On the climate of scarcity and crisis in the rainfed drylands of India

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Introduction

This chapter discusses the prevailing paradigm governing agricultural land and water management in the rainfed drylands of India. It aims to nuance an existing narrative that tightly intertwines agrarian distress in these landscapes with primarily climatic factors – specifically low or diminishing rainfall. In doing so, it contributes to opening up what has become a rather narrow conversation informs a limited set of technical strategies. The central thesis of the chapter is that climate-driven distress is less of a threat (though by no means an insubstantial one) than overuse or unequal allocation of limited water resources. By extension, sustainable land and water management require much more than the provision of more irrigation.

Though these themes are discussed here with reference to empirical material drawn from India, they are applicable globally, given that around 40% of the terrestrial surface is classified as 'dryland'. These landscapes are distinguished by various degrees of 'water limitation', where average rainfall is lower than potential moisture loss through transpiration or evaporation. Depending on the degree of water limitation, drylands may be classified as either dry sub-humid, semi-arid, arid or hyper-arid. Each sub-type is characterised by ecosystems configured to particular levels of productivity determined largely by moisture availability. The drylands have tremendous significance for human development and global social-ecological wellbeing. Some two billion people live and work in these landscapes globally, 90% of them in developing countries. Around one billion of these people practice agriculture in dryland areas. A significant proportion of these rely primarily on rainfall – rather than on built irrigation infrastructures – for their supply of water; around a quarter of the world's drylands are devoted to rainfed agriculture. Historically for such communities, the relative water limitation inherent in dryland ecosystems has not constrained the existence of vibrant agricultural livelihoods. A great variety of adaptations and management practices have allowed dryland communities to contend with the risks of relatively low or erratic precipitation, high temperatures and relatively marginal soils that accompany land-based living in these landscapes. These communities have shown that careful management of blue and green water, soil health and vegetation results in remarkably productive dryland landscapes around the world.

However, the rainfed drylands are now at the forefront of a number of social-ecological crises, bearing much of the global burden of hunger, thirst and poverty. Land-based livelihoods in such contexts are severely constrained by degradation. It is estimated that between 10% (United Nations, 2011) and 25% (Wiesmeier, 2015) of the world's drylands have already been degraded – experiencing some combination of groundwater decline, soil erosion and de-vegetation sufficiently severe to impair productivity and livelihoods (United Nations, 2011). Degradation in the drylands also imposes a significant human cost. Some 1.5 billion people are thought to be affected (UNCCD, 2011), with poverty acting as both outcome and driver of land degradation and limiting the nutritional security of people working in these agricultural landscapes.

The urgency of these challenges is brought into sharp relief by climate change, which will intensify the pressures already experienced by agricultural communities in the drylands. At the same time, an urbanizing and increasingly affluent world will drive bigger demand for food, fibre, fuel and feed crops. Agricultural communities in the drylands will need to play their role in meeting these global challenges of food and energy security, biodiversity conservation and climate regulation. It is now clear that these challenges are generated by particular social and economic responses to dryland landscapes, rather than by the intrinsic biophysical characteristics of the ecosystems themselves. Drylands have often suffered from endemic lack of policy support and chronic under-investment (Barrow, 2014) as well as inappropriate resource management. Unsuitable land-use, competing demands on resources and the breakdown of traditional resource management institutions have exacerbated the social-ecological pressures facing land-based communities in the drylands.

Building social-ecological resilience in rainfed drylands will mean confronting the paradigms, policies and processes which have thus far singularly failed to advance sustainable, viable and vibrant land-based living in drylands. Already, tensions between resource availability and seemingly inexorable increases in demand are giving new life to longstanding debates on dryland management around the role of climate versus human activities (e.g. Akhtar-Schuster et al., 2000), the complex influence of poverty on degradation (e.g. Mortimore and Harris, 2005; Mortimore, 2005) and (though perhaps less so) the nature of the demands social groups make of the land. These conversations will have wide relevance beyond the 'small, poor farmers' who have thus far been at the forefront of concerns about degradation, poverty and dryland agriculture. For example, as this chapter is being composed in November 2015, drought in California is forcing regulators, farmers, residents and consumers around the world to confront the complex collision of climatic factors (either periodic El Niño or emerging global climate change), resource waste, global high-value agricultural commodities and competition between agricultural and non-agricultural water use.

This analysis draws on a long tradition of critical scholarship within the environmental social sciences, particularly political ecology, to explore the dynamics of social-ecological vulnerability, rural development and resource governance in dryland agricultural landscapes. Specifically, I intend to discuss the case of smallholder agriculture in the Indian rainfed drylands – an exemplar case of dryland sustainability challenges – to show how continuing social-ecological vulnerability here is generated, in part, because of an incomplete diagnosis of the complex problems of water scarcity and agrarian distress, which in turn generates limited technocentric solutions and perverse unintended impacts.

My starting point is a set of three 'received wisdoms' concerning water and dryland agriculture: first, that "water *scarcity* is the predominant feature of drylands" (United Nations 2011: 30, emphasis added), second, that this scarcity is the predominant driver of agrarian distress and third, that scarcity is best alleviated by increasing the supply of irrigation. The aim of this chapter is to critically interrogate these established, self-reinforcing wisdoms by referencing empirical material from the Indian case. I show how policy, development practice and even popular media commonly trace direct links between relatively limited rainfall, water scarcity, and social-ecological distress. Low rainfall figures are pitted against growing demands, so that scarcity becomes naturalized. The overriding imagery is of parched landscapes that lie at the mercy of the rain, unable to provide enough for local food security let alone attain enough productivity for agricultural commodity markets. These widespread visions and the prescriptions that follow are simple and compelling. The practical agenda that follows is also clear: a foremost task for development practitioners is to tackle the availability of water in the landscape. Again with reference to India I show that the resulting governance regimes are quite technocentric in nature, and have limited potential to address the real and complex concerns of people living and working in water-limited landscapes.

This exercise does not diminish the real and lived material experience of scarcity in the drylands. Nor is it the intention to discount the value of managing supply. Instead, the point is to contribute to a growing body of literature that calls into question the hegemony of the 'scarcity discourse' (Mahayni, 2013; Mehta, 2010). Evidence from a range of perspectives is converging to show that the 'scare' of scarcity (Mehta, 2010) is neither an accurate nor a particularly helpful way to approach water-limited landscapes. Interrogating the nature, dynamics and implications of a scarcity discourse in water management uncovers new spaces within which to recast old problems and challenge accepted ways of approaching them (Lankford, 2005). Whereas the received wisdom paints a relatively generalized picture of climate-induced distress, more nuanced perspectives show that resilience or vulnerability are generated by many factors in addition to climate and are in fact amenable to management. Dryland communities, policy makers and resource managers all have agency, actively mediating the 'resource environment' through their decisions. The macro- and micro-politics of allocation generate or alleviate scarcities by governing access and the uses to which *limited* – rather than 'scarce' - resources are put. Uncovering these dynamics reveals practical options for management and is thus a highly pragmatic exercise at a time of widespread alarm about planetary limits (cf. Rockström et al., 2009; Steffen *et al.* 2015).

In what follows I touch on these points with reference to India, with a focus on the state of Maharashtra, a particularly significant site within which to interrogate the dynamics of water scarcity, agrarian distress and water governance in rainfed dryland landscapes. The chapter first outlines the material scope of dryland rainfed agriculture in India and the discursive environment which has come to characterise responses to it. I then show how both conventional management responses and seemingly radical alternatives are bound up in a paradigm where naturalized scarcity is the central problematic and increased water supply is the dominant response. I outline emerging evidence showing that management interventions embedded in this paradigm generate perverse social-ecological outcomes. This evidence is then discussed in the light of a brief review of scholarship which finesses the links between climate, scarcity and agrarian distress. The chapter concludes with reflections on the key lessons learned.

A Climate of Crisis in the Indian Drylands

Indian agriculture – and by extension India's economy and social infrastructure – is fundamentally and perhaps uniquely dependent on the "remarkable stability" of the seasonal Asian monsoon (Turner, 2013). Every summer, a reversal of winds brings rain-bearing clouds from the southwest Indian Ocean. These sweep northward across the Indian landmass, bringing 80% of the rainfall that falls over the subcontinent. A warm, wet season of four months ensues, during which farmers plant the main (*kharif*) crop (June to September). Untimely, inadequate or excessive rains disrupt food production, commodity prices, the availability of drinking water and (given India's significant dependence on hydropower) electricity generation. These disruptions cascade across both rural and urban India. The centrality of the monsoon has meant that the rains are the focus of both celebration and anxiety. In Indian cultural iconography and everyday social experience, timely and adequate rain means life, fertility and hope. Dry spells, droughts or floods mean ruination and despair on a colossal scale.

Yet, India leads the world in the prevalence of rainfed agriculture, measured by both area and value of produce (Rao et al., 2015). Approximately 90% of India's cropland is located within the 'water limited tropics' (Milesi et al., 2010). Though some 80% of the freshwater abstracted in India is used for irrigation (Shah, 2013), rainfed agriculture of various types constitute between 60 and 70% of India's cultivated land. Rainfed systems produce around 40% of India's food and support around 40% of the national population. Important food and commercial crops depend fundamentally on rainfed systems, which produce 44% of India's rice, 87% of its coarse cereals, 85% of food legumes, 72% of oilseeds, 65% of cotton and 90% of minor millets (Rao et al., 2015). Thus, rainfed systems are critical for India's food and livelihood security.

As in the rest of the world, these landscapes are in the midst a human-made crisis. Land degradation, poverty and hunger loosely overlap in the Indian drylands (Reddy and Reddy, 2002), with some 30% of the population in India's degraded semi-arid watersheds living below the poverty line (Ryan and Spencer, 2001). The extent of total degraded land is judged to be between 75.5 and 103 million hectares, most of which is to be found in semi-arid and arid areas (Ravindra, 2007). Soil loss costs the equivalent of around 10% of India's annual agricultural production (Babu and Dhyani, 2005), and in rainfed areas cultivating major cereal, oilseed and pulse crops, water erosion causes losses valued at around US$2.51 billion (Sharda et al., 2010: 79). Rainfed systems show large yield gaps relative to irrigated systems (Rao et al., 2015). Yet, the importance of these regions is only set to grow: some 40% of India's net sown area would be totally rainfed even if the country's irrigation potential were completely fulfilled (Rao et al., 2015) (as discussed subsequently, this is not necessarily a desirable objective from a social and environmental perspective). While India is currently self-sufficient in the production of major food crops, improving the viability of dryland agriculture is a key concern for alleviating the hunger and poverty that are particularly concentrated in rainfed dryland landscapes.

Over time, the overarching metanarrative that describing the challenges faced by the rainfed drylands has drawn relatively simple causal links between climate and water scarcity and between this scarcity and the unfolding agrarian crises in these landscapes. In this conception, climate – and rainfall in particular – occupies a particularly central position in the discourse, practice and policy of Indian water governance. This centrality is especially evident in discourses and policies focussed on the drylands. A small indicative selection covering materials presented by government actors (Nos. 1-3) and scholarship (Nos. 4 and 5) is presented below (Box 1).

Box 1: Selection of Narratives on Rainfed Drylands and their Management in India (Various sources)

1. "Rainfall and snowfall are the ultimate sources of water for meeting needs of drinking, irrigation, groundwater recharging (*sic*), rainfed agriculture, and environmental flows, flood and farm income securities… The implications of abnormal monsoon were more devastating in dryland agriculture without ground water utilities."
   Government of India, 2013, p. 29.

2. "An insight into the rainfed regions reveals a grim picture of poverty, water scarcity, rapid depletion of the ground water table and fragile ecosystems."
   Government of India, 2011, p. 4.

3. "… stopping farmer's suicides is the biggest challenge before the government and to meet it, we have undertaken a flagship programme… which aims at making 5000 state villages permanently water-scarcity free. If this succeeds, it will mark an end to farmer's woes. [Existing initiatives to relieve agrarian distress] cost "*crore*s[1] [which] went down the drain as [they] did not try to go to the root of the problem, which was inadequacy of irrigation"
   Maharashtra Chief Minister Devendra Fadnavis announcing the new rural development scheme in the state of Maharashtra (Deccan Herald, 2015).

4. "The fragile regions such as the Indian dry tropical areas have several nature-induced risks and vulnerabilities. Their specific features... such as a high degree of fragility, marginality, diversity and limited accessibility, (when compared to prime land areas of the country), generate the circumstances that keep them poor and contribute to their low productivity..."
   Jodha et al., 2012, p. 3.

5. "Rain-fed areas are confronted with the intrinsic problem of degradation of land and water… A vast proportion of rain-fed areas faces arid and semi-arid type of situations and receive scanty rains for nearly 50-55 days during monsoons, which is grossly insufficient to meet the year-round water requirement."
   Joshi et al., 2011, p. 224.

As this small sample of comments illustrates, the prevailing discursive environment *causally* ties together climate, water and agrarian distress in the rainfed drylands, which are

[1] 1 crore = 10 million in the Indian numbering system.

viewed as “fragile”, “intrinsically” prone to “nature-induced risks”, poverty and marginality, particularly when “compared to the prime land areas of the country”. Vulnerability is thus ‘naturalized’: understood to be primarily an outcome of biophysical factors – precipitation, aridity, and “fragile ecosystems”. In this discourse, the line connecting these “nature-induced” factors with hunger and poverty is straight, and it is short.

How does this discursive context play out in the policy and practice of water governance in the drylands, and with what impacts? To fully explore this question, it is first necessary to take a detour, briefly tracing the dominant features of water management for agriculture in India.

The Waterscapes of Indian Agriculture

Historically, the seasonality and intermittency of the Indian monsoon has not acted as the primary barrier to dryland agricultural communities in India. Farmers in these landscapes have enjoyed a rich legacy of successful water governance dating back to antiquity. An array of techniques, technologies and practices has built on the seasonality of the rainfall to build stable and remarkably productive agricultural communities (see Agarwal and Narain, 1997, for a seminal chronicling of traditional management techniques from across India). Technologies and practices show a great variety of forms, including the capture of rainwater falling on open community lands (e.g. via structures called *kundis*[2]), harvesting flood water from streams and rivers, building embankments, gullies and check dams to control soil erosion and improve percolation, and maintaining community tanks and shared wells to provide water for drinking and irrigation. Strategies have thus incorporated elements that, variously, increase storage, configure the flow of blue water (surface or ground), and manage green water through, for example, improving soil quality and biomass content. Crucially, these historical, communal arrangements have incorporated a number of *governance* practices focussed on risk-management, resource sharing and long-term maintenance. For example, in the arid northern state of Rajasthan, groups come together to construct temporary dams called *hembars* over seasonal streams, from which water is channelled into users' fields. Construction is a group activity led by experienced local farmers, who manage both the physical infrastructure and the cropping pattern of beneficiaries – selection of crops, the area allowed to be irrigated and the frequency of irrigation are the same for all members, irrespective of the size of their lands. To enforce the principle of equal entitlement to water

[2] *Kundis* consist of an artificially created circular microcatchment. Rainwater drains from this catchment into a covered well.

for all members, tail-end farmers who may receive comparatively less water are encouraged to enter into crop-sharing arrangements with head-end farmers.

This body of knowledge and practice unfortunately entered into a long period of decline during the last decades of the colonial period and then immediately following Indian Independence in 1947. The new Indian state was faced with a large agrarian population experiencing severe problems of food insecurity and poverty, driven in no small part by the dismantling of traditional resource management institutions set up during the colonial period and accompanying changes in socioeconomic relations (Davis, 2000; Jodha, 1995). For the new Indian state, there was a general consensus that agricultural intensification was urgently required to deal with these challenges. In response, the thrust of water and agricultural policy shifted overwhelmingly towards increasing the availability of surface and groundwater irrigation, particularly in areas favourable for agricultural intensification. In the northern Indian states – the heartlands of the Indian Green Revolution – farmers received free electricity to pump groundwater, improved seeds, subsidized inputs and minimum support prices. Output soared, and to commentators this suggested “the power of the new technology to liberate the fortunes of Indian agriculture from *the vagaries of the monsoon*” (Frankel, 1971: 8, emphasis added). Groundwater abstraction rose phenomenally, with landowners given full rights to abstract water from aquifers on their land. High rates of abstraction continue to the present, with most groundwater abstraction controlled by individual landowners (Cullet, 2014). The Green Revolution states of northern India are now perhaps “the most heavily irrigated region in the world” (Tiwari et al., 2009, p. 1). Surveying aquifers in the states of Rajasthan, Punjab and Haryana, Rodell et al. (2009) found that over a six-year period between 2002 and 2008, groundwater depletion in these states was approximately 109 km^3 of water – equivalent to around double the capacity of India's largest surface-water reservoir. Crucially, the last authors state that “annual rainfall was close to normal throughout the period”, as were other hydrological features such as soil moisture, surface flows, runoff and biomass, suggesting that “consumption… for irrigation and other anthropogenic uses is likely to be the main cause” of depletion (p. 999). Placing groundwater loss in the region in a global perspective, also Tiwari et al. (2009) state that “this is probably the largest rate of groundwater loss in any comparable-sized region on Earth” (p. 1).

In addition to increased groundwater abstraction, the Green Revolution was also accompanied by huge increases in surface water irrigation capacity. through minor irrigation works as well as large river-based infrastructure projects. From the second half the 20^{th}

century, India embarked on a programme of dam-building that now places it third globally in numbers of large dams completed – some 5,000 to date, with another 345 still under construction (National Register of Large Dams, n.d.). Drawing on British colonial legacies of building permanent headworks and elaborate diversion systems, "irrigation was transformed from a seasonal to a perennial possibility" (D'Souza, 2008). Accompanying hydraulic interventions was the systematic dismantling of longstanding traditions and institutions of water governance, and "having thereby relentlessly extinguished other ways, techniques, arrangements, traditions and cultures for managing and conserving water in India, the large dam is still always pursued as the TINA (there is no alternative) option" (D'Souza, 2008). At the same time, for policymakers, increasing irrigation potential represents a highly visible and politically expedient way in which to be seen to be doing something about agricultural productivity and for 'the national good'.

These modes of water management impose heavy social-ecological costs. An estimated 40 million citizens have been directly displaced by large dams in India, "with possibly a mere tiny fraction of this huge number of oustees having managed anywhere near meaningful resettlement" (D'Souza, 2008). Irrigated lands are now experiencing declining productivity. Around a million hectares of agricultural land in northwest India are affected by irrigation-induced salinization, caused by the application of poor quality groundwater (Datta and de Jong, 2002). In the state of Haryana, waterlogging and salinity cause losses estimated at US$37 million annually (*ibid.*). Datta and de Jong conclude their analysis with an observation that foregrounds the policy and economic drivers of degradation: "… *intensification per se is not the root cause of land degradation, but rather the policy environment that encouraged inappropriate land use and injudicious input use, especially excessive irrigation. Trade policies, output price policies and input subsidies all have contributed to the degradation of agricultural land*" (p. 223). In other words, the prevailing political economies and ecologies of land-use have driven unsustainable overconsumption and degradation.

Perhaps most perverse has been the singular failure of irrigation projects to actually meet their own objectives. Analysing official data from the Union Ministry of Agriculture, Thakkar (2010) finds that between 1991 and 2007, some Rs. 142,000 *crores* (approximately US$ 21.4 billion) were spent on major irrigation projects with the stated objective of increasing canal irrigation. Yet, "the official data shows that this whole expenditure … has not led to the addition of a single hectare in the net irrigated area by canals in the country for the whole of this fifteen year period" (*ibid.*). It is also clear that where irrigation potential has been created, it may not necessarily alleviate agrarian distress: water is appropriated largely by the powerful, articulate and privileged farmers who are able to cultivate profitable water-intensive crops. This dynamic is well demonstrated in the state of Maharashtra, which has more large dams than any other state in India, but where the overwhelming majority of irrigation is appropriated by the vastly lucrative sugarcane crop, which is only grown on some 4% of the state's agricultural land.

Finally, once established, projects do not necessarily provide water for long: siltation and lack of proper repair and maintenance have cut deeply into the storage and distribution capacity of existing irrigation infrastructure. Investment in creating new storage is not matched by the availability of funds to maintain it. A World Bank report, for example, finds that some Rs. 17,000 *crores* (just over US$250 million) are required *annually* for the upkeep of India's irrigation infrastructure, but less than 10% of this amount is actually available (World Bank, 2005) and even less is likely to be spent effectively (Thakkar, 2010).

This irrigation-intensive model of agricultural intensification continues to this day, as does the longstanding neglect of rainfed areas. Landscapes without recourse to bult irrigation infrastructures were were relatively neglected during the Green Revolution, as evidenced by disproportionate discrepancies in dedicated investment and systematic planning relative to irrigated areas. Up to the late 1980s for example – during the height of the Green Revolution – investment in irrigation and flood control was *twenty-two times* that dedicated to soil and water conservation in the non-irrigated zones (Vaidyanath, 1994). Until as late as 1985, rainfed zones were "unrecognized in mainstream planning", and their first inclusion in the national planning process (during the Seventh Five Year Plan period from 1985-1990) was accompanied by the admission that "decades of neglect had led to dryland areas being caught in a vicious circle of high risk, low investment, poor technology and low production" (Chhotray, 2011: 56). Yet, lethargy continues, as does a discursive environment naturalizing the problems of drylands. Though India's current (12^{th}) Five Year Plan (2012-2017) provides for a National Programme on Rainfed Farming (NPRF), three years into the five-year plan period the programme is yet to be implemented because of a lack of capacity to work at the local level in rainfed regions which are considered by the policymakers themselves as "resource-poor, unpredictable and diverse" (Interviews with representatives from the Department of Agriculture and Cooperation, quoted in IIED, 2015: 2).

It is against this background, that scholarship and popular advocacy has called for alternative approaches to water and land management in the rainfed drylands. Mindful of the social-ecological perversities generated by top-down and technocentric models in irrigated landscapes, advocates have called for alternatives which are participatory, decentralized and 'integrated' and which build local communities and ecologies. In regions with no access to centralized irrigation infrastructures, participatory watershed development (WSD) has evolved into the most widespread such alternative, and is now India's foremost strategy for (linked) dryland management and rural development. WSD projects have become an essential feature of the waterscape of the rural drylands, aiming to build social-ecological resilience and rejuvenate agricultural incomes that have so far lagged far behind those of farmers in irrigated regions. Projects, funded and implemented by either state or non-state development agencies, focus on single or small groups of villages which may be grouped together as a microcatchment. Within these boundaries, agencies work with local communities to implement soil conservation, rainwater harvesting, recharge aquifers, add vegetation, and set up community groups for resource management.

This approach largely mirrors the basic tenets of an integrated water resource management (IWRM) approach and crafts a 'complementarity between conservation and productivity objectives' (Kerr, 2001: 1387). It represents a practical acknowledgement of the now well-recognized links between social and environmental wellbeing. As such, watershed development has been viewed as a strong countercurrent to both the 'big project' mania that otherwise dominates Indian water governance, and as a departure from single-focus projects that restrict themselves to the provision of water for irrigation to the exclusion of other aspects of water use and management. Watershed projects also incorporate a long-term vision of stewardship. After the completion of five-year projects, the aim is that any water-management structures that are built will be managed by local communities with dedicated bank accounts and management groups supporting this objective. Women's groups and small savings societies are set up during the project, and these are designed to continue after its completion with a view to encourage livelihood diversification. The autonomy of local communities is foregrounded, at least in theory, in stark contrast to the encounters between local communities and large irrigation infrastructures. Crucially, watershed projects are meant to offer a wider array of options than simply increasing the supply of blue water. Instead, there is a provision for 'dry issues' (Rockström et al., 2010) such as preventing soil erosion, improving soil quality, and adding biomass and organic matter. The potential for increased flows of green water is thus implicit in the practice of watershed development, as is the recognition that low productivity in dryland landscapes is not exclusively a function of irrigation, but instead, can be improved by enhancing soil moisture, soil quality, soil organic content (SOC) and vegetation (Srinivasarao et al., 2014).

In summary, then, conventional approaches to increasing water supply have generated a number of social-ecological perversities which watershed development, as a seemingly radical alternative seeks to avoid. In what follows, I unpack this contention by exploring the long-term performance of watershed projects and tracing the dominant ideologies informing practice on the ground.

Unpacking Alternatives

Watershed development has enabled some remarkable transformations in rainfed dryland landscapes. A number of pioneering cases, notably the villages of Ralegaon Siddhi and Hivre Bazar in the state of Maharashtra, are lauded worldwide as exemplars of participatory, decentralized and 'integrated' resource stewardship. Yet, over time, it is becoming clear that the transformations seen in these seminal cases are not mirrored in more general practice. The evidence base is limited. Comparative and longitudinal analyses are rare, with most evaluations cast in the relatively instrumental idiom of rural development indicators, assessing changes in crop productivity and farmers' incomes mainly in the short-term following projects. Perhaps understandably, success is more visible than general outcomes – and failure is barely visible at all.

Available empirical evidence highlights a significant gap between the potential and reality of the watershed program. Outcomes are found to be patchy, varying from "the spectacular" to the "once good but now not very good" (Samuel et al., 2007: 71). To explain this patchiness, early evaluations of watershed development projects focused primarily on the social dynamics of project design and implementation. These cited factors such as lack of a proper participatory process, inequitable distribution of costs and benefits, and socio-cultural, institutional, and administrative barriers to sustained community engagement (see, among others, Bouma et al., 2007; Joshi et al., 2004; Kerr et al., 2000; Mishra, 2010; Phadke, 2013; Samuel et al., 2007, 2009; Sharma, 2003).

Giving due credence to these factors, an emerging stream of scholarship nevertheless calls for a more fundamental critique. Scholarship in this stream interrogates the foundational premises shaping projects and their outcomes. Specifically, emerging evidence suggests that gaps between promise and reality may derive from the fact that watershed projects might be operating within the same *milieu* as that which governs Indian water management more generally. That is, watershed practice may be manifesting the dominant 'common sense', linking water scarcity directly with lack of rainfall, and centralizing the singular aim of water provision in response. Researchers have pointed out, for example, that programs have relied on a number of 'myths' about water, rainfall and climate – one being that rainfall has been progressively declining and that this underlies water scarcity (Batchelor et al., 2003). The Drought Prone Areas Programme (DPAP) - a key initiative for watershed development - for example, aimed to "drought-proof" the rainfed drylands, and is premised on the need to minimise "the adverse effects of drought on the production of crops and livestock and productivity of land, water and human resources" (Singh and Ballabh 2008: 162). In other words, the central problematic was considered to be a question of rainfall and aridity. Finally, Calder (2005) highlights how incorrect assumptions about land-water interactions have underpinned the Indian watershed development program and resulted in *increased* groundwater abstraction and *reduced* access to common property water resources for poor people, amongst other negative social-ecological externalities. For these scholars then, watershed development practice is not simply sub-optimal because of improper implementation. Instead, improper diagnosis of the problem drives the gap between promise and reality.

Further evidence along these lines is provided by recent research on the long-term outcomes of watershed development in the state of Maharashtra (Bharucha et al., 2014). Interviews with farmers by the authors showed that they overwhelmingly thought of declining rainfall as the chief driver of water scarcity and agrarian distress, despite the fact that aggregate rainfall had not shown significant declines over a hundred-year period (*ibid.*) Qualitative narratives also show that farmers may simply be viewing projects as avenues for the provision of irrigation rather than as a multifaceted and multipronged strategy to institute broad-ranging management across the social-ecological system. For example, some ten years after the completion of projects, beneficiaries described how: "There used to be only 50 wells in the village. Now there are 400! If previously 50 wells were being used for 400 acres, now one well is used for one acre! *This is an improvement, isn't it?*" (Bharucha et al., 2014, emphasis added). Well-digging is regarded as a non-negotiable, practical necessity, as exemplified by the following excerpt from a focus group (Box 2) in the study site.

Box 2: Focus group narratives on well-digging following watershed development (Source: Bharucha et al., 2014).

> *Farmer 1:* Suppose that today, I require some water. I have a shortage of water in the well for my fields. I do not have enough to drink. Then, I will immediately dig a bore well. [If] I have money with me, I will dig a bore(well).
>
> *Farmer 2:* It's not just that. It's not just money. Suppose you take a bore(well) [*referring to focus group participant*]. Then [even] if I don't have enough money, even if I don't have anything – I will dig a bore(well). I will do anything, I will take a loan, but I will dig a bore(well).

Other evaluations have found that following WSD, farmers may have been increasing the abstraction of groundwater based on erroneous beliefs about the potential of soil and water conservation to recharge aquifers. Samuel et al. (2007), for example, find that in recent years farmers may have been tapping groundwater too deeply for it to be recharged by rainfall, thus weakening claims that watershed development is driving a resurgence of rural prosperity via sustainable improvements to irrigation. There is also indication that farmers switch from traditional 'dry' crops such as millets and sorghum to relatively water-intensive crops following watershed development, a transition that is then locked into place, as the switch to high-value cultivation costs money, making it prohibitive to switch back to dry crops offering relatively low returns (Bouma et al., 2007). In the state of Maharashtra, ten years after the completion of watershed projects, farmers almost unanimously reported the decline or cessation of the cultivation of 'dry' crops such as horse gram (*Macrotyloma uniflorum*) and moth bean (*Vigna aconitifolia*) (Bharucha et al., 2014). Thus, rather than watershed development being used to strengthen the resilience of rainfed cultivation, it is instead acting as a catalyst for the transition to a relatively high-input regime of irrigated, commercial cultivation. Interviews with farmers revealed that this change is overwhelmingly framed with reference to the climate. That is, farmers state that traditional 'dry' crops can no longer be grown because there is not enough rainfall to do so. Yet, both horse gram and moth bean possess immense adaptability to conditions of poor soil and low rainfall; traits that have ensured their place as traditional staple crops in dryland India (Brink and Belay, 2006; Gadgil and Guha, 1992; Nene, 2006). In further conversation, it became clear that farmers were in fact simply turning away from rainfed cultivation altogether, viewing it as a negative choice rather than as a regime to be strengthened by watershed development. Instead, they described how watershed development had provided greater access to irrigation, allowing them to cultivate more irrigated and lucrative crops: "we do not have to grow crops which are wholly dependent on the rainfall" (Bharucha et al., 2014: 9). For these farmers then, watershed development is viewed as a means to increasing the availability of water for irrigation, as a catalyst away from rainfed cultivation and as a means to intensify cultivation of relatively lucrative crops.

What does this mean for the social-ecological resilience of rainfed dryland communities? Are farmers who have used watershed development to intensify cultivation more or less vulnerable than before? Conversations around these themes are notably absent in the scholarly literature, which largely neglects to collect systematic accounts of the lived experience of 'project beneficiaries' over time. For interviewees in Maharashtra, the increased abstraction of groundwater for farming has not necessarily alleviated the *experience* of water scarcity and there is still a dominant perception that rainfall remains the ultimate arbiter of water availability (Box 3), even as well-digging and the intensification of irrigation continue apace (Bharucha et al., 2014).

Box 3: Farmers' narratives on water scarcity, rainfall and watershed development (Source: Bharucha et al., 2014)

"In the end, what ultimately determines a farm's viability is rain. WSD cannot buffer against major changes in climate. The WSD advantage so far is only that there is a slight increase in water and therefore slight shortages can be buffered."

"In dry regions, there is no alternative except for it to rain. Suppose it were a place serviced by a canal. Even if it didn't rain, they could release water from a dam, then people could carry on. There is nothing like this here."

Taken together, these narratives suggest a process in which the attribution of deepening scarcity to rainfall goes hand in hand with – or even enables – the continuing unsustainable abstraction of groundwater. Tellingly, groundwater abstraction and the intensification of irrigation are both strictly regulated in the seminal watershed development cases on which the contemporary program is based. Grassroots community work in Ralegaon Siddhi, for example, has included long-term rules limiting the cultivation of water-intensive sugarcane and the sinking of deep bore wells. By contrast, on-the-ground experience in contemporary projects tends to show the process moving in exactly the opposite direction: watershed development becomes a means by which individual farmers justify increased abstraction of groundwater, though these claims do not necessarily hold in light of what is known about the links between water conservation and aquifer recharge (cf. Samuel et al., 2007).

We are thus faced with a situation in which both conventional water management and well-regarded, ‘integrated’ alternatives are bound together by a metanarrative wherein the problem is viewed as climate-driven scarcity and the solution is almost always to increase water supply. Perverse impacts follow from both. Whereas these have been comprehensively chronicled with regard to large dam and canal projects, emerging scholarship on the unintended outcomes generated by alternatives is only just developing. What evidence that does exist highlights the need for a critical rethink of the assumed links between climate, scarcity and agrarian distress.

A multidisciplinary body of literature critically analyzes agrarian distress, land degradation and the impacts of drought as complex multi-causal phenomena rather than as singular outcomes of inadequate rainfall. Empirical work finessing this nexus of issues loosens the links between climate, scarcity and distress that are so tightly woven together in the ‘accepted’ reality of water and land management. It is impossible to provide a comprehensive review of this literature in the space of a single chapter; what follows is simply a brief overview of some of its key themes and insights. These open up new spaces and potentials for effective water governance that contributes to social-ecological resilience.

The first vein comes from critical accounts of environmental and economic history. These have nuanced our understanding of the links between drought, agrarian distress and famine by highlighting the influence of particular political and economic configurations that either amplify social-ecological vulnerability or block communities’ abilities to adapt to the vagaries of climate. The seminal work of Mike Davis comprehensively and powerfully illustrates the specific influence of national and international economic policy in driving agrarian distress during the nineteenth century El Niño (Davis, 2000). For Davis, neither the fact that rainfall was insufficient nor Malthusian explanations of population growth driving famine adequately explain the scale of damage and degree of suffering experienced around the world during the nineteenth century. Instead, the incorporation of peasant agronomies into global commodity chains, the dismantling of traditional systems of crisis management (e.g. locally-controlled grain stores), high unemployment and high prices all combined to ‘turn drought into famine’ on a catastrophic scale. Davis quotes the Famine Commissions which found that “supplies of food were at all times sufficient, and it cannot be too frequently repeated that severe privation was chiefly due to the dearth of employment in agriculture [arising from the drought]” (in Davis, 2002: 161).

Scholars focussing on India were particularly exercised by these questions following the central Indian drought of 1972. Oughton (1982) shows how human suffering associated with the drought was not exclusively the result of inadequate rainfall. Instead, agrarian distress was generated by the combined impacts of the relatively low spread of irrigation, the adoption of water-intensive cash crops in surrounding districts rather than cereals, and a poor public food distribution system that did not effectively distribute aid. Examining the causes of increased vulnerability to drought in India, Kumar (1988) begins by noting that "despite no changes in rainfall patterns, there is evidence that droughts have been causing successively larger variations in employment and rural incomes" (p. 1). He proceeds to highlight the macroeconomic factors that underlie drought vulnerability and concludes that inter-regional inequality needs to be directly addressed through "a much larger effective level of public investment in agriculture – with particular emphasis on the poorer rainfed regions" (p. 30).

In a different vein, the role of water-intensive crops is critically examined in the context of contemporary struggles over water and sustainable dryland livelihoods. For example, commenting on agrarian distress in the state of Maharashtra, the South Asia Network on Dams, Rivers and People (SANDRP, 2015) discusses the case of sugarcane cultivation in the district of Marathwada. SANDRP acknowledges that the region is water-limited and even 'drought prone', but questions why, nevertheless, "in 2013, Marathwada grew over 2 *lakh*[3] hectares of sugarcane and is now crushing the cane in its 61 sugar factories using thousands of *lakhs* of water every day." In another report on the perverse juxtaposition of water-guzzling crops in water-limited landscapes, SANDRP describes how, in the district of Solapur, "In 2012-13, a year that was called a drought year, worse than (the) 1972 drought, Solapur added 4 new sugar factories" (SANDRP, 2013: 2). Following SANDRP, then, we may say that while limited rainfall is a key driver of water-limited landscapes, it is water-intensive cropping patterns that push the boundaries between water-limitation and water-scarcity. At landscape and catchment level, the appropriation of water by sugarcane farmers and politically powerful sugar producers directly affects water for drinking or for the cultivation of other crops. In Solapur, "sugarcane and 'tanker fed' villages co-exist" (SANDRP, 2013: 6) – that is, water for drinking and household use is provided by a state-run tanker service, while local supplies of water are diverted to sugarcane cultivation. These cropping patterns impact both food and water security. In Marathwada, water shortages have driven so-called 'cattle-camps' – the distress sale of cattle by farmers unable to support them

[3] 1 *lakh* = 100 thousand in the Indian numbering system

through a dry period. A recent interview with a researcher-activist on Indian water management highlighted "*possibly one of the most tragic ironies of Maharashtra today: [that] the cattle are fed with sugarcane fodder.*" The same activist also highlighted how grassroots agitations for drinking water coincide with the continued use of water for sugarcane cultivation and crushing:

> "*While he* [activist Prabhakur Deshmukh] *was sitting on a fast for drinking water, sugarcane factories in his own village, 3 sugar factories, one of them belonged to Pawar, were actually crushing sugarcane using nearly 6* lakh *liters of water per day. So we are not talking only about water for livelihood security. We are talking about drinking water security, water as a fundamental right to life, which is also sabotaged by sugarcane. And it's not a one-off case. It is a recurrent example…*" (Interview with researcher-activist on Indian water management, January 2015).

Commenting on the links between the local elite, sugarcane cultivation and agrarian distress in the dryland district of Marathwada, an article in the newspaper *Economic Times* observes:

> "*Sugarcane cultivation and sugar industries have for decades received privileged treatment, thanks to the factories being either owned or controlled by the state's politicians. In 2012-13, Marathwada added 20 sugar factories even as villages were supplied drinking water through tankers. Today, there are around 11* lakh *hectares under sugarcane and 205 sugar factories in the state, of which 70 are in Marathwada alone"* (Mohan, 2015).

A third stream of critical insight is generated by political ecologies of water management and agrarian change. Mehta (2001) developed a seminal political ecology of water allocation in the dryland landscapes of India, revealing how narratives of water scarcity dominate both the politics and the everyday lived experience of people in the semi-arid Kutch region of Gujarat. She shows how these narratives are used to justify centralised irrigation infrastructures – in this case the Sardar Sarovar Dam – which will supposedly alleviate scarcity by increasing the supply of irrigation. Mehta carefully unpacks these narratives to reveal how the spectre of "*dwindling rainfall and increasing droughts… can also be* *'manufactured' in such a way to serve the interests of powerful actors…. (These) popular perceptions of scarcity, as represented in the mass media and by politicians and advocates of the water question, have naturalized scarcity in Kutch*" (p. 2026). For those holding this view, "there is unambiguous consensus … that climate change, independent of human intervention, exacerbates the problems of water scarcity" (p. 2029). Yet, as Mehta shows, there have been no significant changes in rainfall that might explain these popular perceptions. Long-term analysis of rainfall patterns reveals that rainfall has always been variable, and no statistically significant reductions are yet discernible. Instead, as Mehta reveals, water use has increased significantly, driven by rising demand from a growing population and the intensification of agriculture. Farmers have increased the number and depth of bore wells, and de-vegetation has led to increased soil erosion and reduced aquifer recharge. Thus, the spectre of agrarian distress is a powerful tool with which to justify dam building and other measures focussed on the narrow goal of increasing water availability. The same dynamics are discerned in the state of Maharashtra, where observers highlight how the construction of large irrigation infrastructures:

> "*… is an enterprise between businesses and politicians (that) has nothing to do with water availability especially for the poor. Examples where the poor got water from a dam are very, very rare. They do exist, I don't say that they don't exist at all. But if you compare them with the number of dams that we have, and the slogans that we've been giving for the past 50 years, it doesn't hold ground at all.*"
> (Interview with researcher-activist on Indian water management, January 2015).

The establishment of these infrastructures dovetails with the 'lock in' of a relatively water-intensive agricultural commodity complex which, over time, has actively impeded resilience by displacing drought-adapted crops and established livelihoods. In Maharashtra, traditionally prosperous oilseed-dominant agroecosystems have flourished within water-limited conditions. Yet at present: "*of the 16,000 ha expected of oilseed, only 2000 ha are actually cultivated. So much oilseed has just not been planted. Instead, they are cultivating sugarcane because of the sort of security that the sugar factories give them. There is no such security when it comes to oilseed*" (Interview with researcher-activist on Indian water management, January 2015).

Finally, new evidence on the sustainable intensification of agriculture shows the remarkable outcomes that can be achieved in rainfed dryland landscapes where green water, soil health and biodiversity are well managed by local communities themselves. Rainfed dryland communities which have focussed on 'dry' issues (Rockström et al., 2010) have seen huge increases in productivity and resilience. The Sahel provides a particularly powerful example. Here, some 3 million hectares of previously degraded land have been improved through a combination of soil conservation and the cultivation of some 120 million trees. In the mid-1980s, restrictive policies prohibited farmers from managing trees on their own lands; this was accompanied by creeping land degradation. The relaxation of these policies, coupled with the promotion of agroforestry, has seen farmers actively managing so-called 'fertilizer trees' on their lands (Pretty and Bharucha, 2014; Pretty et al., 2011). Farmers plant nitrogen-fixing species (e.g. *Faidherbia albida*) on and around cereal fields, and community groups have implemented small-scale water harvesting to capture rainwater and improve soil moisture. A stream of positive externalities have emerged, including aquifer recharge, improved soil health and improved availability of firewood fodder and other non-timber products. In all, the 'Green Wall of the Sahel' has resulted in substantial increases in food production – some 500,000 additional tonnes of food per year (Reij et al., 2009). Similarly, in Malawi, Tanzania, Mozambique, Cameroon and Zambia, cereal production has increased from 5 tonnes to 8 tonnes over a five year period (Asaah et al., 2011; Ajayi et al., 2011; Pretty et al., 2011). While the long-term outcomes and political ecologies of these schemes need to be explored in further detail, these examples nevertheless do show the potential of interventions which do not focus solely on increasing water supply. Instead, strategies for sustainable intensification in drylands can generate significant improvements through the management of soil, green water and vegetation.

In summary, these different streams of scholarship open up the conversation about climate, scarcity and rainfed agriculture. They show that vulnerability is not as tightly bound to the climate, and specifically to declining rainfall, as the dominant narrative in India suggests. There is much potential for an 'opening up' of land and water management beyond simple technical measures to increase water availability. Perhaps ironically, the importance of this 'opening up' will only *increase* as climate change advances and climatic pressures become increasingly immediate. As this occurs, it will be ever more important for rainfed farmers to have a well-developed and diverse suite of options to maintain all-round social-ecological resilience.

Going forward

This chapter discussed the prevailing paradigm governing land and water management in the rainfed drylands of India. Assumptions of naturalized scarcity as the primary driver of agrarian distress have coloured both conventional and well-regarded alternatives such as watershed development. Though integrated, community-scale management was initially meant to strengthen rainfed cultivation, evidence on its outcomes and critical analysis of stakeholders' narratives shows that watershed development is embedded within the very same paradigm as conventional 'business as usual' irrigation management in India. Across both irrigated and rainfed landscapes, the prevailing vision valorizes water availability as the primary criterion of water management, increasing supply of blue water to cultivate relatively water-intensive and lucrative crops. For farmers working in rainfed landscapes however, this does not enable resilience over time. Instead, short-term spikes in productivity and incomes precede the return of a narrative of water scarcity (Bharucha et al., 2014). The continued attribution of these outcomes to rainfall means that potentially useful management measures, such as introducing rules on cropping patterns and limiting well-digging, are not implemented.

At the time of writing, the state of Maharashtra is once again faced with the prospect of dry spells affecting the rainfed cotton crop. It has been reported that the government is considering employing a private agency to undertake cloud-seeding to encourage rainfall (Economic Times, 2015). So, both the spectre of scarcity and the supposed saviours of increased rainfall (or more blue water) are still powerfully in play. With increased concern about global climate change, the intensity and variability of the Indian monsoon are both likely to be exacerbated, as are regional disparities between water-abundant and drier areas (Roy, 2006). It would be easy to conclude that while the impact of climatic factors has thus far been overstated, it should now be at the front and centre of the conversation. And yet, it is quite clear that dryland communities are 'double-exposed' – vulnerable on two fronts, to both climate change and the imperatives of capricious markets (O'Brien, 2004). The received wisdom is that both can be navigated if we simply increase the amount of water available. However, efforts to do so have not only failed to alleviate agrarian distress, but have introduced a whole array of social-ecological perversities that increase vulnerability to climate change when it does occur.

The streams of evidence and critical scholarship that have only just been briefly summarized in this chapter converge to reveal very real opportunities for a genuine transformation towards sustainability and resilience. These bodies of scholarship widen the space between climatic 'givens' and outcomes on the ground. In doing so they reveals the wide array of strategies that may be employed to build social and natural capital over and above the provision of increased water for irrigation. It is time to recommit to forms of governance that build on the longstanding competencies of agricultural communities, and employ them to build resilient rainfed agriculture, rather than chasing the mirage of super-abundant water in dryland landscapes.

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