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Squaring the circle: Agricultural intensification vs. water conservation in Morocco

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ABSTRACT

Drip irrigation is widely promoted as a means of saving water. In Morocco, where the current annual overdraft of aquifers is around 1 billion m^3, drip has been promoted, with subsidies as high as 100%, as a means of both raising productivity and rural incomes and 'saving' over one billion of m^3. The paper shows that in the conditions of Morocco, drip tends to be associated with higher crop density, a shift to more water-intensive crops, and the reuse of 'saved water' to expand cultivated areas, resulting in higher water consumption. The Green Morocco Plan not only subsidizes conversion to drip but also the expansion of intensive farming, with an impact on water resources opposite to what is announced. We evidence contradictions in official discourses and policies and show how current policies undermine the resilience of irrigated agriculture to extreme drought events. Planning is carried out based on illusory local savings, disregards climate change projections, and runs against hydrologic realities that should be better accounted for through more elaborate water budgets.

1. Introduction

The achievements of the Moroccan water sector over the past 60 years are conventionally associated with a number of milestones, including the foresight of King Hassan II's 'Dam program' in ensuring a healthy storage capacity for the nation, the extent and quality of urban water services, the technical capacity of its water professionals, a long-term planning policy launched in the early 1980s, and finally a 'state-of-the-art' institutional framework and legal arsenal, most prominently Law 10–95 enacted in 1995 (SECEE, 2009). These policies have endowed the country with 140 large dams and large irrigated public schemes, satisfied domestic, industrial and tourism water needs, improved flood protection, and developed hydropower production (SECEE, 2009; El Gueddari and Arrifi, 2009).

In Morocco's semi-arid context, irrigation has long constituted a very important element of rural livelihoods and now accounts for 50% of agricultural added value. The irrigated area in Morocco is estimated at 1.46 million ha, that is around 17% of the total agricultural area of the country, to which can be added 300,000 ha of occasionally irrigated land in communal schemes (Belghiti, 2005; CESE, 2014). This total includes in particular 683,000 ha of large-scale public irrigation, divided into nine Regional Development Agencies (ORMVAs), and 441,430 ha of private irrigation, generally based on groundwater and private wells (CESE, 2014).

Although Morocco's economy is dominated by the service sector, with a share of GDP of 55% in 2011, against 30% for industries and 15% for agriculture, the role of agriculture in the economy is better illustrated by the fact that it employs 44% of the economically active population of the country (United Nations, 2014). In a post-Arab Spring context with a political urge to make livelihood opportunities available, agriculture is back on the agenda with a 'modernizing' ethos and both intensification and expansion as objectives.

But such plans heavily depend on water resources that are now ünder threat (. . .) [due] to the combination of growth in demand and increasing scarcity of the resource(HCP, 2007). The bulk of the Kingdom's water resources is consumed by agriculture, invariably described as wasteful, the blame being put on the poor efficiency of 'traditional' gravity irrigation, ẅhich means that less than half of the water delivered to farms currently reaches the crops(World Bank, 1998). Groundwater resources are of particular concern. According to the Minister of Water, groundwater resources provide drinking water to 90% of the rural population and to nearly 40% of the total

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area irrigated in the Kingdom, contributing to more than 50% of the economic value-added generated by all irrigated areas (quoted in Maroc.ma, 2014); but the Kingdom's main aquifers are all overexploited, with an overall overdraft of 1 billion m^3/y (Bm^3)(ibid.).

Investments in irrigation infrastructure have always lagged behind investments in dams, and in the late 1990s/early 2000s they declined. However, in 2008, a year after his appointment, the Minister of Agriculture launched the Green Morocco Plan (*Plan Maroc Vert*, PMV in what follows) that signalled a surge in investments in the agricultural sector. The PMV is a sector-wide comprehensive agricultural development plan launched with ambitious objectives (a planned investment of 174 Billion DH,[1] the creation of 1.15 million jobs by 2020, the tripling of the income of 3 million people in rural areas). With regard to irrigation, ongoing projects from the Ministry of Agriculture have been subsumed into the PMV. They include the National Program for Water Savings in Irrigation (PNEEI) and the Program to bridge the gap between dams and irrigated areas, which aimed to complete the development of irrigated areas originally planned together with the main dams of the country (140,000 ha over 10 years) (Belghiti, 2010).

The implementation of the PMV requires that the current overexploitation of water be addressed, and the Ministry of Agriculture is pinning its hopes on drip irrigation. The Ministry of Water, through its river basin master plans and overarching National Water Plan, is planning to mobilize more resources through a north-south interbasin transfer, new dams, wastewater reuse and seawater desalination. Yet supply augmentation is not enough to reverse current overdraft. This paper examines the promotion of drip irrigation as a means of allegedly saving 1 Bm^3 annually by 2020 while modernizing and intensifying agriculture, in the context of the current status of Morocco's water resources. It does so through, first, a technical analysis and, second, an examination of the policy discourse and contradictions. The paper is principally based on a comprehensive analysis of existing written sources, complemented with insights from exploratory interviews with farmers in the Haouz region, surrounding Marrakesh, between 2013 and 2015, and interviews with decision-makers/officials in Rabat and Marrakesh between 2014 and 2017.

There is a growing body of literature examining the impact of a shift from gravity irrigation to micro-irrigation, questioning in particular whether micro-irrigation was reducing water consumption (Willardson et al., 1994; Playán and Mateos, 2006; Berbel et al., 2014; Perry and Steduto, 2017). This debate intersected an older field of research that emphasizes the scale-sensitivity of the concept of irrigation efficiency, distinguishing between on-farm and system/basin level savings (Seckler, 1996; Molle and Turral, 2004; Perry, 2007, 2011; Frederiksen and Allen, 2011). This paper contributes to these debates by investigating the likelihood that the water savings envisaged in the Moroccan government's policies will materialize. It does so by engaging with the literature on the impact of drip irrigation on water consumption and return flows, as well as on cropping patterns, water productivity and farmer strategies, and examines likely outcomes in the particular context of Morocco. It then analyses how agricultural expansion is also promoted and how irrigation '(re)conversion' policies have been thought of, in particular with regard to cross-sectoral consistency and projections of climate change, and possible negative effects anticipated and dealt with. It finally concludes that while these policies do boost production and land/water productivity, they do so at the expense of an already overexploited resource, suggesting that political objectives have taken precedence over technical and hydrological realities.

[1] One US$ ≈ 10 DH

2. Water saving policies in Morocco

Water shortages in general, and problems of groundwater overexploitation in particular, have spurred calls for 'improving efficiency' worldwide (Lundqvist et al., 2008). A standard and almost knee-jerk policy response has been the promotion of micro-irrigation (Postel et al., 2001), most particularly in the Mediterranean region. In Tunisia, the National Program for Water Savings, established in 1995, offers subsidies for farmers of 40% to 60% of the total investment costs for water saving irrigation technologies (Frija et al., 2016). In Algeria, a program adopted in 2000 (PNDA) subsidized micro-irrigation (among other things) at a level as high as 100%. In Spain, the Shock Plan (*Plano de Choque*) for micro-irrigation set up in 2006 with a planned budget of €3.7 billion subsidized micro-irrigation at a level of 60% (López-Gunn et al., 2012).

Likewise, Moroccan policymakers have given strong priority to the dissemination of micro-irrigation (El Gueddari, 2004). Taxes on the import of equipment for micro-irrigation have been reduced or canceled since 1982 (MAPM, 2007a; Laamari et al., 2011). In the 1990s subsidies offered by the FDA (*Fonds de Développement Agricole*), averaged 17% of the investment costs in micro-irrigation. In 2002 a new decree raised the level of subsidies to 30%–40% (depending on the water status of the river basin), and extended this subsidy to all components of the project (including wells, pumps and intermediate storage ponds). Shortly after, a National Program for the Development of Micro-Irrigation was launched with a target of 114,000 ha. In five years this program had only attained 39% of the stated objective (El Gueddari and Arrifi, 2009), with 75% of the conversion observed actually achieved through the pre-existing FDA. Faced with the evidence that few farmers yet had the capacity to invest, in 2006 the government raised the rate of subsidies to 60%. Yet the Prime Minister declared that "efforts to establish an efficient demand management did not live up to [our] ambitions" and that the government was ready to launch a large national program for water savings, a key measure of which would be the expansion on a large scale of efficient irrigation techniques" (MAPM, 2007a). In 2007 the National Program for Water Savings in Irrigation (PNEEI) was established.

The PNEEI adopted ambitious targets. It sought to achieve the conversion of 550,000 ha of land irrigated by gravity or sprinkler to drip irrigation in 15 years, at the cost of 37 billion MD (~3.7€ billion). Of this conversion, 72% would involve large-scale public irrigation (including some individual farm conversions and the modernization of the collective distribution of pressurized water through pipes), with the remainder being devoted to private individual irrigation. Technical change was to be accompanied by technical advice on irrigation practices, crop choice, and strengthened linkages with the agro-industry and export markets (MAPM, 2007b).

The predicted outcomes of the program included water savings varying between 30% and 50% (with an ultimate total of 826 million m^3 (Mm^3) 'saved' every year), an increase in yields of up to 100%, increases in job creation, rural incomes, and service fee recovery, a reduction in the energy demand of the irrigation sector, and—rather optimistically—a reduction in the overexploitation of aquifers (El Gueddari and Arrifi, 2009). The PNEEI was to be conducive to a revolution in Moroccan irrigated agriculture, not only with regard to irrigation water use efficiency, but also to productivity and competitiveness (El Gueddari and Arrifi, 2009).

In 2008 the overarching PMV was launched and the PNEEI was incorporated into it. Three years later the PMV would finally raise the level of subsidies to 80% for large farms (area over 25 ha) and 100% for small farms. In less than 10 years the support to micro-irrigation shifted from 17% to 100% in subsidies.