المعهد المغربي لتحليل السياسات
MOROCCAN INSTITUTE FOR POLICY ANALYSIS
ⵓⵔⴰⵔⵉⵏ ⵓⵎⵔⵕⵓⴷⵉⵢ ⵏ ⵜⵙⵙⵓⵏⵉⵜ ⵏ ⵜⵙⵙⵓⵏⵉⵡⵉⵏ

JANUARY 2025

JUST WATER TRANSITION

Report

The Moroccan Institute for Policy Analysis

REPORT

JUST WATER TRANSITION

The Moroccan Institute for Policy Analysis

5, Apt: 5, Rue Figuig, Hassan - Rabat

Contact@mipa.institute

www.mipa.institute

05.37.26.26.02

The institute acknowledges the significant contributions of Dr.Amal Ennabih. Data collection, through individual interviews, were conducted by Monica Carrion, project manager, Ayman Taleb, project manager and Dr. Hajar Idrissi, researcher and project manager.

The institute extends its sincere appreciation to Professor Mohamed Taher Sraïri for his insightful comments and thorough review of this report.

This report is sponsored by the Just Transition Green Bridge project in partnership with the Arab Reform Initiative (Lebanon), and Alternative Policy Solutions-AUC (Egypt).

The project is funded by the Civil Society Facility for the Mediterranean (European Union) and the Swedish International Development Cooperation Agency (SIDA)

The Moroccan Institute for Policy Analysis is a nonprofit public policy institution which aims to conduct in-depth research on various public policy issues by proposing innovative ideas to solve problems facing society in terms of democracy and development. The main activity of the Institute is to produce systematic and in-depth analyses of policy related issues. The results and analyses are published by the institute in the form of policy briefs, research articles and reports.

SUMMARY

Transitioning from a water-supply approach that favors intensive irrigation practices to a new paradigm focused on water-demand management is essential for ensuring fair and equitable access to water in Morocco. However, a critical review of the country's water policies reveals that public authorities often perpetuate a myth: the belief that the agricultural sector can drive economic growth based on the illusion of unlimited water availability and the unrealistic promise of greening deserts. This mindset not only undermines sustainable water management but also exacerbates the risk of further water scarcity in the country. Here are the main takeaways:

- The Green Morocco Plan (2008-2020) had promoted market-oriented farming through the commodification of horticultural products, shifting them from domestic consumption to becoming export-oriented crops, which exerts significant pressure on water resources. This approach has marginalized rainfed agriculture, particularly cereals, in favor of more profitable irrigated farming.
- Rather than delivering the expected water savings in large-scale irrigation schemes, the Green Morocco Plan had the unintended effect of accelerating the expansion of private irrigation in rain-fed areas, primarily drawing on aquifers. Drip irrigation subsidies and insufficient regulatory oversight on well drillings had led to the severe over-exploitation – even depletion in some areas - of groundwater resources.
- By subsidizing solar energy for water pumping, the Generation Green Strategy (2020-2030) is enabling a durable access to well water (as long as water remains available), making the extraction process virtually free, which accelerates the extension of irrigated schemes in oases areas. As a result, structural social inequality is escalating as access to water resources, particularly in oasis areas, becomes increasingly controlled by speculators. This shift has gradually limited water access for small farmers from the original oases, contributing to their declining numbers as well as jeopardizing drink water to urban areas.
- The techno-triumphalism surrounding the discourse of desalination as the game changer for Morocco water scarcity's woes must give way to a critical examination of its environmental and economic sustainability. Moreover, desalination development as a water supply solution without addressing the underlying structural and historical issues in the water sector may only deepen existing disparities and neglect the root causes of water scarcity.

For a just water transition we propose three key pathways: 1/ Breaking away from an irrigation-driven, market-oriented agricultural model and steering towards a rainfed agriculture centered on food sovereignty where irrigation comes only as a supplement; 2/ Shifting from a water supply approach to demand management by regulating groundwater withdrawals and strictly enforcing water consumption controls aligned with territorial-level planification; 3/ Implementing a participatory governance of water management by adopting a bottom-up approach and prioritizing local socio-economic needs and initiatives over national imperatives.

TABLE OF CONTENTS

SUMMARY 03
TABLE OF CONTENTS 04
TABLE OF FIGURES 05
1. INTRODUCTION: MOROCCAN WATER POLICIES SEEM TO HAVE DONE LITTLE TO PREVENT WATER STRESS IN THE LONG TERM 06
2. MOROCCO'S WATER SECTOR IN NUMBERS 11
3. WATER SECTOR GOVERNANCE IN MOROCCO 13
3.1. THE PLANIFICATION OF THE WATER SECTOR 13
3.2. THE DAY-TO-DAY MANAGEMENT OF THE WATER SECTOR 14
4. A CRITICAL VIEW OF THE MAIN WATER POLICIES 17
4.1. GREEN MOROCCO PLAN (2008-2020) 17
4.2. THE GREEN GENERATION STRATEGY (2020-2030) 21
4.3. BASIN WATER TRANSFERS 22
4.4. UNCONVENTIONAL WATER RESOURCES: DESALINATION AND TREATED WASTEWATER RESOURCES 25
5. EMBLEMATIC CSO'S ENGAGEMENTS FOR A JUST WATER ACCESS IN MOROCCO 28
5.1. THE FIGHT AGAINST THE WATERMELONS DRYING UP ZAGORA'S OASIS 28
5.2. THE STRUGGLE FOR A FAIR WATER ALLOCATION BETWEEN THE POPULATION AND THE SILVER-MINING INDUSTRY IN IMIDER 32
6. CONCLUSION AND RECOMMENDATIONS 37
7. REFERENCES 39

TABLE OF FIGURES

FIGURE 1. MOROCCO'S WATER INFLOWS (IN BILLION M3/YEAR)
FIGURE 2. WATER SECTOR GOVERNANCE IN MOROCCO
FIGURE 3. WATER TRANSFER PROJECTS' SCHEMES
FIGURE 4. EVOLUTION OF DAM FILLING RATES IN THE SEBOU BASIN
FIGURE 5. PROJECTS FOR SEAWATER DESALINATION CURRENTLY OPERATIONAL OR UNDER DEVELOPMENT
FIGURE 6. REPRESENTATIVE SCHEME OF THE ORGANIZATION OF GROUNDWATER EXTRACTION IN IMIDER

1.INTRODUCTION

Moroccan water policies seem to have done little to prevent water stress in the long term

Morocco's water management has evolved through three distinct phases[1]. The first phase, the era of rain-dependent water (pre-protectorate), saw rural and urban populations living at the mercy of climate variability and the unpredictability of rainfall. The second phase, the era of State-controlled water, began in the 1960s with substantial public investment in hydraulic infrastructure. This period was defined by an ambitious vision to "not let a drop of water go to the sea"[2] and to expand irrigated land, aiming to cultivate one million hectares by the year 2000[3]. By maximizing water storage and prioritizing irrigation, Morocco sought to reduce climate-related risks and support agricultural growth through state-driven, large-scale interventions. The third phase, the era of privatized water[4] was generalized with the Green Morocco Plan in 2008. It incentivized private investment in irrigation, accelerated agricultural expansion and fostered unsustainable practices. Weak regulatory oversight led to unregulated groundwater withdrawals, causing severe depletion of aquifers. Additionally, the shift from traditional rain-fed crops to water-intensive orchards further aggravated the pressure on limited water resources.

As of 2023, Morocco has built 152 large dams with a total storage capacity of 19.9 billion cubic meters, alongside 16 water transfer structures covering a combined length of 785 kilometers[5]. It has managed to develop around 1.7 million hectares of irrigable land and a drinking water connection rate of nearly 95%[6]. However, over the past six years, the persistent drought and the lack of groundwater renewal has raised significant concerns about the effectiveness of Morocco's long-standing and active water management policies in preventing water stress and ensuring equitable access to water for all.

Morocco's water and agricultural policies have been deeply shaped by a "California imaginary"[7], a myth inspired by the large-scale irrigation schemes that transformed California's arid landscapes into productive agricultural hubs in the start of the 20th century.

---

1. Anne-Marie Jouve, « Les trois temps de l'eau au Maroc », Confluences Méditerranée, 2006, no 58, pp. 51-61, Paul Pascon, « De l'eau du ciel à l'eau d'Etat : psychosociologie de l'irrigation », Hommes, terre et eaux, 1978, vol. 1, no 28, pp. 3-10.
2. Will D. Swearingen, Moroccan mirages: agrarian dreams and deceptions, 1912-1986, Princeton, N.J, Princeton University Press, 1987.
3. Ibid.
4. Anne-Marie Jouve, « Les trois temps de l'eau au Maroc », op. cit. Kévin Del Vecchio et Pierre-Louis Mayaux, « Gouverner les eaux souterraines au Maroc : L'État en aménageur libéral », Gouvernement et action publique, 13 mars 2017, VOL. 6, no 1, pp. 107-130.
5. Ministère de l'Équipement et de l'Eau et Direction Générale de l'Hydraulique, L'hydraulique en chiffres [Rapport], Rabat, 2023.
6. François Molle et Pierre-Louis Mayaux, « Les angles morts de la politique de l'eau au Maroc : », Confluences Méditerranée, 9 novembre 2023, N° 126, no 3, pp. 165-184.
7. Marcel Kuper, Pierre-Louis Mayaux et Ahmed Benmihoub, « The Persistent Appeal of the California Agricultural Dream in North Africa », *Water Alternatives*, 2023, vol. 16, no 1 Will D. Swearingen, *Moroccan mirages*, *op. cit.*

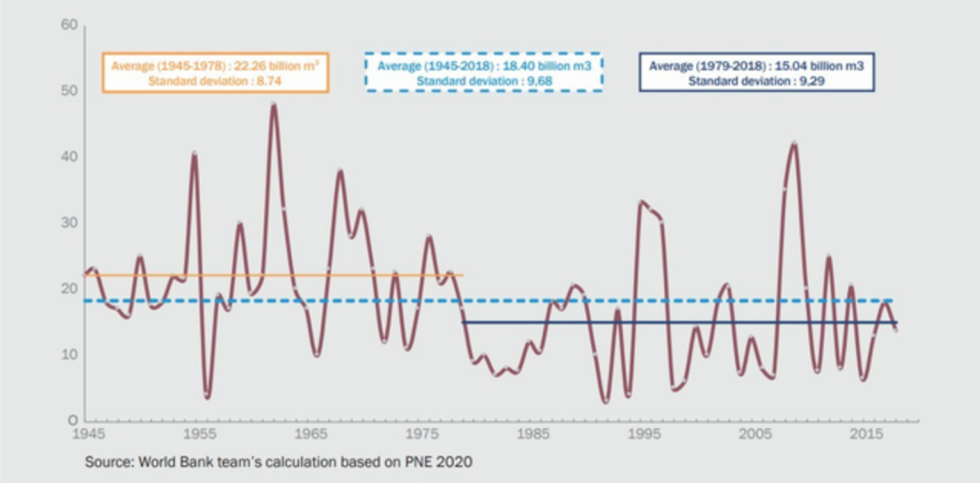
This enduring imaginary, rooted since the French Protectorate, perpetuated the belief that Morocco could similarly green the desert through intensive agriculture.

This vision aligned with colonial narratives that cast North Africa as a region of agricultural abundance to be revived and modernized. Nowadays, this legacy continues to influence Morocco's modernist approach to water management and hydro-agricultural policies, emphasizing large-scale irrigation and the pursuit of agricultural expansion as central to national development. As a result, Morocco has become "Europe's vegetable garden"[8]: Moroccan watermelon exports to the European market reached 271,000 tons in 2022, making Morocco the second-largest supplier to the European Union after Spain[9]. Since 2019, Morocco has boosted its watermelon sales by 81.7%, an increase of 121,830 tons[10]. Similarly, Morocco's frozen raspberries exports to the European market more than doubled in 2022, reaching 16,700 tons, a significant rise from the 3,600 tons recorded in 2020[11]. Furthermore, exports of fresh blueberries hit a new record during the 2023-2024 season, increasing by 25% to 67,300 tons[12]. However, studies have demonstrated that Morocco's exported agricultural products are disproportionately concentrated on water-intensive crops[13]. This approach contradicts the virtual water trade theory, which advocates for water-poor countries to import water-intensive goods while focusing domestic production on crops with lower water requirements[14]. It means that "Morocco has a trade structure of virtual water detrimental to its water resource"[15].

Furthermore, economic indicators struggle to conceal the underlying reality of Morocco's severe water scarcity. As of August 27, 2024, the average dam filling rate stands at 27.7%, equivalent to 4.5 billion cubic meters[16]. This marks a significant decline from August 27, 2015, when the dam filling rate was 72.10%[17]. In fact, Morocco has become structurally drier over the past decades as shown in the figure below describing Morocco's water inflows (i.e. surface water).

8. https://telquel.ma/instant-t/2024/03/12/tribune-faire-de-la-crise-hydrique-une-opportunite-de-reinventer-le-maroc_1861318/
9. https://medias24.com/2023/03/22/exportations-de-pasteques-le-maroc-deuxieme-fournisseur-de-lue/
10. Idem.
11. https://fr.le360.ma/economie/exportations-de-framboises-surgelees-vers-lue-le-maroc-integre-le-podium_Y2XUQNM23VBYZMZGW57UYZIWUI/
12. https://fr.le360.ma/economie/myrtilles-fraiches-le-maroc-etablit-un-nouveau-record-a-lexport_6WRILYYO5VF3VMZTARQZG63YTI/
13. Abdeslam Boudhar, Said Boudhar, Mohamed Oudgou et Aomar Ibourk, « Assessment of Virtual Water Flows in Morocco's Foreign Trade of Crop Products », Resources, 11 avril 2023, vol. 12, no 4, p. 49.
14. Ibid.
15. Ibid.
16. https://x.com/maadialna/status/1828432396338757680
17. https://dash.medias24.com/barrages

Figure 1. Morocco's water inflows (in billion m^3/year)



Source: World's bank Background Paper Water Scarcity and Droughts based on the National Water Plan,2019

For the short term, public authorities have relied on measures to regulate water access, often resorting to domestic water cuts[18]. On December 26th, 2023, the Ministry of Interior issued a circular to regional and local governments, prohibiting the use of potable water for watering green spaces, including golf courses, and public gardens, as well as for cleaning the streets and public squares[19]. The circular also restricted the filling of public and private swimming pools to once per year, limited vehicle washing to three times per week, and mandated the closure of hammams three days a week[20]. Moreover, 2024 has seen major cities such as Casablanca[21], Marrakech[22], and Agadir[23]affected by frequent water cuts and significant reductions in water pressure – often without notifying the population. For the long term, the National Water Plan had estimated overall water demand at 18.6 billion cubic meters by 2050[24]. To address these needs, public authorities are relying on a planning strategy hinging on the individual exploitation of groundwater resources, the development of non-conventional resources such as seawater desalination and treated wastewater reuse as well as the construction of additional dams et water transfer schemes[25].

18. Meaning water used for everyday purposes such as drinking, cooking, cleaning and sanitation
19. https://medias24.com/2023/12/28/stress-hydrique-nouvelles-directives-du-ministere-de-linterieur/
20. https://medias24.com/2024/01/24/nouvelles-mesures-restrictives-pour-rationaliser-la-consommation-deau-dans-plusieurs-villes-au-maroc/
21. https://www.h24info.ma/casablanca-coupures-deau-nocturnes-les-explications-de-la-lydec/
22. https://medias24.com/2022/06/22/a-marrakech-les-coupures-deau-potable-ne-sont-pas-exclues/
23. https://www.bladi.net/deja-coupures-eau-agadir,106007.html
24. Département de l'Eau, Projet de Plan national de l'eau [Rapport], Rabat, Maroc, 2019.p.86-88. The National Water Plan provides the following breakdown: By 2050, the projected annual demand for potable, industrial, and tourism water is expected to reach 2,600 million cubic meters, with the annual demand for irrigation water rising to 16 billion cubic meters.
25. Ibid. ;https://www.equipement.gov.ma/eau/Strategies-plans-programmes/Pages/PNAEPI-2020-2027.aspx

Yet, experts have criticized Morocco's hydraulic plan as "extremely optimistic"[26] and have identified several challenges. We will focus on two key areas of concern. First, the plan predominantly concentrates on increasing water supply, with no boundaries, and without adequately accounting for the impacts of climate change[27]. Studies have shown that Morocco has already experienced a rise in average national temperatures rise by +0.42°C per decade since 1990, alongside a precipitation decline of over 20% between 1961 and 2005[28].This reduction in rainfall has led to a significant decrease in annual surface water supply, which has dropped from an average of 21.7 billion cubic meters between 1945 and 1980 to 10.4 billion cubic meters between 2015 and 2021[29]. Concurrently, the annual per capita water allocation has plummeted from an estimation of 2,560 cubic meters in 1960 to 620 cubic meters in 2019[30]. Projection models[31] indicate that this trend towards aridification is likely to persist, with temperatures expected to increase by +1.5°C by 2050 while precipitation may decline to approximately 15%[32]. Under higher greenhouse emissions scenarios, annual average temperatures could even rise to 2°C by 2050, while precipitation could decline by as much as 40%[33]. Hence, experts warn of a severe and escalating water crisis in Morocco, with per capita water availability potentially falling below 500 cubic meters by 2030[34]. This situation poses serious risks to the sustainability of the current hydro-agricultural model and threatens access to domestic water for the population.

26. François Molle et Pierre-Louis Mayaux, « Les angles morts de la politique de l'eau au Maroc », op. cit.
27. Ibid.
28. Marie-Noelle Woillez, Revue de littérature sur le changement climatique au Maroc : observations, projections et impacts [Rapport], Papiers de Recherche AFD.
29. Groupe Eau des Lauréats IAV, Livre Blanc sur les ressources en eau au Maroc. Pour une gestion durable assurant la sécurité hydrique du pays [Rapport], 2022. p.15
30. Institut Royal des Études Stratégiques, « Quel avenir de l'eau au Maroc ? » Rapport de synthèse des travaux de la journée scientifique du 17 mars 2022 [Rapport] p5 ; Haut-Commissariat au Plan, Examen national volontaire de la mise en œuvre des objectifs de développement durable [Rapport], 2020.p 85. It is also called the Water Stress Index or the Falkenmark Indicator, a ratio of the country's water footprint to its total renewable water resources (ground and surface water and moisture stored in soil). A region is considered under stress in the supply of water if the threshold drops below 1700 m3 per capita per year. If renewable water supply drops below 1000 m3 per capita per year, the region is considered as under chronic water scarcity. However, if a region's renewable water supply drops below 500 m3 per capita per year, the region is under absolute scarcity. See for further details on water stress indicators : Grace Kam Chun Ding et Sumita Ghosh, « Sustainable Water Management —A Strategy for Maintaining Future Water Resources », in Encyclopedia of Sustainable Technologies, Elsevier, 2017, pp. 91-103.
31. Projection models were based on five Representative Concentration Pathways (RCPs) of greenhouse gases outlined in the fifth assessment report of the IPCC published in 2014. See : Marie-Noelle Woillez, Revue de littérature sur le changement climatique au Maroc : observations, projections et impacts, op. cit. p. 8.
32. Ibid. Groupe Eau des Lauréats IAV, Livre Blanc sur les ressources en eau au Maroc. Pour une gestion durable assurant la sécurité hydrique du pays, op. cit. p. 14.
33. Marie-Noelle Woillez, Revue de littérature sur le changement climatique au Maroc : observations, projections et impacts, op. cit. Groupe Eau des Lauréats IAV, Livre Blanc sur les ressources en eau au Maroc. Pour une gestion durable assurant la sécurité hydrique du pays, op. cit. p. 14.
34. Groupe Eau des Lauréats IAV, Livre Blanc sur les ressources en eau au Maroc. Pour une gestion durable assurant la sécurité hydrique du pays, op. cit. p. 15.

Second, despite official efforts led by public authorities to promote water conservation in agriculture through initiatives like the National Irrigation Water Conservation Program[35] since 2008, experts have noted that the public discourse often overlooks the "elephant in the room": the prevailing policy paradigm which allocates the majority of available water resources to agricultural irrigation[36]. Some of them are calling for a debate on the future of the sector, given its high-water consumption, and emphasize the need "to seriously work on developing solutions adapted to climate change"[37]. This would involve not only reassessing the allocation of water resources but also formulating policies that address the specificities of each water source—renewable resources such as rainfall and natural reservoirs, non-renewable sources like fossil groundwater, and virtual water embedded in imports. Additionally, effective water demand regulation is essential to ensuring sustainable management of these critical resources. In the absence of a public debate on how to adjust and adapt the hydro-agricultural sector to increasingly scarce resources, the socio-political and economic consequences of these policies on local populations are being invisibilised, especially in a context of territorial disparities with significant differences in climate from the north to the south of Morocco.

Whether intentional or non-intentional, theses consequences include water reallocation dynamics, inequalities of access, conflicts and competition over water use that favor more financially advantaged groups. This further exacerbates the vulnerability of the most fragile segments of local communities, increasing their risk of poverty, displacement, and migration.

The main objective of this paper is to provide a critical situational analysis of the water sector in Morocco and to identify key policy gaps. It aims to analyze the current paradigm embodied in the main water policies and their unintended effects on water access, especially in vulnerable areas. To achieve this, the paper examines how Moroccan water policies are currently locked-in a water-supply approach that favors intensive irrigation practices and reflects on how to transition towards a new paradigm in water resource management that prioritizes sustainability and equitable access. It also seeks to convey the voices of affected communities by presenting emblematic case studies that highlight injustices – as a consequence of policy priorities - in water access. These case studies showcase community-led initiatives to advocate for a fair, equitable, and locally relevant adjustment of public policy.

To do so, the methodology of the background paper involves the review of the existing literature on the water sector as well as the interview of key stakeholders, including researchers, civil society organizations and public officials to gather their perspectives on the challenges facing the sector.

35. Called Programme National d'Economie d'Eau en Irrigation (PNEEI) which was integrated within the Green Morocco Plan (Plan Maroc Vert) in 2008. It promotes, through the financial and management support of the Ministry of Agriculture, the use of drip irrigation systems in order to enhance water efficiency in irrigation. See: https://www.agriculture.gov.ma/fr/projet/le-programme-national-deconomie-deau-dirrigation-pneei

36. François Molle et Pierre-Louis Mayaux, « Les angles morts de la politique de l'eau au Maroc », op. cit.

37. See the excerpt of Mohamed Taher Srairi intervention in Crise de l'eau : L'agriculture pointée du doigt. Enass Media. March 5, 2024 : https://enass.ma/2024/03/05/crise-de-leau-lagriculture-pointee-du-doigt/

2.MOROCCO'S WATER SECTOR IN NUMBERS

The agricultural sector accounts for approximately 87% of total water demand, amounting to over 14 billion cubic meters per year, including 10 billion cubic meters per year for the irrigation of large-scale hydraulic and small-to-medium hydraulic schemes, and over 4 billion cubic meters for private irrigation (i.e. groundwater)[38]. More specifically, large-scale irrigation is distributed across nine schemes, covering an area of 682,600 hectares[39]. They are generally based on dams located upstream. Moreover, there are around 3,000 small and medium-scale irrigation schemes covering an area of 334,000 hectares[40]. In addition, there are seasonal irrigation areas (120,000 hectares) and floodwater irrigation areas (180,000 hectares)[41]. As for private irrigation, it covers an area of 435,881 hectares[42]. The growing demand for irrigation water and the structural deficit in surface water, have contributed to a shift towards a model of large-scale irrigation schemes that combine the use of "state-owned surface water" with "private" groundwater from pumping, which is encouraged by public authorities[43]. Approximately 180,000 hectares in large-scale irrigation (and in small and medium-scale irrigation schemes) have access to groundwater[44]. In the Tadla irrigated scheme, for example, groundwater is used in 70% of the area[45].

Latest data available[46]show that Morocco in these recent years of drought has been receiving an average of 5 billion cubic meters of water per year, while its needs are estimated at 16 billion cubic meters by 2020 and 18.6 billion cubic meters per year by 2050 .[47]Out of the 5 billion cubic meters of water available, the current breakdown of water usage goes as follows:

- Potability: The priority is to ensure the availability of 1.7 billion cubic meters for potable water. Approximately 1 billion cubic meters come from dams, while the remaining 700 million cubic meters are sourced from groundwater and an increasingly significant share of desalinated water, as observed in regions such as Agadir, Safi, and El Jadida.
- Agriculture: The water allocation for irrigation has been reduced to 3 billion cubic meters then to 1 billion cubic meters, which is equivalent to the amount allocated for potable water. As of

38.https://medias24.com/2024/01/18/un-entretien-avec-nizar-baraka-ce-quil-faut-savoir-sur-la-problematique-de-leau-au-maroc/
39.Kévin Del Vecchio et Marcel Kuper, « La mise en visibilité des eaux souterraines au Maroc : un processus historiquement lié aux politiques de développement de l'irrigation », Développement durable et territoires, 22 mars 2022, Vol. 12, n°3.
40.Ibid.
41.Ibid.
42.This figure is likely underestimated due to the rapid growth of private irrigation.
43.Kévin Del Vecchio et Marcel Kuper, « La mise en visibilité des eaux souterraines au Maroc : un processus historiquement lié aux politiques de développement de l'irrigation », op. cit.
44.Ibid.
45.Ibid.
46.https://medias24.com/2024/01/18/un-entretien-avec-nizar-baraka-ce-quil-faut-savoir-sur-la-problematique-de-leau-au-maroc/
47.Département de l'Eau, Projet de Plan national de l'eau, op. cit.

January 2024, Morocco had received 606 million cubic meters of water in its dams, with nearly 350 million cubic meters allocated for irrigation[48]. This marks a shift from 80% of the water stored in dams being used for agriculture to approximately 52-53% per year.

- Industry: Most of the industrial sector's demand stems from the Office Chérifien du Phosphates (OCP)'s needs which are estimated at 260 to 300 million cubic meters per year. Nowadays, OCP has achieved complete self-sufficiency through seawater desalination and water reuse implementation programs[49].

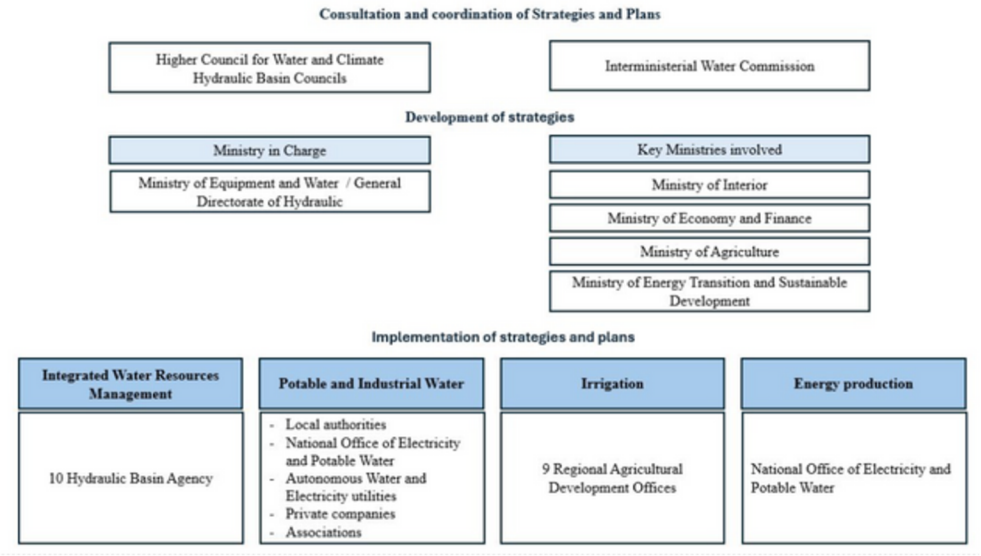
To address unmet water demands, public authorities are prioritizing deep aquifers, desalination, and treated wastewater. First, a comprehensive mapping of 130 groundwater aquifers has been completed, including 32 deep aquifers. This includes conducting deep drilling operations up to 500 meters and analyzing the water quality of each aquifer. Second, by 2030, the Ministry of Agriculture aims to mobilize nearly 500 million cubic meters of desalinated water for the irrigation of 100,000 hectares. Additionally, the goal is for all potable water in coastal areas to be sourced from desalination by 2030. Third, in terms of treated wastewater reuse, the target is to increase capacity from 40 million to 100 million cubic meters per year by 2027. This initiative will also support the growth of arboriculture[50].

48. https://medias24.com/2024/01/18/un-entretien-avec-nizar-baraka-ce-quil-faut-savoir-sur-la-problematique-de-leau-au-maroc/
49. Ibid.
50. Ibid.

3.WATER SECTOR GOVERNANCE IN MOROCCO

The water sector in Morocco is multi-faceted and involves a multitude of stakeholders with diverse interests and approaches (Figure 2).

Figure 2. Water Sector Governance in Morocco



Source: General Directorate of Hydraulic, 2023; translated in English by author

3.1. The planification of the water sector

The Law 36-15 on Water governs the water sector in Morocco through an integrated management framework and defines the responsibilities of various stakeholders. It also includes provisions for planning water resources, including wastewater and desalinated water. The law also showcases a collaborative approach to water planning:

- The Integrated Water Resources Masterplan[51] is developed for each basin by the Hydraulic Basin Agencies. They incorporate strategic orientations and requirements from the National Water Plan and includes: the evaluation of water resources both qualitatively and quantitatively, the assessment of the state of resources development and their usage, the forecast of future water demand by sector and type of use, and the proposition of resource mobilization and management schemes. The Masterplan is designed for a minimum of 30 years and is created in coordination with administrations, public institutions, and the technical committee of the basin council. Following a participatory approach, it also involves other stakeholders intervening in the basin. It can be revised every 10 years. (Articles 91-92)

51.In French: Plan Directeur d'Aménagement intégré des ressources en eau (PDAIRE)

- The National Water Plan is established by the General Directorate of Hydraulic in coordination with the relevant national administrations (see figure above). The plan provides the framework for national water policy and is submitted for review to the Higher Council for Water and Climate before being approved by decree. It includes a diagnosis of the water sector, its major challenges, the strategic objectives and orientations, the national priorities for water resources mobilization and the necessary institutional reforms needed. The plan is set for a minimum of 30 years and can be revised every 10 years, except in exceptional circumstances requiring earlier modifications. (Article 90).

However, alongside long-term planning for hydraulic infrastructure and the increase of water supply, water management and allocation are handled on an annual basis due to the current water crisis[52]. The approach is as follows: the priority is to ensure the availability of potable water for the year, with the remaining water allocated for irrigation based on the needs of each hydraulic basin. Water allocation decisions are therefore made on a basin-by-basin basis. Within each basin, the Ministry of Agriculture determines the crops and areas to irrigate[53]. Decisions regarding the types of crops to be irrigated are made by the Regional Agricultural Development Offices (ORMVA). ORMVA is regarded as the "main instrument of irrigation policy at the regional level"[54] and operates under the supervision of the Ministry of Agriculture. These structures were created for decentralization purposes and are tasked with 1) the implementation of the entire agricultural policy; and 2) the management of irrigation waters within designated areas of operation, which include large-scale irrigation schemes in 9 regions : Gharb, Doukkala, Haouz, Ouarzazate, Tafilalet, Tadla, Moulouya, Souss-Massa, and Loukkos.

3.2. The day-to-day management of the water sector

The day-to-day management of the water sector involves three main actors: ORMVA, as presented above, Water Users' Associations (Association des Usagers de l'Eau Agricole, AUEA) within the irrigated schemes, and the Water Police (Police des Eaux) at the hydraulic basin level.

First, the ORMVAs play a key role in the management and development of agricultural areas. Its responsibilities include the development of irrigation systems and the rehabilitation of hydro-agricultural infrastructure, the promotion of irrigation techniques, and the support agricultural production. ORMVAs also focus on the diversification of crops and animal production and provide professional training for farmers. In relation to water, ORMVAs are in charge of: Programming, distributing, and billing irrigation water to farmers; Promoting and establishing Water Users' Associations; Maintaining hydro-agricultural equipment (e.g., pumping stations, irrigation networks,…); Monitoring groundwater withdrawals and issuing pumping permits; Reviewing

52. https://medias24.com/2024/01/18/un-entretien-avec-nizar-baraka-ce-quil-faut-savoir-sur-la-problematique-de-leau-au-maroc/
53. Ibid.
54. Abdellah Herzenni, « Les ORMVA, les AUEA, et la gestion participative de l'irrigation », Revue H.T.E, décembre 2002, p. 11.

applications for state subsidies for drip irrigation projects; Representing the office in environmental projects and research and development initiatives in collaboration with regional and national partners[55].

Second, Water Users Associations[56] are established either at the initiative of ORMVA or the Provincial Directorate of Agriculture, or upon request by two-thirds of the farmers within one irrigated scheme. The primary goal is to enable the active participation of farmers in the implementation of irrigation programs, as well as the management and maintenance of water infrastructure. Their key missions include ensuring proper conservation and effective management of water use infrastructure; organizing the distribution of water for irrigation; collecting taxes and water distribution fees from their members. However, literature on Water Users Associations has highlighted several challenges. These associations have been considered as a means to remove traditional communities from their customary rights and to transition them toward the principles of modern law[57]. Additionally, they have often been criticized for functioning primarily as instruments of agricultural policy implementation, serving as conduits for public authorities[58]. Finally, researchers have pointed out that young farmers have been taking advantage of these associations, using them as platforms for professional advancement, aiming to gain political prominence or capitalize on local investment opportunities[59].

Third, in practice, Morocco has had a dedicated Water Police only since 2018[60]. This entity, which operates under the supervision of the Hydraulic Basin Agencies (ABH), has faced several dysfunctions that hinder its effectiveness[61]. These challenges led to a call from King Mohammed VI for its operationalization in his 29th July 2024 Throne Speech[62].The Water Police is an

55.https://ormvasm.ma/index.php/fr/metiers/gestion-des-reseaux.html ; https://www.ormvatafilalet.ma/missions/

56.Created by the law n°02-84 relative aux associations d'usagers des eaux agricoles, promulgated by the Dahir n°1-87-12 of December 21st,1990.

57.Toufik Ftaïta, « Chapitre 26. De la gestion communautaire à la gestion associative de l'eau : Légitimité et illégitimité des associations des usagers des eaux agricoles comme nouveau cadre institutionnel de la gestion participative de l'irrigation au Maroc », in De l'eau agricole à l'eau environnementale, Éditions Quæ, 2012, pp. 351-362.

58.Mohammed El Alaoui, « Les pratiques participatives des associations d'usagers de l'eau dans la gestion de l'irrigation au Maroc : étude de cas en petite, moyenne et grande hydraulique », in , Rabat, Maroc, 2004.

59.Pierre Bonte, Mohamed Elloumi, Henri Guillaume et Mohamed Mahdi (dir.), Mohamed Tozy, « Leaders et leadership : configurations complexes, ressources politiques et influence potentielle des leaders dans le cadre de l'Oriental marocain », in Développement rural, environnement et enjeux territoriaux: regards croisés Oriental marocain et Sud-Est tunisien, Tunis, Cérès Éditions, 2009 Zakaria Kadiri et El-Hassane Abdellaoui, « Les projets d'irrigation à l'épreuve des dynamiques territoriales locales », in Assia Boutaleb, Baudouin Dupret, Jean-Noël Ferrié et Zakaria Rhani (dir.), Le Maroc au présent : D'une époque à l'autre, une société en mutation, Maroc, Centre Jacques-Berque, Description du Maghreb, 2016, pp. 91-101 Zakaria Kadiri, Karima Belmoumene, Marcel Kuper, Nicolas Faysse, Mohamed Tozy et Mostafa Errahj, « L'innovation institutionnelle dix ans plus tard : quelles opportunités pour les agriculteurs, et quels apprentissages pour les pouvoirs publics ? Le cas des associations d'irrigants au nord du Maroc », in Bernard HUBERT Emilie COUDEL Hubert DEVAUTOUR, Christophe-Toussaint SOULARD (dir.), ISDA 2010, Montpellier, France, Cirad-Inra-SupAgro, 2010, URL complète en biblio Ibid.

60.Décret n° 2.18.453, fixant les conditions et les modalités de nomination des agents de police de l'eau et de l'exercice de leurs fonctions

61.https://medias24.com/2024/09/18/la-police-de-leau-une-operationnalisation-entravee-par-plusieurs-dysfonctionnements/

62.https://www.mapnews.ma/fr/dossier/probl%C3%A9matique-de-l%E2%80%99eau-sm-le-roi-souligne-l%E2%80%99imp%C3%A9ratif-d%E2%80%99une-mise-%C3%A0-jour-continue-des-leviers

administrative body tasked with overseeing the public hydraulic domain, which includes all types of water—surface, groundwater, fresh, brackish, saline, mineral, wastewater, and desalinated seawater - flowing into the public hydraulic domain, as well as hydraulic infrastructure. Their primary responsibility is to identify violations of the water law (Law 36-15) and its regulations, and to prepare the corresponding reports. However, despite its importance, many stakeholders have highlighted significant shortcomings in the Water Police's operations. Among these challenges are a lack of human resources, insufficient funding, and a lack of coordination between Basin Agencies and the judicial system[63]. For example, in the Bouregreg-Chaouia basin, which covers an area of 20,000 km^2, there are only five agents assigned to oversee the entire region[64]. Additionally, tracking the progress and judicial outcomes of the reports filed by the Water Police remains a challenge for the relevant Basin Agencies. Unauthorized well drilling is the most frequent violation reported by the Water Police, accounting for 90% of all infractions[65]. This highlights the Water Police's most important role in managing water demand and regulating groundwater withdrawals, yet its capacity to effectively fulfill this role remains limited.

63. https://medias24.com/2024/09/18/la-police-de-leau-une-operationnalisation-entravee-par-plusieurs-dysfonctionnements/
64. https://medias24.com/2024/09/18/la-police-de-leau-une-operationnalisation-entravee-par-plusieurs-dysfonctionnements/
65. https://medias24.com/2024/09/18/la-police-de-leau-une-operationnalisation-entravee-par-plusieurs-dysfonctionnements/

4.A CRITICAL VIEW OF THE MAIN WATER POLICIES

4.1. Green Morocco Plan (2008-2020)

Objectives

The Green Morocco Plan (GMP) was launched as a flagship public policy aimed at modernizing Moroccan agriculture, targeting economic growth and poverty reduction by 2020. With a total investment of 104 billion MAD, 40% public and 60% private, it aimed to position the sector of agriculture as a key driver of GDP growth and rural development[66]. To support such ambitious goals, it was then essential to ensure the availability of sufficient water resources[67]. Therefore, the Green Morocco Plan integrated the National Irrigation Water Conservation Program (PNEEI), initially launched in 2007. The PNEEI is a strategic program focused on water conservation and improving resources efficiency through State subsidies, as it promotes the conversion of traditional irrigation methods, such as gravity and sprinkler systems, to modern drip irrigation. The program aimed to convert 550,00 hectares by 2020, with a total investment of 37 billion MAD[68].

The plan structured around two key pillars. The first pillar focused on creating a modern, high value agricultural sector through private investment as it relied on large private investors with managerial and financial capacity to aggregate small and medium sized farms[69]. The second pillar targeted poverty alleviation by supporting small farmers in disadvantaged areas. The official goal was to improve the income of 560,000 vulnerable farmers with a discourse of inclusive agricultural development[70]. Three main criteria distinguish the two pillars under the Green Morocco Plan: geographical location, farm characteristics and source funding[71]. Generally, projects under Pillar I are designed for areas characterized by intensive farming practices, such as irrigated plains whereas Pillar II projects focus on small-scale farms in regions with extensive farming systems, such as mountainous or less fertile areas. The source of investment further differentiates the two T he source of investment further differentiates the two pillars. Pillar I projects primarily attract funding from private sector investments, while Pillar II projects are largely subsidized by state resources . Nonetheless, both pillars share a key commonality: the promotion of market-oriented

66.Najib Akesbi, « Une nouvelle stratégie pour l'agriculture marocaine : Le « Plan Maroc Vert » », New Medit, 2012, no 2, pp. 12-23.
67.François Molle et Oumaima Tanouti, « Squaring the circle: Agricultural intensification vs. water conservation in Morocco », Agricultural Water Management, octobre 2017, vol. 192, pp. 170-179. ; https://www.agrimaroc.ma/pneei-programme-eau/
68.Ibid. ; https://www.agrimaroc.ma/pneei-programme-eau/
69.Ibid. Ministère de l'Agriculture et de la Pêche Maritime, Plan Maroc Vert [Rapport], Rabat, Maroc, 2009.
70.Najib Akesbi, « Une nouvelle stratégie pour l'agriculture marocaine : Le « Plan Maroc Vert » », op. cit. Ministère de l'Agriculture et de la Pêche Maritime, Plan Maroc Vert, op. cit.
71.Nicolas Faysse, « The rationale of the Green Morocco Plan: missing links between goals and implementation », The Journal of North African Studies, 8 août 2015, vol. 20, no 4, pp. 622-634.

farming through the commodification of horticultural products[72], which exerts significant pressure on water resources. For instance, apple production has shifted from serving primarily domestic consumption to becoming an export-oriented crop, supported by investments in production and storage technologies partially funded by the Green Morocco Plan[73]. Adapted to high-altitude climates, apples are prioritized as a cash crop to enhance agriculture in remote areas (e.g., Pillar II regions such as the High Atlas)[74]. This transition has transformed agricultural practices, including the increased use of pesticides[75], and has amplified water demand[76].

Results

According to the Agency for Agricultural Development, the Green Morocco Plan delivered the following results by 2020: growth of the agricultural GDP by 5,25% annually, launch of 1,575 projects over 112,000 hectares attracting 22,3 billion MAD of investments, the expansion of the drip irrigation system to 542,000 hectares (vs.128,000 hectares in 2008), and the increase of agricultural exports by 117%[77]. However, experts and researchers have offered a critically more nuanced view of the Green Morocco Plan results and its impact on water resources management:

- Contrary to expectations, data indicates a significant decline in rural employment, with a net loss of 159,000 jobs between the first trimesters of 2023 and 2024[78], contributing to a broader trend of one million rural jobs lost between 2016 and 2023[79]. This decline can be attributed to several factors. From 2006 to 2015, rural employment exhibited relative stability, largely driven by the Green Morocco Plan launched in 2008[80]. Key initiatives, such as the establishment of fruit, olive, and almond orchards, acted as a substantial driver of job creation. However, since 2016, the pace and scale of these plantation projects have diminished, leading to reduced demand for labor and, consequently, a decline in employment levels. As a result, rural areas face decreasing economic appeal for younger generations[81]. Persistent drought conditions have further intensified the employment crisis as agricultural activities (such as grain production) plummeted[82].

72. Nicolas Faysse, « The rationale of the Green Morocco Plan: missing links between goals and implementation », op. cit.
73. Zachary A. Goldberg, « Development through commodification: exploring apple commodity production as pesticide promotion in the High Atlas », Agriculture and Human Values, juin 2022, vol. 39, no 2, pp. 663-682.
74. Ibid.
75. Ibid.
76. Assia Lozzi, Rim Chakroun, Fatiha Hakimi, Nassreddine Maatala, Imane Bounadi, Taha Lahrech, Younes Bekkar et Ahmed Bouaziz, « Diagnostic des systèmes de production de pommier face aux changements climatiques : cas de M'semrir, Haut Atlas, Maroc », Cahiers Agricultures, 2024, vol. 33, p. 28.
77. https://www.ada.gov.ma/fr/principales-realisations-du-plan-maroc-vert
78. Haut-Commissariat au Plan, Note d'information relative à la situation du marché du travail au premier trimestre 2024 [Rapport].
79. https://medias24.com/2024/04/25/a-cause-des-secheresses-1-million-demplois-ruraux-perdus-entre-2016-et-2023/
80. https://medias24.com/2024/05/12/le-monde-rural-et-lemploi-agricole-perdent-leur-attractivite-chez-les-jeunes-pr-errahj/
81. https://medias24.com/2024/05/12/le-monde-rural-et-lemploi-agricole-perdent-leur-attractivite-chez-les-jeunes-pr-errahj/
82. https://medias24.com/2024/04/25/a-cause-des-secheresses-1-million-demplois-ruraux-perdus-entre-2016-et-2023/. The average grain production fell from 82.8 million quintals between 2010 and 2015 to 64.1 million quintals between 2016 and 2023. Similarly, the average level of rural employment dropped from 5.2 million jobs during the 2010–2015 period to 4.2 million jobs between 2016 and 2023.

- The indicators chosen to monitor the Green Morocco Plan — such as the number of projects implemented, the scale of investments, and production increases as seen above—fail to capture key dimensions of its impact. Critical aspects like improvements in farm-level income and the empowerment of farmers in agricultural value chain governance remain unmeasured[83]. Consequently, the lack of tailored performance indicators has hindered the ability to effectively evaluate the outcomes of GMP projects[84].
- While the PNEII included support and advisory services for farmers implementing drip irrigation, this has proven insufficient. Public subsidies (ranging from 80% to 100%, depending on farm size and investment ceilings) had accelerated the adoption of the technology, but without ensuring its effective use[85]. As a result, farmers' practices associated with drip irrigation have not consistently led to water savings. Experts have observed frequent instances of over-irrigation, along with the intensification and expansion of irrigated areas. There has also been a noticeable shift from rain-fed crops, such as cereals and fodder, to more water-intensive crops. This shift is driven by the misconception of unlimited groundwater availability and the illusion of sustainability offered by drip irrigation systems[86].
- It had been observed that the discourse and implementation of the PNEEI appeared to prioritize agricultural productivity over actual water savings as concrete water savings measures, like systematically setting up water meters, were not a priority for those overseeing the program[87].
- Rather than delivering the expected water savings in large-scale irrigation schemes, the Green Morocco Plan and the PNEEI had the unintended effect of accelerating the expansion of private irrigation in rain-fed areas, primarily drawing on aquifers[88]. Driven by "indiscriminate subsidies"[89]for drip irrigation and insufficient regulatory oversight on well drillings had led to the severe over-exploitation – even depletion in some areas -of groundwater resources. As per 2023 estimations[90], only 10% of Morocco's 372,000 wells and boreholes[91] are officially

83. Nicolas Faysse, « The rationale of the Green Morocco Plan: missing links between goals and implementation », op. cit.
84. Ibid.
85. https://www.libe.ma/Quelles-marges-de-manoeuvre-pour-l-agriculture-marocaine-face-a-la-contrainte-hydrique_a68772.html
86. Maya Benouniche, Marcel Kuper et Ali Hammani, « Mener le goutte à goutte à l'économie d'eau : ambition réaliste ou poursuite d'une chimère ? », Alternatives Rurales, novembre 2014 François Molle et Oumaima Tanouti, « Squaring the circle », op. cit.The debate surrounding drip irrigation and its impact on water savings is well-documented internationally. The challenges observed in Morocco, are not unique to the country. See : Jean-Philippe Venot, Marcel Kuper et Margreet Zwarteveen (dir.), Drip irrigation for agriculture: untold stories of efficiency, innovation and development, New York, NY, Routledge, Earthscan studies in water resource management, 2017 Anthony J. Jakeman, Olivier Barreteau, Randall J. Hunt, Jean-Daniel Rinaudo et Andrew Ross (dir.), Integrated Groundwater Management: Concepts, Approaches and Challenges, Cham, Springer International Publishing, 2016.
87. Maya Benouniche, Marcel Kuper et Ali Hammani, « Mener le goutte à goutte à l'économie d'eau : ambition réaliste ou poursuite d'une chimère ? », op. cit.
88. https://enass.ma/2024/04/24/plan-maroc-vert-gc-comment-amplifier-les-derives/
89. Institut Royal des Études Stratégiques, Rapport de synthèse des travaux de la journée de réflexion prospective : L'avenir de l'Agriculture au Maroc dans un contexte de la rareté structurelle de l'eau [Rapport], 2024.
90. https://www.h24info.ma/eau-le-maroc-compte-372-000-puits-dont-90-ne-sont-pas-autorises/
91. This also concerns large scale irrigation scheme.

registered, underscoring the urgent need for stronger and stricter enforcement of regulations. A clear example of this is illustrated by the Berrechid Plain, where groundwater overexploitation particularly due to the unregulated irrigation of carrot crops, among other vegetables[92], results in an annual deficit of 36,7 million cubic meters[93]. As a solution, the Basin Agency established a "groundwater contract" among stakeholders. This agreement sets an annual water allocation of each party, mandates the installation of water meters, and is managed by a farmers' association[94]. Designing such a contract necessitates careful attention to the power asymmetry among stakeholders, particularly between influential speculators or large farms and smaller farmers. It also requires a critical examination of who is included or excluded from the agreement to ensure fairness. Furthermore, the process demands strong political will to enforce agreed-upon measures, such as installing water meters and adhering to regulated water withdrawal volumes.

All in all, the prevailing economic logic of the Green Morocco Plan has prioritized the expansion of irrigated agriculture, relying on cheap labor and increasing the country's dependence on imports for staple foods like cereals, legumes, and animal feed[95]. This approach has marginalized rainfed agriculture, particularly cereals, in favor of more profitable irrigated farming[96]. It also overlooks significant negative externalities, including water and soil pollution, loss of soil fertility, aquifer depletion, and health risks, all of which threaten the sustainability of agriculture, especially in arid regions. To address these challenges, researchers call for a paradigm shift in Morocco's agricultural strategy. This shift requires a critical reassessment of water use, focusing not only on the volumes mobilized but also on the sources of water (groundwater, rainwater, seawater, virtual water…)[97]. A renewed emphasis on rainwater utilization should be at the forefront of future strategies by promoting rainfed crops such as cereals and legumes, alongside livestock systems that depend on non-irrigated fodder[98].

92. https://medias24.com/2022/09/12/dici-dix-ans-la-nappe-phreatique-de-berrechid-risque-detre-epuisee/; https://medias24.com/2023/07/19/eau-un-contrat-et-des-mesures-draconiennes-pour-sauver-la-nappe-souterraine-de-berrechid/; 95% of the extracted water is used for vegetable irrigation in the area
93. https://abhbc.com/fr/Bassin/ressource-en-eau-0
94. Romaïssa Ouassissou, Marcel Kuper, Patrick Dugué, Mohamed El Amrani, Ali Hammani et Fatah Ameur, « Rivalités et arrangements coopératifs pour l'accès à l'eau souterraine dans la plaine de Berrechid au Maroc », Cahiers Agricultures, 2019, vol. 28, p. 4 Romaïssa Ouassissou, Marcel Kuper, Ali Hammani et Mohamed El Amrani, « Le contrat de gestion participative pourrait-résoudre la crise de gouvernance des eaux souterraines? Cas de la nappe de Berrechid au Maroc », Alternatives Rurales, décembre 2019, no 7.
95. Mohamed Taher Sraïri, « Repenser le modèle de développement agricole du Maroc pour l'ère post Covid-19 », Cahiers Agricultures, 2021, vol. 30, p. 17.
96. Ibid. Najib Akesbi, « La nouvelle stratégie agricole du Maroc annonce-t-elle l'insécurité alimentaire du pays ? », Confluences Méditerranée, 2011, vol. 78, no 3, pp. 93-105.
97. Mohamed Taher Sraïri, « Repenser le modèle de développement agricole du Maroc pour l'ère post Covid-19 », op. cit. François Molle et Pierre-Louis Mayaux, « Les angles morts de la politique de l'eau au Maroc », op. cit. Groupe Eau des Lauréats IAV, Livre Blanc sur les ressources en eau au Maroc. Pour une gestion durable assurant la sécurité hydrique du pays, op. cit.
98. Mohamed Taher Sraïri, « Repenser le modèle de développement agricole du Maroc pour l'ère post Covid-19 », op. cit.

4.2. The Green Generation Strategy (2020-2030)

The Green Generation Strategy builds on the Green Morocco Plan with a stronger focus on human development in rural areas. Its key objective is to create a middle class in the agricultural sector by promoting agricultural entrepreneurship among rural youth and developing support mechanisms[99]. A secondary goal is to consolidate the achievements of the Green Morocco Plan and further develop the agricultural sector[100]. In terms of water management, the National Irrigation Water Conservation Program (PNEEI) is being continued, alongside efforts to promote renewable energy for water pumping (such as solar energy)[101]. The strategy emphasizes in "investing in water and energy efficiency to preserve natural resources" as part of the development of an agriculture sector more “resilient” to climate change.

However, experts and researchers have pointed out that by subsidizing solar energy for water pumping, the State is enabling a sustainable access to well water (as long as water remains available), making the extraction process virtually free[102]. Indeed, they observed that “as solar energy becomes more widespread, farmers tend to pump water for extended periods since it incurs minimal cost, accelerating groundwater overexploitation”[103]. Previously, the high cost of fossil fuels and its constraints acted as a deterrent to excessive water use[104]. Furthermore, researchers working in oases areas identified these series of trends:

- A water mobilization model for irrigation that combines drip irrigation, solar energy installations, and the construction of water storage;
- The extension of irrigated schemes in oases areas had been driven by the growth of solar pumping. In the Ferkla oasis for example, the number of pumping stations equipped with solar panels increased from around 20 in 2013 to over 180 in 2020[105];
- As water tables decline, some farmers in oasis areas using traditional khettaras (traditional underground irrigation system) have started integrating solar pumping into their systems. This innovation, known as "solar khettaras”[106], helps maintain the traditional social structure for managing groundwater. However, experts caution that while this approach provides short-term water access, it does not guarantee long-term sustainability without proper groundwater regulation[107];

99. Ministère de l’Agriculture et de la Pêche Maritime, Nouvelle stratégie de développement agricole. Generation Green 2020 [Rapport], n.d.
100. Ibid.
101. https://www.mem.gov.ma/Pages/secteur.aspx?e=3&prj=39
102. Interview, August 13, 2024.
103. Interview, August 13, 2024.
104. Yassine Khardi, Guillaume Lacombe, Marcel Kuper, Abdelilah Taky, Sami Bouarfa et Ali Hammani, « Pomper ou disparaître : le dilemme du renforcement des khettaras par le pompage solaire dans les oasis du Maroc », Cahiers Agricultures, 2023, vol. 32, p. 1. ; Interview, August 13, 2024.
105. Ibid.
106. Ibid.
107. Ibid. ; Interview, August 13, 2024.

- Structural social inequality is escalating as access to water resources, particularly in oasis areas, becomes increasingly controlled by both local and external speculators. Many smallholder farmers in Morocco, faced with high upfront costs and limited access to resources, are forced to rent out their land to these speculators. This shift has gradually limited water access for farmers from the original oases, contributing to their declining numbers[108]. While the influx of speculators does provide some employment opportunities, the scarcity of alternative work creates an environment ripe for exploitation[109]. As a result, wages remain low, and workers who demand better pay or improved conditions are often dismissed and replaced, deepening the cycle of inequality and insecurity[110].

4.3. Basin Water Transfers

To increase water supply, three Basin Water transfer plans were drawn under the National Water Plan project[111]: Sebou – Bouregreg - Oum Er Rabia – Tensift; Loukos – Tangerois and Laou-Moulouya (Figure 5). We will focus on the first project, as it is the most advanced in its implementation.

The first phase of the Sebou-Bouregreg project was launched in September 2023 at a cost of 6 billion MAD. This phase aims to transfer 360 million cubic meters of water[112], to enhance drinking water supply for the coastal areas of Rabat-El Jadida and Greater Marrakesh, as well as to provide additional resources for irrigation (for approximately 176,000 hectares) thereby protecting the Berrechid Plain[113]. The volumes of water to be transferred are to be determined based on the hydrological and environmental conditions of both the source and recipient basins[114].

108. Interview, August 13, 2024.
109. Alison D. Elder, « The Green Morocco Plan in Boudnib: Examining Effects on Rural Livelihoods », The Journal of Environment & Development, septembre 2022, vol. 31, no 3, pp. 275-299.
110. Ibid.
111. Département de l'Eau, Projet de Plan national de l'eau, op. cit.
112. https://www.agrimaroc.ma/autoroute-eau-record-8-10-mois/
113. https://medias24.com/2022/08/16/lancement-des-etudes-pour-le-projet-dinterconnexion-des-bassins-du-sebou-bouregreg-oum-er-rabia-et-tensift/ ; https://medias24.com/2022/08/16/lancement-des-etudes-pour-le-projet-dinterconnexion-des-bassins-du-sebou-bouregreg-oum-er-rabia-et-tensift/
114. Département de l'Eau, Projet de Plan national de l'eau, op. cit .p.132.

Figure 3. Water Transfer projects' schemes

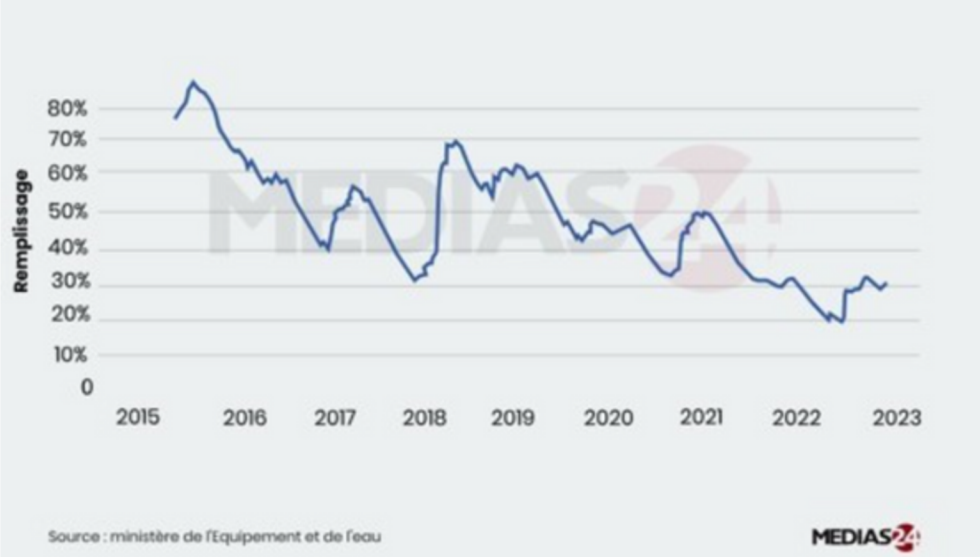
Source: National Water Plan, 2019

Although public discourse emphasizes that the water transferred is "recovered" as it would otherwise be "lost at sea"[115], the reality is more complex. The Sebou Basin faces significant water stress due to prolonged drought, resulting in a groundwater deficit of 268 million cubic meters and dam filling rates at 47% as of May 27, 2024[116] (Figure 6). In addition to these shortages at the regional level, several civil society organizations (CSOs) have raised concerns about spatial inequalities in water access, particularly in rural and remote areas. They highlight the paradox in areas deemed "water-rich" but still suffering from shortages[117]. For example, in the province of Taounate, despite the presence of 6 dams, only 2 dams are used to distribute water to the main city[118]; small towns and villages (douars) do not have access to tap water as they use public fountains, with some receiving only two hours of water per day (schools are also concerned by these water cuts)[119]. In these cases, residents are forced to rely on water deliveries in cisterns[120].

115. https://www.lopinion.ma/Nizar-Baraka-rend-visite-au-chantier-de-l-autoroute-de-l-eau_a43281.html
116. Water Basin Agency of Sebou, Water situation of the Sebou Basin and key directions [Rapport], Fès, 2024.; There are a total of 11 large dams and 39 small dams on the river, with 4 new large dams currently under construction (Interview, May 28, 2024)
117. Interviews, May 28 and 29,2024.
118. Interview, May 28, 2024.
119. Interview, May 28,2024.
120. Ibid.

This situation led to a “march of thirst”, with residents protesting not only the lack of water but also its poor quality, due to pollution from olive oil wastes and contamination from heavy metals and pesticides[121]. Similarly, in the Sefrou region, although the area is one of the most water-abundant with groundwater and surface water resources, the city struggles with water access due to the depletion of groundwater caused mostly by unauthorized wells, and with water pollution, due to sand quarries[122], which impacts local tourism, a key economic driver in the region[123].

Figure 4. Evolution of dam filling rates in the Sebou Basin



Source: Ministry of Equipment and Water, designed by Médias24

The 2023 Integrated Water Resource Management Masterplan developed by the Sebou Hydraulic Basin Agency sets several key targets for 2050[124]. It aims to increase the potable water connection rate to 98%, up from the current 94%[125]. The plan also includes the construction of 10 new large dams and 50 small dams[126]. Finally, it seeks to reduce pollution levels by 70%, a significant improvement from the current reduction rates of 50% in urban areas (through wastewater treatment) and 30% for industrial waste[127].

121. Ibid.
122. Interview, May 29, 2024.
123. Ibid.
124. https://medias24.com/2023/07/14/voici-les-details-du-plan-directeur-damenagement-integre-du-bassin-de-sebou/.
125. Ibid.
126. https://medias24.com/2023/07/14/voici-les-details-du-plan-directeur-damenagement-integre-du-bassin-de-sebou/.
127. Ibid.

4.4. Unconventional water resources: Desalination and Treated Wastewater Resources

The Drinking Water Supply and irrigation Program (PNAEPI, 2020-2027) plans to direct investment towards increasing water availability through non-conventional resources.

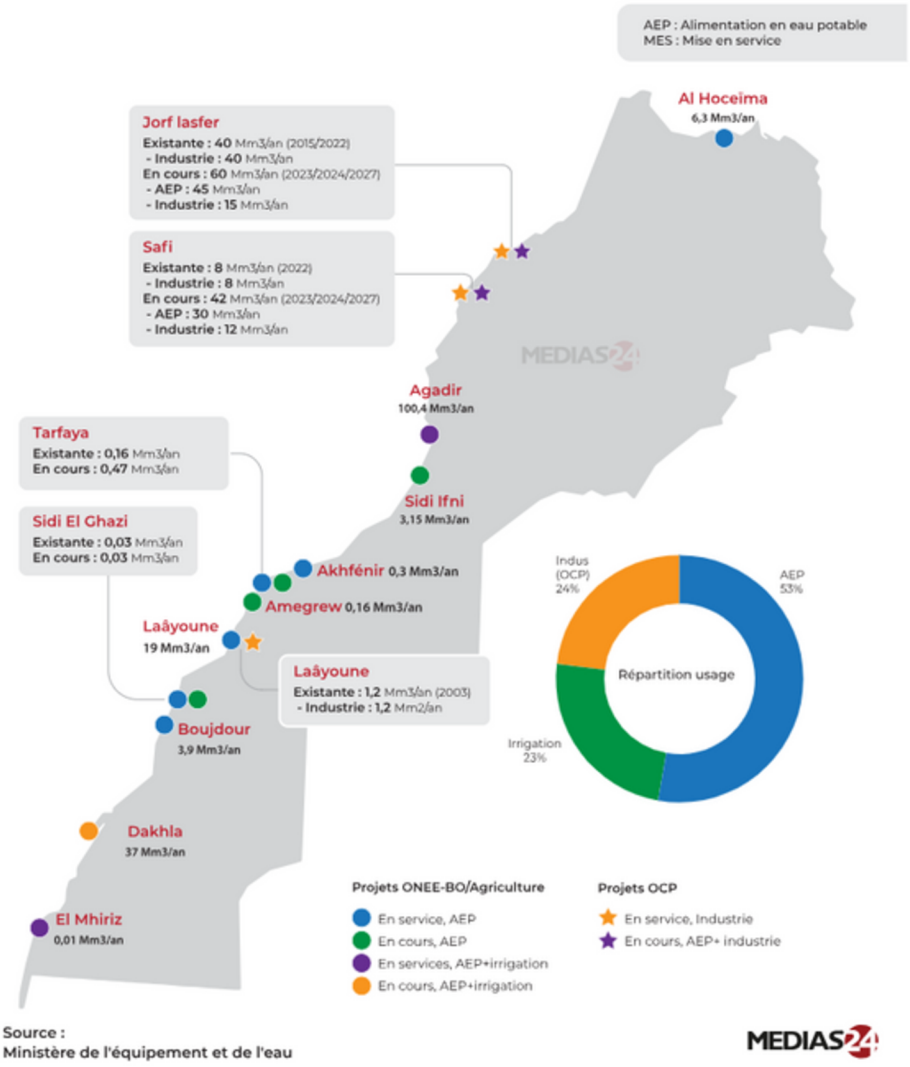
Desalination

Morocco currently operates 12 desalination plants with a capacity of 118,700 cubic meters per day and is constructing or planning 7 additional plants with a combined capacity of 396,200 cubic meters per day[128]. The state's goal is to reach a desalination capacity of 1 billion cubic meters per year by 2050[129].

The Chtouka Ait Baha desalination plant, launched in February 2022 with a cost of 4 billion MAD, is often showcased as a flagship project[130]. This joint initiative by the National Office of Electricity and Potable Water and the Ministry of Agriculture aims to address both drinking needs for Greater Agadir and irrigation requirements for the Chtouka Plain. The plant's first phase has a production capacity of 275,000 cubic meters per day, 150,000 cubic meters for drinking water and 125,000 cubic meters for irrigation[131]. However, desalination is a solution that globally faces criticisms regarding its environmental impacts and high costs in investments and operations, due to energy expenditure[132]. Therefore, desalinated water remains expensive for irrigation compared to other sources, except for the irrigation of high-value export crops[133]. For instance, the Chtouka Ait Baha plant irrigates 15,000 hectares, benefiting 1,500 farmers, which produces early crops (particularly tomatoes and berries) destined to European markets[134].

128. Ministère de l'Equipement et de l'Eau et Direction Générale de l'Hydraulique, L'hydraulique en chiffres, op. cit.
129. Département de l'Eau, Projet de Plan national de l'eau, op. cit. p. 147.
130. https://medias24.com/2024/05/07/dessalement-visite-guidee-au-coeur-de-la-station-de-chtouka/
131. Département de l'Eau, Projet de Plan national de l'eau, op. cit. p.73.
132. Groupe Eau des Lauréats IAV, Livre Blanc sur les ressources en eau au Maroc. Pour une gestion durable assurant la sécurité hydrique du pays, op. cit. p.23.
133. Ibid. p.23.
134. https://medias24.com/2024/05/07/dessalement-visite-guidee-au-coeur-de-la-station-de-chtouka/

Figure 5. Projects for seawater desalination currently operational or under development



Author: Médias24[135]

The techno triumphalism surrounding desalination often overlooks several critical issues[136] that public authorities must take into consideration: 1/ the environmental impacts of desalination processes which harm marine life, uses toxic chemicals and discharges saline brine, disrupting ecosystems; 2/ the high-energy intensity of such technology questions "the potential for desalination to lock societies into high energy pathways, and the implications for sustainability and

135.https://medias24.com/2024/01/18/un-entretien-avec-nizar-baraka-ce-quil-faut-savoir-sur-la-problematique-de-leau-au-maroc/

136.Joe Williams, « Desalination in the 21st Century: A critical Review of Trends and Debates », Water Alternatives, 2022, vol. 15, no 2, pp. 193-217.

environmental justice of 'shifting scarcities' from the water sector to the energy sector"[137]; 3/ the high costs of desalinated water make it only viable for high-yield crops, limiting its role in a sustainable agricultural sector[138]; 4/ the urban transformation led by desalination, as cities increasingly rely on the resource[139]; 5/ the commodification of water, as it represents a costly, high-tech water production process[140]; 6/ desalination development as a water supply solution without addressing the underlying structural and historical issues in the water sector risks exacerbating water access inequalities, deepening existing disparities and neglecting the root causes of water scarcity[141].

Treated wastewater reuse

Morocco currently operates 41 wastewater reuse projects, collectively enabling the reuse of approximately 32 million cubic meters of water annually[142]. However, the volumes remain negligible compared to the country's overall water demand, which stands at 16 billion cubic meters annually, and the available water resources, estimated at 5 billion cubic meters. The Mutualized Plan for Wastewater Management[143] projects a reusable potential for 600 million cubic meters per year by 2050. However, technical, regulatory cost-related challenges have led to a more conservative target of 340 million cubic meters per year, as outlined in the National Water Plan[144]; the goal being to preserve freshwater and aquifers.

Although treated wastewater reuse has long been promoted internationally as a resource that could capitalize on urban expansion[145], its implementation in Morocco had faced several challenges. Treated wastewater management requires robust intersectoral coordination, particularly to minimize public health risks associated with its reuse. In agriculture, stringent regulations made it difficult for farmers to adopt reuse practices, restricting them to less competitive crops and high management costs. Consequently, in Morocco, reuse projects have primarily targeted irrigation for golf courses and green spaces, often integrated into large-scale infrastructure projects like in Marrakesh, Tangiers or Rabat.

137. Ibid.
138. Ibid.
139. Ibid.
140. Ibid.
141. Ibid.
142. Ministère de l'Équipement et de l'Eau et Direction Générale de l'Hydraulique, L'hydraulique en chiffres, op. cit.
143. Direction de l'Eau et de l'Assainissement, Mutualisation des programmes nationaux d'assainissement liquide et de réutilisation des eaux usées [Rapport], Direction Générale des Collectivités Locales, ministère de l'Intérieur, Royaume du Maroc, n.d.
144. Département de l'Eau, Projet de Plan national de l'eau, op. cit.
145. UN Water et UNESCO, Les eaux usées, une ressource inexploitée, Paris, 2017.

5.EMBLEMATIC CSO'S ENGAGEMENTS FOR A JUST WATER ACCESS IN MOROCCO

We will focus on two emblematic community-led initiatives emphasizing their role in addressing water scarcity and the negative effects of public policies on water access. These initiatives, located in the oases of Zagora in the Draa Valley (5.1) and the rural commune of Imider in Southeastern Morocco (5.2), were selected for their long-standing activism, their diverse repertoires of action in engaging public authorities, and their significant advocacy efforts to bring local water crises to the public agenda. Both cases underline the vulnerability of their ecosystems, which are already under strain from climate change, and demonstrate how public policies have compounded these challenges.

5.1.The fight against the watermelons drying up Zagora's oasis

Context: Zagora, one of the main cities of the Draa Valley with 40,000 inhabitants, has been using the valley's groundwater for its drinking supply since 1985[146]. Local farmers depend on agriculture irrigated through dam releases for their crops, with a farming system that generally combines a stratified production of date palms, fruit trees and annual crops, with a collective management of irrigation water[147]. For the last two decades, farmers have increasingly turned to groundwater from shallow individual wells as a backup resource during dry periods and summer, which previously allowed its renewal[148]. However, experts have indicated that the Green Morocco Plan (2008-2020) and its successor, Generation Green (2020-2030), have facilitated access to groundwater through subsidies[149], leading to a rapid growth of irrigated farmlands for high-value crops in the desert regions[150]. As a matter of fact, watermelons were introduced in the area between 2007-2009 on a small scale, with some farmers experimenting by planting them in January for a highly profitable early market in April/May instead of July[151].This small-scale cultivation rapidly expanded into large, market-oriented production operations in the extensions outside the original oases, driven by investors from outside the region[152].Watermelons are now grown on large parcels of land, ranging

146.ABH (Agence du Bassin Hydraulique de Draa-Oued Noun). 2020. Étude d'élaboration du contrat de nappe de Feija Mission 2 : État des lieux, tendance de l'évolution future et identification d'axes stratégiques d'amélioration de la situation actuelle. Sous-Mission 2.1: Etat des lieux.

147.Interview, August 13, 2024, the collective is called Jmaa.

148.Lisa Bossenbroek, Hind Ftouhi, Zakaria Kadiri et Marcel Kuper, « Watermelons in the desert in Morocco: Struggles around a groundwater commons-in-the-makings. », Water Alternatives, 2023, vol. 16, no 1, pp. 87-107.

149.It is important to consider the nuances regarding the intentionality of public policy effects. While it is not clear that the extensions resulting from the Green Morocco Plan were deliberately planned by public authorities, it is clear that these authorities have tolerated and allowed the development of such extension projects, effectively adopting a laissez-faire approach.

150.Lisa Bossenbroek, Hind Ftouhi, Zakaria Kadiri et Marcel Kuper, « Watermelons in the desert in Morocco: Struggles around a groundwater commons-in-the-makings. », op. cit.; Interview, August 14, 2024.

151.Interview, August 13, 2024,

152.Lisa Bossenbroek, Hind Ftouhi, Zakaria Kadiri et Marcel Kuper, « Watermelons in the desert in Morocco: Struggles around a groundwater commons-in-the-makings. », op. cit. p. 93.

from one hectare to several dozen hectares, using an intensive productive approach. Experts identify four main reasons for the boom in watermelon production in the area[153]:

1. Short growth cycle: watermelons, as said previously, are a short-cycle crop, growing from December/January to May/June

2. Profitability: Watermelons are highly profitable, selling at high prices when there is little competition. Watermelons from Zagora reach national and international markets first

3. Resource availability: The presence of groundwater and available land supports large-scale watermelon growth.

4. Financial and technical support: As said earlier the Green Morocco Plan and the Generation Green strategy have offered subsidies that cover equipment costs particularly for drip irrigation systems and water storage basins.

Overall, watermelon cultivation expanded from 2 hectares in 2007 to an estimated 20,000 hectares by 2017[154]. Moreover, groundwater extraction for watermelon production increased from 4.9 million cubic meters in 2014 (48% of total withdrawals) to 12.6 million cubic meters in 2019 (64% of total withdrawals)[155]. Access to water has become more and more difficult as boreholes depths reach up to 200 meters in the region[156].

Results: The severe drought has further slowed the renewal of groundwater, exacerbating the current overexploitation and depletion of aquifers. As a result, Zagora's inhabitants have increasingly faced drinking water shortages. Indeed, the city relied on 11 wells, but over the years 4 have gone dry[157]. And according to public authorities the production capacity of the aquifers has decreased significantly, from 1.8 million cubic meters in 2005 to 0.7 million cubic meters in 2018[158]. Concretely, the severe water shortages in Zagora have led to significant anxiety and concern over access to drinking water from the population. This crisis prompted the "March of thirst" protests in 2017 and 2018[159], and some villages still rely on cisterns to obtain water[160]. This shows that

153. Ibid. p. 92.
154. Interview, August 13, 2024.
155. Jamie Fico, « Frontiers of fortune: mobilising land, water, and collective identity for watermelon production in Southeastern Morocco », The Journal of North African Studies, 21 septembre 2024, pp. 1-24.
156. Ibid.
157. ABH (Agence du Bassin Hydraulique de Draa-Oued Noun). 2020. Étude d'élaboration du contrat de nappe de Feija Mission 2 : État des lieux, tendance de l'évolution future et identification d'axes stratégiques d'amélioration de la situation actuelle. Sous-Mission 2.1: État des lieux.
158. Ibid.
159. https://en.siyada.org/siyada-board/food-water-and-land/zagora-a-symbol-of-climate-injustice-in-morocco/ ; https://www.lemonde.fr/afrique/article/2017/10/13/dans-le-sud-marocain-des-manifestations-de-la-soif-contre-les-penuries-d-eau_5200650_3212.html ; https://ledesk.ma/2020/11/04/au-maroc-des-pasteques-qui-consomment-plus-deau-que-les-humains/
160. https://lakome2.com/flash-infos/350519/

watermelon production, while highly lucrative in the export market, does not necessarily translate into improved livelihoods for local families[161]. It also highlights a troubling dynamic: once watermelon farming begins, it becomes nearly impossible to halt, as watermelons are still associated to financial well-being[162]. Both residents and speculators continue to cultivate watermelon, relentlessly extracting groundwater until aquifers are depleted[163].

Moreover, the depletion of irrigation water within the oases has resulted in the loss of palm groves and the erosion of farmers' primary sources of income (80% of Zagora are farmers)[164]. Local CSOs have reported a dramatic decline in the number of date palms from 5.2 million in 1930 to just 800,000 in 2024, precising that "they are standing, but dead, as they don't yield any produce anymore"[165](see photos below). Moreover, the extremely dry climate, the desertification and the absence of water have led to multiple episodes of fire in the oases[166]. They also describe a climate-induced exodus, with inhabitants leaving the region[167]. According to them, this trend is evident in the dwindling school enrollments, with classes now having only 4 to 8 students, and the increasing number of households canceling their utilities subscriptions as they abandon their homes[168].

CSO's demands and initiatives: The association has long urged public authorities—including the Ministry of the Interior, the Hydraulic Basin Agency, and the Ministry of Agriculture—to acknowledge that the severe situation in Zagora and the Draa Valley in general is directly caused by the watermelon production in the region. However, the issue of watermelons has remained a "taboo subject"[169]within the Ministry of Agriculture, leading to friction with the Department of Water[170]. In 2017, Charafat Afilal, the Secretary of State in Charge of Water took a different stance, acknowledging the connection between watermelon cultivation and groundwater depletion[171]. As for the Ministry of Agriculture, it had denied for a long time that watermelons were a water-intensive crop[172], instead attributing the groundwater depletion to climate change[173]. Over the years, the

161. Jamie Fico, « Frontiers of fortune: mobilising land, water, and collective identity for watermelon production in Southeastern Morocco », op. cit.
162. Ibid.
163. Ibid.
164. Interview, August 13, 2024.
165. Ibid.
166. https://fr.le360.ma/societe/au-sud-est-les-incendies-et-la-secheresse-menacent-les-oasis_2H5TKCGLW5HIZLU3TODPMTJUMY/; https://www.lopinion.ma/Zagoura-Un-incendie-devore-les-oasis-de-la-region_a17488.html
167. Interview, August 13, 2024.
168. Ibid.
169. Ibidem.
170. Interview, August 13, 2024.
171. https://lematin.ma/nation/charafat-afailal-affirme-avoir-mis-en-garde-contre-la-penurie-deau/213949;
172. Lisa Bossenbroek, Hind Ftouhi, Zakaria Kadiri et Marcel Kuper, « Watermelons in the desert in Morocco: Struggles around a groundwater commons-in-the-makings. », op. cit. p.98; https://www.lavieeco.com/affaires/irrigation-ces-cultures-hydrovores-noyees-de-reproches/
173. Interview, August 13, 2024.

association has consistently called on public authorities to ban watermelon production in the region, implement a policy for the protection and conservation of palm groves, and preserve the traditional oasis production system. Moreover, the association has long advocated for the deployment in the region of the "water police" by the Hydraulic Basin Agency to regulate and control the ongoing drilling of unauthorized and enforce a "just distribution of water" [174].

Public authorities' response: Following the social protest due to the drinking water shortage, a series of projects were launched to ensure access to safe drinking for the city of Zagora : the National Office of Water and Electricity (ONEE) deepened 4 wells (out of the remaining 7), established a desalination station to treat the pumped groundwater and launch of the construction of a new dam close to the city of Agdz in order to divert the water to Zagora[175]. The dam, which became operational in 2022, has a storage capacity of 317 million cubic meters[176]. Regarding watermelon production, it was not until July 2022 that the Ministry of Agriculture decided to stop providing subsidies for localized irrigation of watermelons, as well as avocados and new citrus plantations[177]. In October 2023, the governor of Zagora imposed a restriction limiting the maximum area for watermelon cultivation to 1 hectare in crucial zones for drinking water supply, such as along the Draa Valley, within oases, near rivers, and other areas reserved for vital water use[178]. This regulation seems to be strictly enforced, and officials do not hesitate to destroy crops that violate the rules[179]. However, this does not mean that watermelon production has ceased entirely as cultivation continues to expand elsewhere in the area[180]. Last but not least, the Hydraulic Basin Agency had launched in 2019 a study to develop an aquifer contract between the different stakeholders concerned with the management and the use of the groundwater (in the called Feija plain), in order to better organize the distribution of water among them[181]. However, some young local farmers deem that the designed contract may not be in their favor and prefer to directly discourage investors (from outside the region) to set up watermelon plantations[182].

174. Ibid.
175. Lisa Bossenbroek, Hind Ftouhi, Zakaria Kadiri et Marcel Kuper, « Watermelons in the desert in Morocco: Struggles around a groundwater commons-in-the-makings. », op. cit.
176. https://www.lopinion.ma/Nizar-Baraka-le-barrage-d-Agdez-a-Zagora-permet-de-couvrir-les-besoins-pendant-quatre-ans_a41320.html
177. https://medias24.com/2022/09/29/lirrigation-des-avocatiers-pasteques-et-nouvelles-plantations-dagrumes-ne-sera-plus-subventionnee/
178. https://www.agrimaroc.ma/reduire-production-pasteques-zagora-secheresse/
179. https://www.agrimaroc.ma/destruction-de-champs-de-pasteques-et-de-melons-qui-depassaient-la-superficie-fixee-a-zagora/
180. https://www.agrimaroc.ma/saison-des-pasteques-marocaines-2024/
181. Lisa Bossenbroek, Hind Ftouhi, Zakaria Kadiri et Marcel Kuper, « Watermelons in the desert in Morocco: Struggles around a groundwater commons-in-the-makings. », op. cit. ; https://www.abhdon.ma/article/contrat%20nappe%20feija%20zagora ; https://telquel.ma/instant-t/2023/01/24/a-zagora-trois-accords-signes-pour-la-preservation-de-la-nappe-et-la-protection-contre-les-inondations_1798927/
182. Ibid. p.98.

From left to right: The evolution of drying of the Zagora's oases from 2016 to 2024, photo of dying palm groves, photo of a March of Thirst protest in the area, Watermelons production in the desert. Photos providedby a local CSO

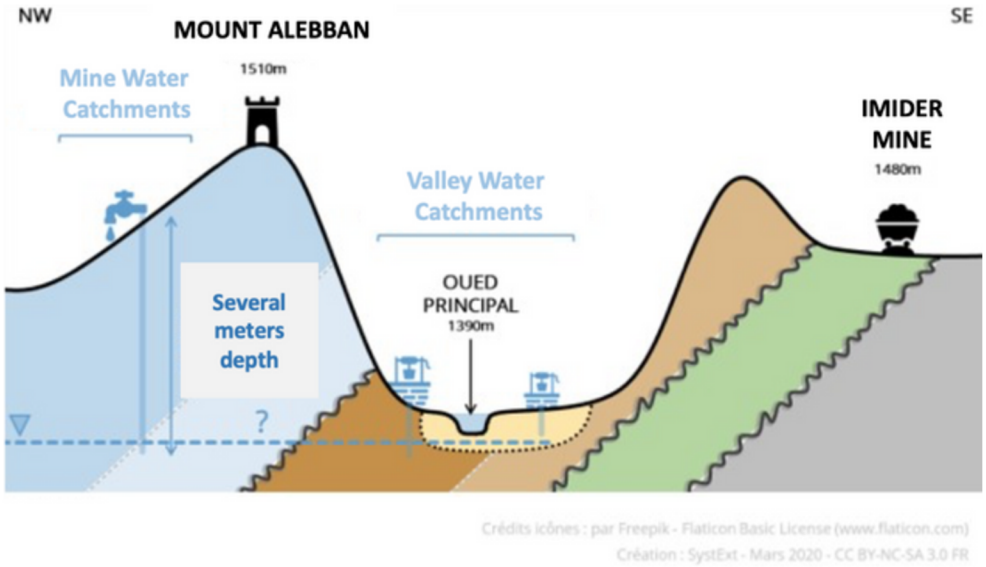
5.2.The struggle for a fair water allocation between the population and the silver-mining industry in Imider

Context: Imider is a village of 5000 inhabitants, living across 7 hamlets, located 300 km southeast of Marrakech in the Tinghir province. Situated in a mountainous area between the High Atlas and Anti-Atlas, its local economy primarily revolves around subsistence agriculture, such as vegetable farming and small-scale livestock[183]. Given the arid climate of the region, with "less than one day of rainfall on average per month"[184], water resources are extremely limited. As a result, rivers often run dry, and water for drinking and irrigation is mainly sourced from underground aquifers. Therefore, water distribution is managed through a delicate balance using shallow wells and traditional khettaras (drainage galleries built to tap into underground water[185]). However, the resurgence of However, the resurgence of silver mining operations near the village in 1969, strained the area's

183.Association SystExt, Mine d'argent-mercure d'Imider, province de Tinghir, Maroc. Analyse des risques potentiels sur les eaux souterraines et de surface. Résultats d'une étude bibliographique et d'une mission de terrain réalisée du 21 au 23 avril 2019 [Rapport], Paris, 2020. ; https://www.congres-mondial-amazigh.org/2012/12/01/maroc-imider-province-de-tinghir-spoliation-des-ressources-naturelles-et-r%C3%A9sistance-populaire/
184.Ibid.
185.Ibid.

water resources, as, according to local activists, the mine "is reported to use 1,555 cubic meters of water per day[186], which is more than 12 times the daily consumption of all the inhabitants of Imider"[187]. The Imider mine is one of the richest silver mines in Africa, producing annually 240 tons of silver[188]. It is also recognized as « one of the few mines in the world where silver can be found in its native form"[189], as "the mine produces silver ingots with a purity of 99.5%"[190]. In 1969, the Société Métallurgique d'Imiter (SMI), which operates the mine, was state-owned by the Office National des Hydrocarbures et des Mines (ONHYM)[191]. It was privatized in 1996 and acquired by ONA (36.1% of the capital), as part of the Managem mining holding. ONA was later rebranded as Al Mada in 2018.[192] For their need, the company installed 7 deep wells[193] in three catchment areas: one well was drilled in 1986, another in 2004 in Mount Alebban and 5 wells built in 2013[194].

Figure 6. Representative scheme of the organization of groundwater extraction in Imider



Source: SystExt, 2020, Translated by author

186. CSOs explained that the company needed the water to treat and wash the extracted minerals, Interview August 12, 2024.
187. https://www.congres-mondial-amazigh.org/2012/12/01/maroc-imider-province-de-tinghir-spoliation-des-ressources-naturelles-et-r%C3%A9sistance-populaire/
188. https://www.cadtm.org/Maroc-l-histoire-d-une-lutte-Le-mouvement-contre-la-mine-d-Imider-dure-depuis
189. https://www.managemgroup.com/mine-dimiter
190. https://www.managemgroup.com/mine-dimiter
191. Mohammed Benidir, « Ce que l'extractivisme fait aux eaux souterraines au Maroc : La mine d'argent d'Imider contestée par ses riverains », EcoRev', 26 juin 2023, N° 54, no 1, pp. 29-49.
192. Ibid.
193. Although their depth is unknown.
194. Association SystExt, Mine d'argent-mercure d'Imider, province de Tinghir, Maroc. Analyse des risques potentiels sur les eaux souterraines et de surface. Résultats d'une étude bibliographique et d'une mission de terrain réalisée du 21 au 23 avril 2019, op. cit. p.19.

Results: Experts and activists identify three key outcomes of the silver extraction activity in Imider: Land grabbing, water grabbing and environmental and water pollution[195]. Regarding land grabbing, the mining site is situated on collective land, historically used as a pastoral area and, to a lesser extent, for cultivation by families in Imider[196]. When the SMI arrived in 1969, Imider was home to 57 families, 30 of whom left after receiving financial compensation whereas some families were forced to leave due to mining activities encroaching too closely on their cultivated fields or grazing areas[197]. However public authorities did not intervene and have allowed the SMI to occupy and expand on these lands[198]. In the context of water grabbing, a local CSO has pointed out that the local population noticed a reduction in water flow, an even the drying up of the khettaras just 11 months after SMI began exploiting the wells in Mount Alebban in 2004[199]. Engineers, who were dispatched in 2019 by a local CSO to assess the situation, found that the reported decreases were particularly surprising given that these specific khettaras were known for "exceptional stability, even during droughts"[200].

One proposed hypothesis was that there may be a connection between the groundwater captured by the mine and the aquifers supplying the village of Imider, hence the depletion of the khettaras[201]. Finally, the population of Imider also suffers from environmental pollution resulting from mining activities[202]. This pollution is a consequence of mineral extraction residues and processing waste. In 1987, cyanide leaks led to the death of 25 goats[203]. More recently, in April 2023, 50 sheep belonging to a nomadic-sedentary herder faced a similar fate[204]. It also impacts the health of the population as activists note a rise of skin diseases and cancer cases[205].

195. Mohammed Benidir, « Ce que l'extractivisme fait aux eaux souterraines au Maroc », op. cit. Soraya El Kahlaoui et Koenraad Bogaert, « Politiser le regard sur les marges. Le cas du mouvement «sur la voie 96» d'Imider », L'Année du Maghreb, 10 décembre 2019, no 21, pp. 181-191. ; https://www.cadtm.org/Maroc-l-histoire-d-une-lutte-Le-mouvement-contre-la-mine-d-Imider-dure-depuis , Interview, August 12, 2024 ; https://www.congres-mondial-amazigh.org/2012/12/01/maroc-imider-province-de-tinghir-spoliation-des-ressources-naturelles-et-r%C3%A9sistance-populaire/
196. Mohammed Benidir, « Ce que l'extractivisme fait aux eaux souterraines au Maroc », op. cit.
197. Ibid.
198. Ibid.
199. Interview, August 12, 2024
200. Association SystExt, Mine d'argent-mercure d'Imider, province de Tinghir, Maroc. Analyse des risques potentiels sur les eaux souterraines et de surface. Résultats d'une étude bibliographique et d'une mission de terrain réalisée du 21 au 23 avril 2019, op. cit. p.37.
201. Ibid. p. 37.
202. https://www.congres-mondial-amazigh.org/2012/12/01/maroc-imider-province-de-tinghir-spoliation-des-ressources-naturelles-et-r%C3%A9sistance-populaire/
203. Mohammed Benidir, « Ce que l'extractivisme fait aux eaux souterraines au Maroc », op. cit.
204. Ibid.
205. https://www.congres-mondial-amazigh.org/2012/12/01/maroc-imider-province-de-tinghir-spoliation-des-ressources-naturelles-et-r%C3%A9sistance-populaire/;https://www.cadtm.org/Maroc-l-histoire-d-une-lutte-Le-mouvement-contre-la-mine-d-Imider-dure-depuis

CSO's demands and initiatives: In August 2011, a local CSO began with graduate students calling for the right to employment, as SMI restricted their access to summer seasonal jobs[206]. Their rationale was that the local population, despite the company's significant profits (estimated at 32 million euros in 2011[207]), gained no social or economic benefits from the exploitation of the mines as opposed to initial promises[208]. As negotiations with public authorities and SMI failed, activists escalated by cutting off the mine's water supply through a sit-in in Mount Alebban on September 16. This marked the convergence for 40 years of memorialized struggles[209]centered on protests against the monopolization of water and groundwater contamination by the mines. Broader demands included environmental remediation, scholarships, local employment, and SMI's investment in the infrastructures and economic development of Imider[210]. Local CSOs are renowned for its large repertoire of actions: from the nonstop sit-in that lasted from 2011 to 2019, to the use of traditional customs of deliberation and decision-making (*Agraw*, meaning Agora in Tamazight)[211], the production of a documentary film *Amussu* to bring national and international awareness to their cause[212], and the use of technically grounded discourse supported by expert reports they commissioned[213].

Public authorities' response: Public authorities initially engaged in dialogue with local CSOs through several meetings until December 2013. According to activists, they had proposed investments in school transportation, the construction of an irrigation canal, the renovation of local handicraft center as well as the creation of 50 jobs[214]. However, these offers were found inadequate and the protests continued. From 2014, public authorities shifted to repression, with numerous arrests and imprisonment of activists occupying Mount Alebban[215]. By 2019, local CSOs had ended the sit-in[216]. As of 2024, local rivers (Oued) have been dry for two years, and traditional khettaras

207.Soraya El Kahlaoui et Koenraad Bogaert, « Politiser le regard sur les marges. Le cas du mouvement «sur la voie 96» d'Imider », op. cit. Mohammed Benidir, « Ce que l'extractivisme fait aux eaux souterraines au Maroc », op. cit. ; Interview, August 12, 2024.
208.https://www.congres-mondial-amazigh.org/2012/12/01/maroc-imider-province-de-tinghir-spoliation-des-ressources-naturelles-et-r%C3%A9sistance-populaire/
209.Interview, August 12, 2024.
210.Mohammed Benidir, « Ce que l'extractivisme fait aux eaux souterraines au Maroc », op. cit. Mohammed Benidir, « Résister dans des échelles imbriquées. Les notables et les militants contre la Société Métallurgique d'Imiter dans le sud-est du Maroc », Cahiers d'Outre-Mer, 1 juillet 2021, vol. 74, no 284, pp. 349-381 Mohammed Benidir, « Leaders associatifs et élus locaux au Maroc: épreuves de face-à-face et controverses dans les arènes du développement », Politique africaine, 2010, vol. 120, no 4, p. 87. ; Interview, August 12, 2024.
211.Soraya El Kahlaoui et Koenraad Bogaert, « Politiser le regard sur les marges. Le cas du mouvement «sur la voie 96» d'Imider », op. cit.
212.Interview, August 12, 2024.
213.https://www.opendemocracy.net/en/north-africa-west-asia/amussu-participatory-art-and-cinema-means-resistance/
214.Association SystExt, Mine d'argent-mercure d'Imider, province de Tinghir, Maroc. Analyse des risques potentiels sur les eaux souterraines et de surface. Résultats d'une étude bibliographique et d'une mission de terrain réalisée du 21 au 23 avril 2019, op. cit.
215.https://www.cadtm.org/Maroc-l-histoire-d-une-lutte-Le-mouvement-contre-la-mine-d-Imider-dure-depuis
216.Ibid.;https://ledesk.ma/2016/09/06/imider-fete-la-liberation-de-ses-trois-prisonniers-liberes-apres-30-mois-de-detention/

are deteriorating. Some farmers are now relying on newly constructed basins and pumping system and trying to dig deeper wells. With viable agricultural activity increasingly difficult to sustain, inhabitants are leaving their land, while SMI continues its mining expansion.

6.CONCLUSION AND RECOMMENDATIONS

This report has shown that Morocco is locked-in a water policy path that perpetuates the myth of the agricultural sector as the driver of economic growth, due to the illusion of unlimited water resources. This vision relies on large-scale hydraulic infrastructures and subsidized technologies to increase water availability. It promotes a market-oriented agricultural model, heavily focused on the export of off-season crops. However, the current rate of water consumption in the agricultural sector is unsustainable. It causes water access injustices, where policies favor national economic growth at the expense of local livelihoods. As demonstrated in the report, such policies often result in unintended consequences that intensify water stress and negatively affect rural communities.

Drawing from interviews, literature review and our analysis, we propose three key areas for recommendations to start a paradigm shift in order to implement a just water transition:

1.Breaking away from an irrigation-driven, market-oriented agricultural model[217]**.** This shift requires the adoption of agricultural policies that minimize reliance on irrigation, treating it as a supplementary measure rather than a primary water source. Priority should be given to cultivating crops that thrive under rainfed conditions and are adapted to Morocco's climatic realities. Public authorities should actively promote the production of resilient staples, such as cereals and legumes, which not only consume less water but also enhance domestic food security. Groundwater reserves must be secured and designated exclusively for emergency use. Similarly, the expansion of irrigated farmland must be carefully controlled to prevent adding further pressure on already scarce water resources. Focusing on rainwater utilization compels public authorities to confront the natural limits of Morocco's water resources. It also necessitates more complex and finetuned planning, requiring the management of water based on the natural or regulated limits of each water source.

2.Shifting from a water supply approach to demand management and water consumption control. This requires halting the relentless expansion of irrigation, which has led to the degradation of fragile ecosystems, including the depletion of some fossil aquifers. Notable measures have already been introduced, such as groundwater contracts aimed at distributing and regulating water use among stakeholders sharing the same aquifer, bans on certain water-intensive crops, and the strengthening of the presence of water police across the territory. However, their effectiveness depends on the systematic enforcement of laws and regulations. For this, strong political will is essential to ensure that all users comply to these frameworks.

217.This recommendation stems from the work of Professor Mohamed Sraïri. https://medias24.com/chronique/quelles-cultures-doit-favoriser-lagriculture-marocaine-face-au-manque-structurel-deau-et-au-rencherissement-des-intrants/

3.Adopting a bottom-up approach to water management projects. There is a need for genuine collaboration between public authorities and local communities (community leaders and small farmers alike). Currently, power dynamics often skew in favor of macroeconomic interests, sidelining local needs and proposals. Traditional community-based water management methods have proven effective locally and contribute significantly to social and economic development. Recognizing and integrating these practices into broader water management strategies can lead to more tailored and effective outcomes, avoiding the pitfalls of “one-size-fits-all” solutions.

7.REFERENCES

- Akesbi Najib, « Une nouvelle stratégie pour l'agriculture marocaine : Le « Plan Maroc Vert » », *New Medit*, 2012, no 2, pp. 12-23.
- Akesbi Najib, « La nouvelle stratégie agricole du Maroc annonce-t-elle l'insécurité alimentaire du pays ? », *Confluences Méditerranée*, 2011, vol. 78, no 3, pp. 93-105.
- Association SystExt, *Mine d'argent-mercure d'Imider, province de Tinghir, Maroc. Analyse des risques potentiels sur les eaux souterraines et de surface. Résultats d'une étude bibliographique et d'une mission de terrain réalisée du 21 au 23 avril 2019* [Rapport], Paris, 2020, 64 p.
- Benidir Mohammed, « Ce que l'extractivisme fait aux eaux souterraines au Maroc: La mine d'argent d'Imider contestée par ses riverains », *EcoRev'*, 26 juin 2023, N° 54, no 1, pp. 29-49.
- Benidir Mohammed, « Résister dans des échelles imbriquées. Les notables et les militants contre la Société Métallurgique d'Imiter dans le sud-est du Maroc », *Cahiers d'Outre-Mer*, 1 juillet 2021, vol. 74, no 284, pp. 349-381.
- Benidir Mohammed, « Leaders associatifs et élus locaux au Maroc : épreuves de face-à-face et controverses dans les arènes du développement », *Politique africaine*, 2010, vol. 120, no 4, p. 87.
- Benouniche Maya, Kuper Marcel et Hammani Ali, « Mener le goutte à goutte à l'économie d'eau : ambition réaliste ou poursuite d'une chimère ? », *Alternatives Rurales*, novembre 2014.
- Bonte Pierre, Elloumi Mohamed, Guillaume Henri et Mahdi Mohamed (dir.), Tozy Mohamed, « Leaders et leadership : configurations complexes, ressources politiques et influence potentielle des leaders dans le cadre de l'Oriental marocain », *in Développement rural, environnement et enjeux territoriaux: regards croisés Oriental marocain et Sud-Est tunisien*, Tunis, Cérès Éditions, 2009.
- Bossenbroek Lisa, Ftouhi Hind, Kadiri Zakaria et Kuper Marcel, « Watermelons in the desert in Morocco: Struggles around a groundwater commons-in-the-makings. », *Water Alternatives*, 2023, vol. 16, no 1, pp. 87-107.
- Boudhar Abdeslam, Boudhar Said, Oudgou Mohamed et Ibourk Aomar, « Assessment of Virtual Water Flows in Morocco's Foreign Trade of Crop Products », *Resources*, 11 avril 2023, vol. 12, no 4, p. 49.
- Del Vecchio Kévin et Mayaux Pierre-Louis, « Gouverner les eaux souterraines au Maroc: L'État en aménageur libéral », *Gouvernement et action publique*, 13 mars 2017, VOL. 6, no 1, pp. 107-130.
- Département de l'Eau, *Projet de Plan national de l'eau* [Rapport], Rabat, Maroc, 2019, 230 p.

- Ding Grace Kam Chun et Ghosh Sumita, « Sustainable Water Management—A Strategy for Maintaining Future Water Resources », *in Encyclopedia of Sustainable Technologies*, Elsevier, 2017, pp. 91-103.
- Direction de l'Eau et de l'Assainissement, Mutualisation des programmes nationaux d'assainissement liquide et de réutilisation des eaux usées [Rapport], Direction Générale des Collectivités Locales, Ministère de l'Intérieur, Royaume du Maroc, n.d, 66 p.
- El Alaoui Mohammed, « Les pratiques participatives des associations d'usagers de l'eau dans la gestion de l'irrigation au Maroc : étude de cas en petite, moyenne et grande hydraulique », in , Rabat, Maroc, 2004, p. 18.
- Elder Alison D., « The Green Morocco Plan in Boudnib: Examining Effects on Rural Livelihoods », The Journal of Environment & Development, septembre 2022, vol. 31, no 3, pp. 275-299.
- Faysse Nicolas, « The rationale of the Green Morocco Plan: missing links between goals and implementation », The Journal of North African Studies, 8 août 2015, vol. 20, no 4, pp. 622-634.
- Fico Jamie, « Frontiers of fortune: mobilising land, water, and collective identity for watermelon production in Southeastern Morocco », The Journal of North African Studies, 21 septembre 2024, pp. 1-24.
- Ftaïta Toufik, « Chapitre 26. De la gestion communautaire à la gestion associative de l'eau: Légitimité et illégitimité des associations des usagers des eaux agricoles comme nouveau cadre institutionnel de la gestion participative de l'irrigation au Maroc », in De l'eau agricole à l'eau environnementale, Éditions Quæ, 2012, pp. 351-362.
- Goldberg Zachary A., « Development through commodification: exploring apple commodity production as pesticide promotion in the High Atlas », Agriculture and Human Values, juin 2022, vol. 39, no 2, pp. 663-682.
- Groupe Eau des Lauréats IAV, Livre Blanc sur les ressources en eau au Maroc. Pour une gestion durable assurant la sécurité hydrique du pays [Rapport], 2022, 70 p.
- Haut-Commissariat au Plan, Examen national volontaire de la mise en oeuvre des objectifs de développement durable [Rapport], 2020, 214 p.
- Haut-Commissariat au Plan, Note d'information relative à la situation du marché du travail au premier trimestre 2024 [Rapport].
- Herzenni Abdellah, « Les ORMVA, les AUEA, et la gestion participative de l'irrigation », Revue H.T.E, décembre 2002, p. 11.
- Institut Royal des Études Stratégiques, Rapport de synthèse des travaux de la journée de réflexion prospective : L'avenir de l'Agriculture au Maroc dans un contexte de la rareté structurelle de l'eau [Rapport], 2024.
- Institut Royal des Études Stratégiques, « Quel avenir de l'eau au Maroc ? » Rapport de synthèse des travaux de la journée scientifique du 17 mars 2022 [Rapport], 19 p.

- Jakeman Anthony J., Barreteau Olivier, Hunt Randall J., Rinaudo Jean-Daniel et Ross Andrew (dir.), Integrated Groundwater Management : Concepts, Approaches and Challenges, Cham, Springer International Publishing, 2016.
- Jouve Anne-Marie, « Les trois temps de l'eau au Maroc », Confluences Méditerranée, 2006, no 58, pp. 51-61.
- Kadiri Zakaria et Abdellaoui El-Hassane, « Les projets d'irrigation à l'epreuve des dynamiques territoriales locales », in Assia Boutaleb, Baudouin Dupret, Jean-Noël Ferrié et Zakaria Rhani (dir.), Le Maroc au présent : D'une époque à l'autre, une société en mutation, Maroc, Centre Jacques-Berque, Description du Maghreb, 2016, pp. 91-101.
- Kadiri Zakaria, Belmoumene Karima, Kuper Marcel, Faysse Nicolas, Tozy Mohamed et Errahj Mostafa, « L'innovation institutionnelle dix ans plus tard : quelles opportunités pour les agriculteurs, et quels apprentissages pour les pouvoirs publics ? Le cas des associations d'irrigants au nord du Maroc », in Bernard HUBERT Emilie COUDEL Hubert DEVAUTOUR, Christophe-Toussaint SOULARD (dir.), ISDA 2010, Montpellier, France, Cirad-Inra-SupAgro, 2010, p. 12.
- Kahlaoui Soraya El et Bogaert Koenraad, « Politiser le regard sur les marges. Le cas du mouvement « sur la voie 96 » d'Imider », L'Année du Maghreb, 10 décembre 2019, no 21, pp. 181-191.
- Khardi Yassine, Lacombe Guillaume, Kuper Marcel, Taky Abdelilah, Bouarfa Sami et Hammani Ali, « Pomper ou disparaître : le dilemme du renforcement des khettaras par le pompage solaire dans les oasis du Maroc », Cahiers Agricultures, 2023, vol. 32, p. 1.
- Kuper Marcel, Mayaux Pierre-Louis et Benmihoub Ahmed, « The Persistent Appeal of the California Agricultural Dream in North Africa », Water Alternatives, 2023, vol. 16, no 1.
- Lozzi Assia, Chakroun Rim, Hakimi Fatiha, Maatala Nassreddine, Bounadi Imane, Lahrech Taha, Bekkar Younes et Bouaziz Ahmed, « Diagnostic des systèmes de production de pommier face aux changements climatiques : cas de M'semrir, Haut Atlas, Maroc », Cahiers Agricultures, 2024, vol. 33, p. 28.
- Ministère de l'Agriculture et de la Pêche Maritime, Plan Maroc Vert [Rapport], Rabat, Maroc, 2009, 32 p.
- Ministère de l'Agriculture et de la Pêche Maritime, Nouvelle stratégie de développement agricole. Generation Green 2020 [Rapport], n.d.
- Ministère de l'Equipement et de l'Eau et Direction Générale de l'Hydraulique, L'hydraulique en chiffres [Rapport], Rabat, 2023, 12 p.
- Molle François et Mayaux Pierre-Louis, « Les angles morts de la politique de l'eau au Maroc : », Confluences Méditerranée, 9 novembre 2023, N° 126, no 3, pp. 165-184.
- Molle François et Tanouti Oumaima, « Squaring the circle: Agricultural intensification vs. Water conservation in Morocco », Agricultural Water Management, octobre 2017, vol. 192, pp. 170-179.

- Ouassissou Romaïssa, Kuper Marcel, Dugué Patrick, Amrani Mohamed El, Hammani Ali et Ameur Fatah, « Rivalités et arrangements coopératifs pour l'accès à l'eau souterraine dans la plaine de Berrechid au Maroc », Cahiers Agricultures, 2019, vol. 28, p. 4.
- Ouassissou Romaïssa, Kuper Marcel, Hammani Ali et El Amrani Mohamed, « Le contrat de gestion participative pourrait-résoudre la crise de gouvernance des eaux souterraines ? Cas de la nappe de Berrechid au Maroc », Alternatives Rurales, décembre 2019, no 7.
- Pascon Paul, « De l'eau du ciel à l'eau d'Etat : psychosociologie de l'irrigation », Hommes, terre et eaux, 1978, vol. 1, no 28, pp. 3-10.
- Sraïri Mohamed Taher, « Repenser le modèle de développement agricole du Maroc pour l'ère post Covid-19 », Cahiers Agricultures, 2021, vol. 30, p. 17.
- Swearingen Will D., Moroccan mirages : agrarian dreams and deceptions, 1912-1986, Princeton, N.J, Princeton University Press, 1987, 217 p.
- UN Water et UNESCO, Les eaux usées, une ressource inexploitée, Paris, 2017.
- Vecchio Kévin Del et Kuper Marcel, « La mise en visibilité des eaux souterraines au Maroc : un processus historiquement lié aux politiques de développement de l'irrigation », Développement durable et territoires, 22 mars 2022, Vol. 12, n°3.
- Venot Jean-Philippe, Kuper Marcel et Zwarteveen Margreet (dir.), Drip irrigation for agriculture : untold stories of efficiency, innovation and development, New York, NY, Routledge, Earthscan studies in water resource management, 2017.
- Water Basin Agency of Sebou, Water situation of the Sebou Basin and key directions [Rapport], Fès, 2024, 17 p.
- Williams Joe, « Desalination in the 21st Century : A critical Review of Trends and Debates », Water Alternatives, 2022, vol. 15, no 2, pp. 193-217.
- Woillez Marie-Noelle, Revue de littérature sur le changement climatique au Maroc : observations, projections et impacts [Rapport], Papiers de Recherche AFD, 33 p.

المعهد المغربي لتحليل السياسات
MOROCCAN INSTITUTE FOR POLICY ANALYSIS
ⵓⵔⵣⵓⵔ ⵓⵎⵖⵔⴱⵉ ⵏ ⵜⵙⵖⵓⵙⵜ ⵏ ⵜⵙⵓⵜⵔⵉⵡⵉⵏ

5, Apt: 5, Rue Figuig, Hassan - Rabat
contact@mipa.institute
www.mipa.institute
05.37.26.26.02