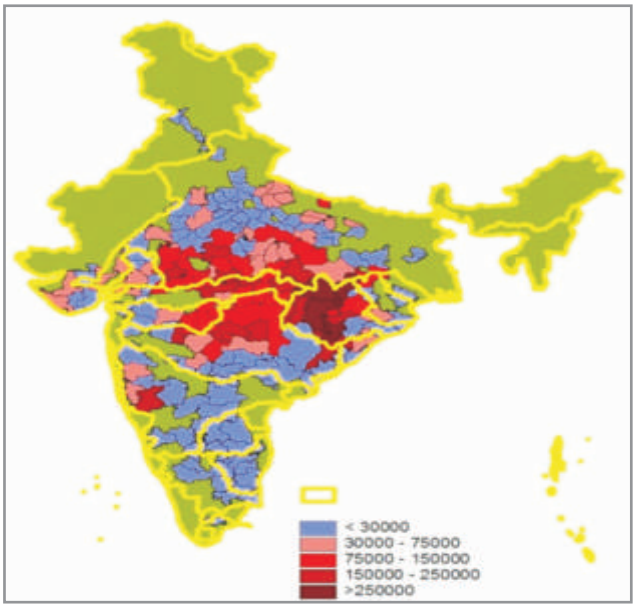
A New Paradigm

Improved technology and rural infrastructure have made important contributions to agricultural growth and poverty reduction in India. However, these effects have varied widely across agro-ecological zones and specific states. In the past, the government has devoted more resources to irrigated areas, and this has led to significant production growth and poverty reduction mainly in irrigated areas. However, as investments in irrigated areas continue to increase, marginal social and economic returns to new irrigation investments diminish. It is now in many of the rainfed areas, including some with low agricultural potential, where the marginal returns from additional government investments in supplemental irrigation, technology and infrastructure are the largest (Fan et al. 2000). Additionally, most regional climate models for India project an increase in the absolute amount of precipitation in future in all months except in the period between December and February, when it is likely to decrease. This increase may however, be accompanied by heavier precipitation events and fewer rainy days leading to increased frequency of droughts and floods in the region (Aggarwal et al. 2012). So, now it is smart and even essential to allocate significant resources for improving the rainfed landscapes and livelihoods. A key strategy is to minimise the risk from dry spell induced crop failures and assure small water supplies needed for enterprise diversification.

Targeted regional scale adoption of water harvesting systems will require a new insight in Integrated Water Resources Management, in which rainfall is regarded as an entry point for the governance of freshwater, thus incorporating green water (sustaining rainfed agriculture and the ecosystem) and blue water (local runoff). The divide between rainfed and irrigated agriculture may be reconsidered in favour of governance, investment, and management. A new focus is needed on the meso-catchment scale - as it offers the best opportunities for water investments to build resilience in small scale agricultural systems and to address trade-offs between water for food and other ecosystem functions and services. For its implementation, we may approach the problem through the lens of 'socio-hydrology', which treats the individual human beings and communities as co-evolving with the natural systems. Departing from the traditional emphasis on water resources development, it shall seek to identify common patterns in coupled nature-community interaction. It will unravel the underlying principles with the ultimate objective of helping communities adaptively manage water to achieve equity, security, resilience and sustainability. Innovative rainwater management strategies - integrating technologies, policies and institutions - will be identified and implemented so as to closely match the community needs. The intention is to improve the overall landscape water productivity and livelihoods, and especially of the rainfed farmers.

Once the first step is accomplished, it is possible to address the second and more expedient reason for unlocking the value out of rainfed farming. It is now established that as income levels rise in India, people eat more protein rich - milk, meat, eggs and pulses - and oil rich food, fruits and vegetables. The demand-supply gap of these commodities leads to high food inflation on one hand and a missed opportunity to unshackle the poverty trap for the 98 million small and marginal land holdings on the other hand. Fortunately, most of these food items are produced either on the rainfed farms or small farms with assured water access. Generally, these small farms have higher productivity, allocate large proportion of land to high value crops, dairy and poultry and contribute to food security and diversification (Dev 2011). Small farms with some access to water continue to produce more in value terms per hectare than large farms. This has also been recently demonstrated in Gujarat, Madhya Pradesh and West Bengal where investments in individual rainwater harvesting structures have allowed farmers to produce more staple crops, extend their cropping areas, increase their dry-season cropping options, diversify into rearing livestock and fish and increase income by as much as 70 percent (Giordano et al. 2012). The huge success of Sardar Patel Participatory Water Conservation Project in Gujarat under

Figure 4 Spatial distribution of surplus runoff (ham) across dominant rainfed districts and river basins of India



which numerous check dams, boribunds and farm ponds were constructed have played a big part in agrarian resurgence visible in Saurashtra and Kutch. These efforts have drought proofed 3.2 lakh ha, enhanced recharge by 300 million m^3 enough to augment farm output by 30 percent. Efforts of one enlightened District Collector in Dewas (Madhya Pradesh) became the Rewa Sagar Bhagirath Farmers Movement and more than 4000 water tanks have now been built to conserve monsoon rainwater for irrigation and allied activities. The proportion of area cultivated during non rainy season has increased from about 23 percent to 95 percent and milk production increased by 34 percent - witnessing a real increase in both crop yields and their incomes. Providing access to loans, subsidy and technical support will enable more farmers to benefit from harvesting the rainwater that falls on their land in the monsoon season.

To upscale these efforts to the national scale calls for some active organisation and extension work on the ground, apart from building rural infrastructure like rural power, rural roads, warehouses, cold storages, transport and markets. A proposal has been made to the Planning Commission and Government of India to set up National Rainfed Farming Agency which sets out the new policy framework and provides oversight on all programs in rainfed areas and designs and implements a National Rainfed Farming Program in at least 1000 blocks, besides the creation of Rainfed Investment Windows and Supportive Policy Action. It is suggested and requested that these blocks may be identified in the 'Dominant rainfed districts' for early and demonstrable success. The technology and policy researchers be encouraged to demonstrate a paradigm shift in approach, "....instead of developing a few small watersheds through some interventions and showcase this as a success; rather develop, demonstrate and change the entire process and policy of rainfed landscape development through inclusive and informed interactions at all levels" (Sharma et al. 2012). This can be achieved by providing a fair chance to 'Happy Strategies' where communities are encouraged to mix and match rainwater management practices to develop context specific interventions. 'Innovation Platforms' at different scales ranging from communities to the states to engage a range of stakeholders for prioritisation of the interventions, investments and implementation plans and improved communication between various actors shall facilitate informed decision making. Instead of pushing rainwater management interventions and technologies to achieve short term quotas, attempt should be to empower and engage actors in rainwater management strategies to achieve sustainable landscapes and improved livelihoods. These small and poor farmers need to be organised into production units, co-operatives and companies. 'Amul' succeeded because it organised milk farmers in this fashion and invested in the entire value chain. A similar miracle can be achieved for the rainfed farmers with visionaries and functionaries performing the role Verghese Kurien played here in Anand.

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About the IWMI-Tata Program and Water Policy Highlights

The IWMI-Tata Water Policy Program (ITP) was launched in 2000 as a co-equal partnership between the International Water Management Institute (IWMI), Colombo and Sir Ratan Tata Trust (SRTT), Mumbai. The program presents new perspectives and practical solutions derived from the wealth of research done in India on water resource management. Its objective is to help policy makers at the central, state and local levels address their water challenges – in areas such as sustainable groundwater management, water scarcity, and rural poverty – by translating research findings into practical policy recommendations. Through this program, IWMI collaborates with a range of partners across India to identify, analyze and document relevant water-management approaches and current practices. These practices are assessed and synthesized for maximum policy impact in the series on Water Policy Highlights and IWMI-Tata Comments.

Water Policy Highlights are pre-publication discussion papers developed primarily as the basis for discussion during ITP's Annual Partners' Meet. The research underlying these Highlights was funded with support from IWMI, Colombo and SRTT, Mumbai. However, the Highlights are not externally peer-reviewed and the views expressed are of the author/s alone and not of ITP or either of its funding partners.

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