

# Under the High Patronage of His Majesty King Mohammed VI



## Agricultural policies and water resources in Morocco: Challenges of water governance under severe water scarcity, insights from Souss Massa basin.

Moussa Ait el kadi<sup>1</sup>, Lhoussaine Bouchaou<sup>1,2</sup>, Abdelwahed Chaaou<sup>2</sup>, Mohammed El hafyani<sup>1</sup>, Soumia Gouahi<sup>1</sup>, Brahim Meskour<sup>1</sup>, Victor Fernandez<sup>5</sup>, Chaima Aglagal<sup>1</sup>, and Mohammed Hssaisoune<sup>1,2,3</sup>.

<sup>1</sup>Laboratory of Applied Geology and Geo-Environment, Ibn Zohr University, Agadir, 80035, Morocco. E-mail: [moussa.aitelkadi@edu.uiz.ac.ma](mailto:moussa.aitelkadi@edu.uiz.ac.ma)

<sup>2</sup>Mohammed VI Polytechnic University (UM6P), International Water Research Institute, Ben Guerir, 43150, Morocco.

<sup>3</sup>Faculty of Applied Sciences, Ibn Zohr University, Ait Melloul, 86153, Morocco.

<sup>4</sup>École Supérieure d'Agro Développement International (ISTOM), 4 rue Joseph Lakanal - 49000 Angers, France.



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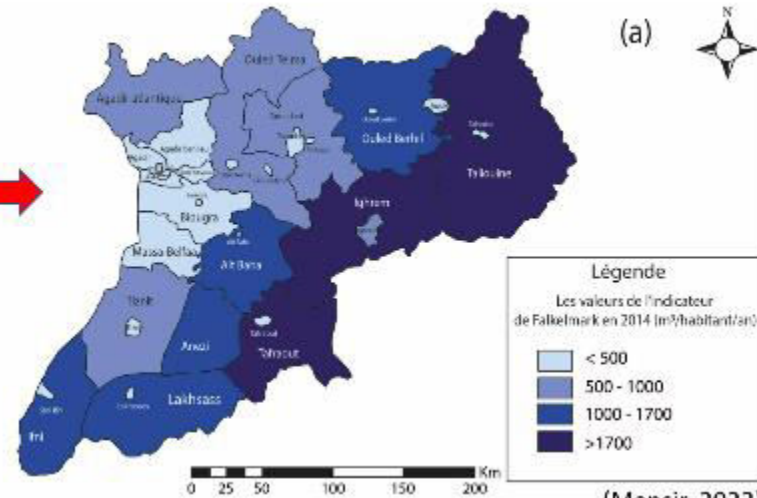
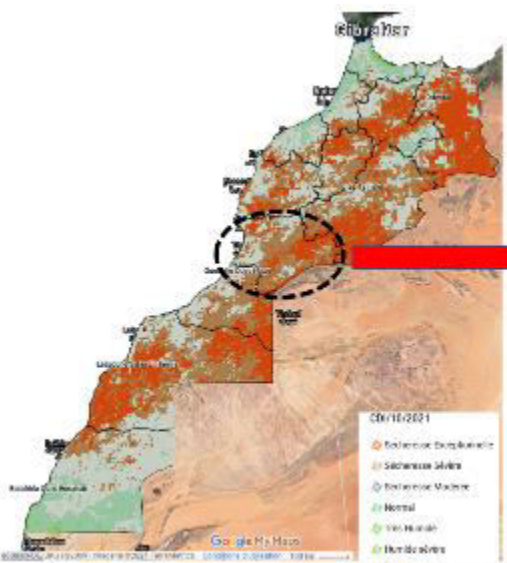


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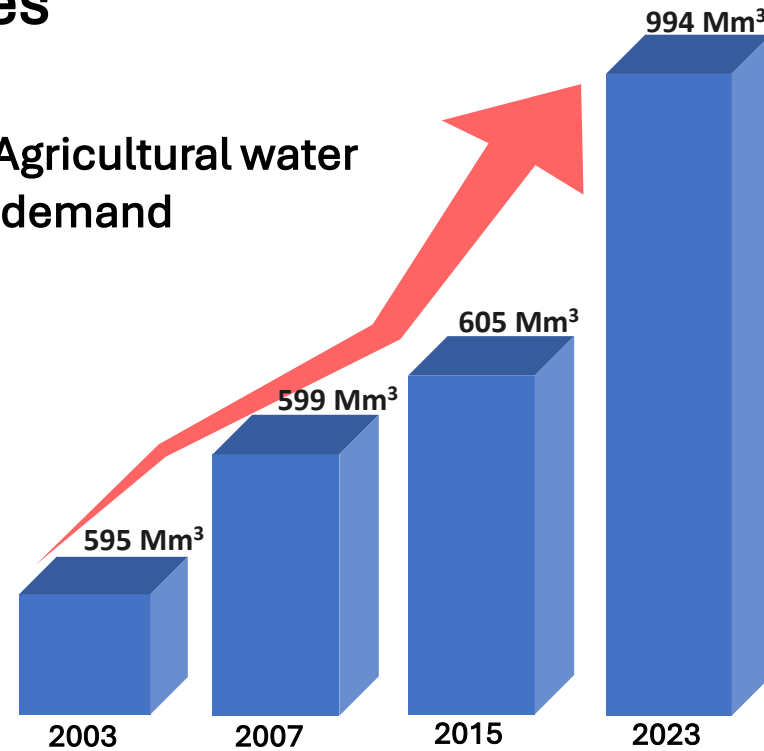


Marrakech, December 04, 2025

# Problem: Key figures

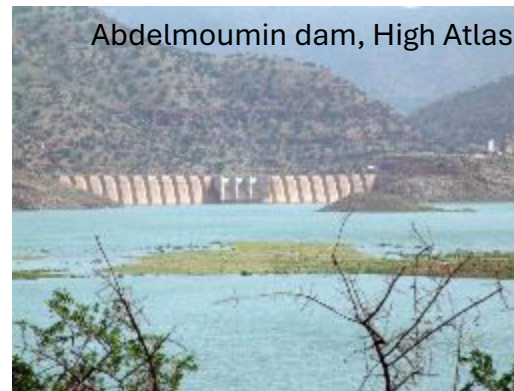


## Agricultural water demand



In 2022: available volume per inhabitant per year =  $390\text{m}^3$

**Severe water scarcity**



2010



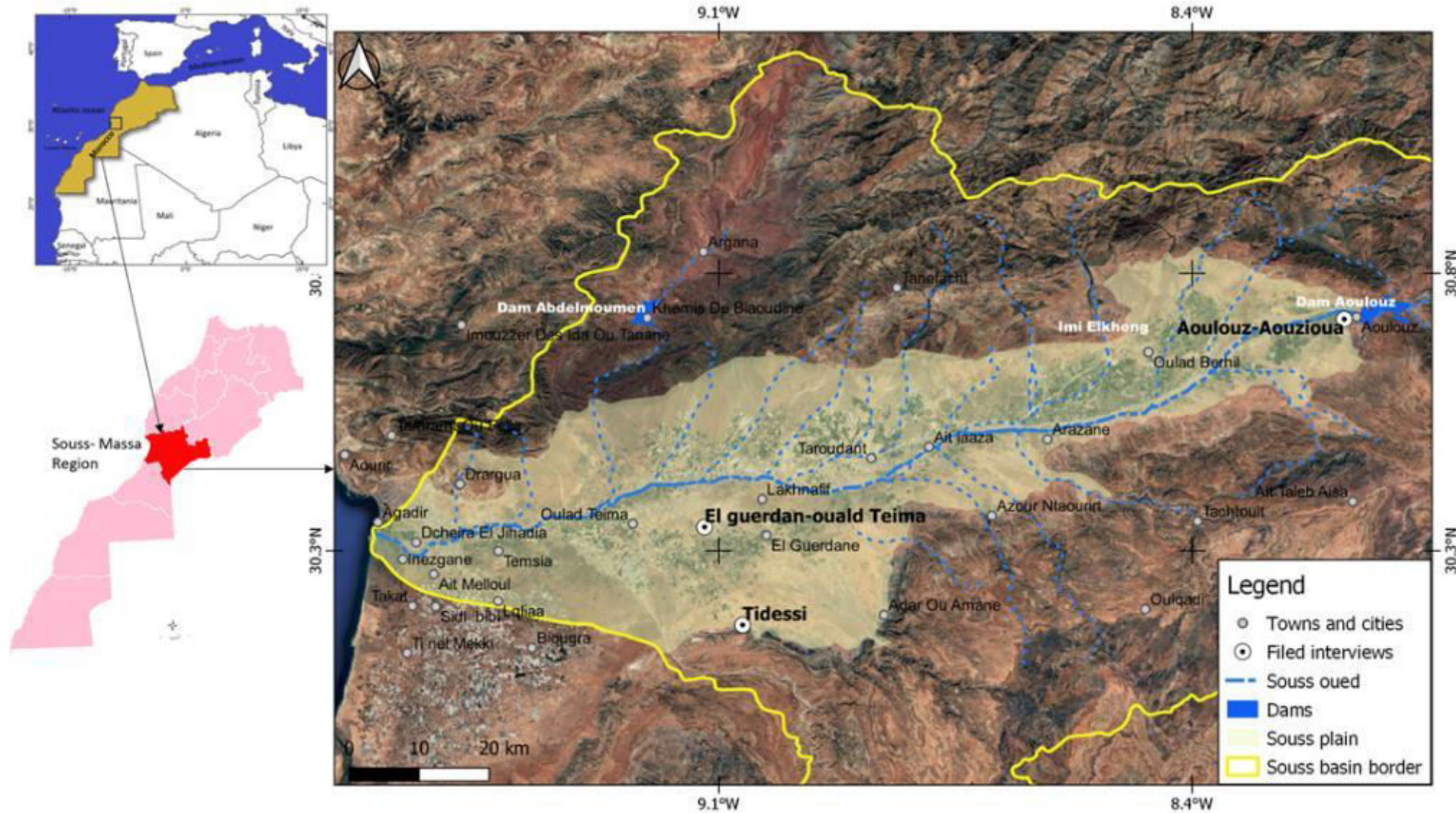
2021



# Study area presentation



XIX WORLD WATER CONGRESS  
1-5 December 2025 | Marrakech, Morocco



# Study area presentation



Area: 27 000km<sup>2</sup>  
66% Mountains (High and Anti-Atlas)  
34% Flat terrain  
Population: 3 M  
55% Rural 45% urban



Average precipitation  
High Atlas: 500 mm  
Plain: 150 mm  
Evapotranspiration: 2000 mm



150,000 hectares of irrigated land  
950Mm<sup>3</sup>: 36% surface et 64% groundwater  
90 % of water resources  
15.3% of the regional GDP  
40% of regional employment  
44% of national agricultural exports



Citrus orchards and greenhouse in the Souss Plain

Agriculture intensification in Souss plain, Credit: Boujnikh & humbert, 2010



# Methodology



Literature review



History of agricultural policies

LULC MCD12Q1  
MODIS



Land use shift monitoring

Aquifer balance  
Water level mapping

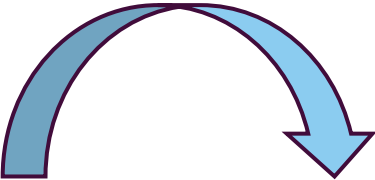


Groundwater monitoring

Interviews and fields visits



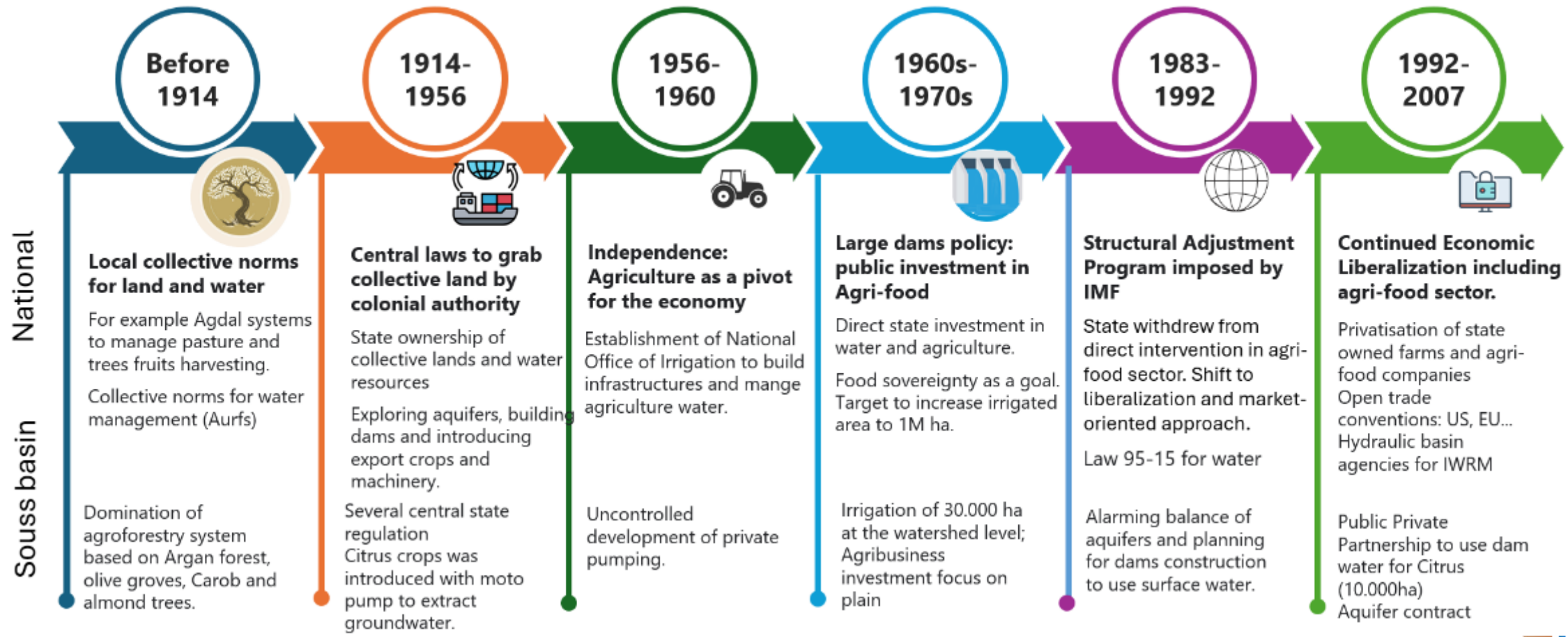
Socio-economic implications



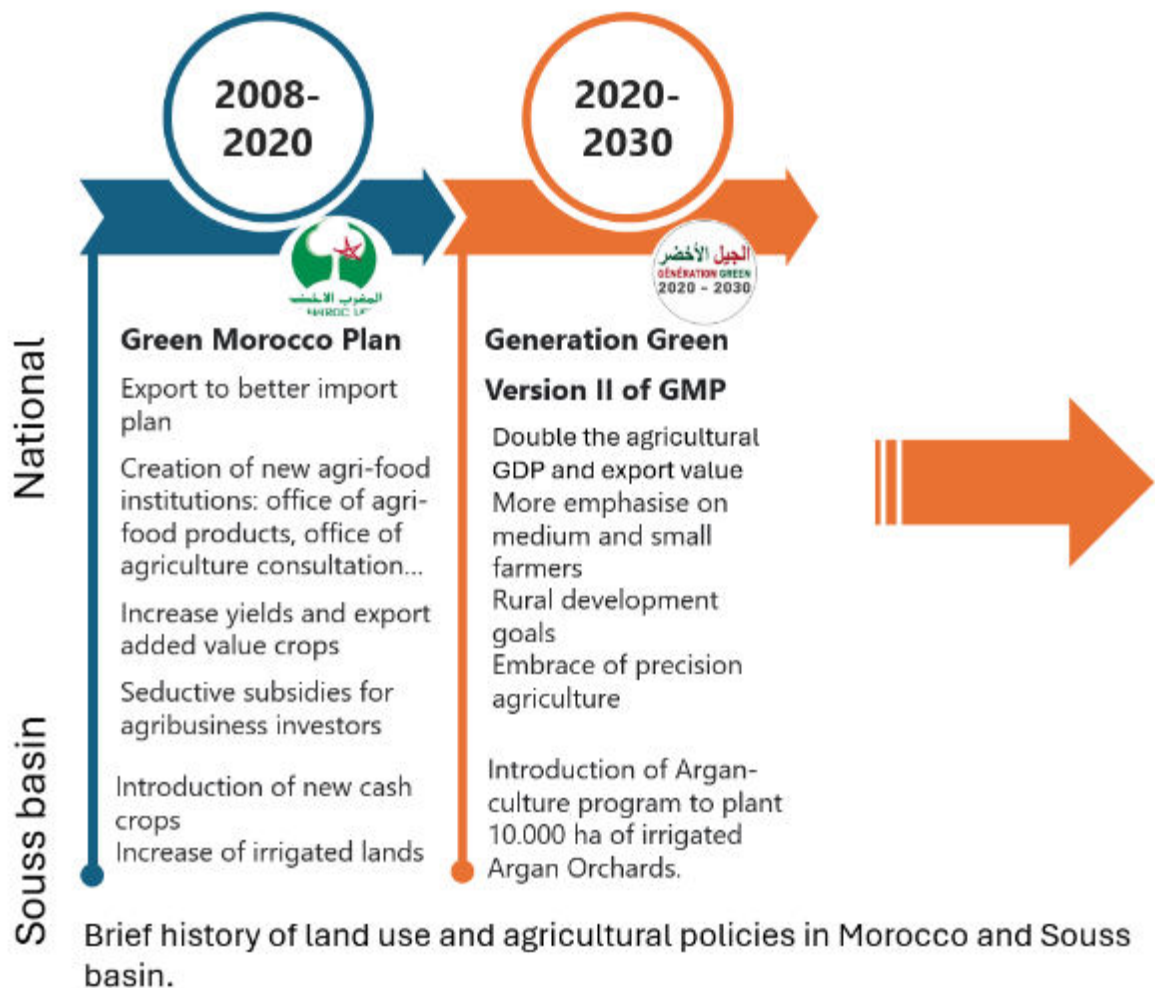
Implications of agricultural policies on water resources and rural livelihoods ?



# Results and implications: agricultural and land use policies



# Results and implications: agricultural and land use policies



## Synthesis

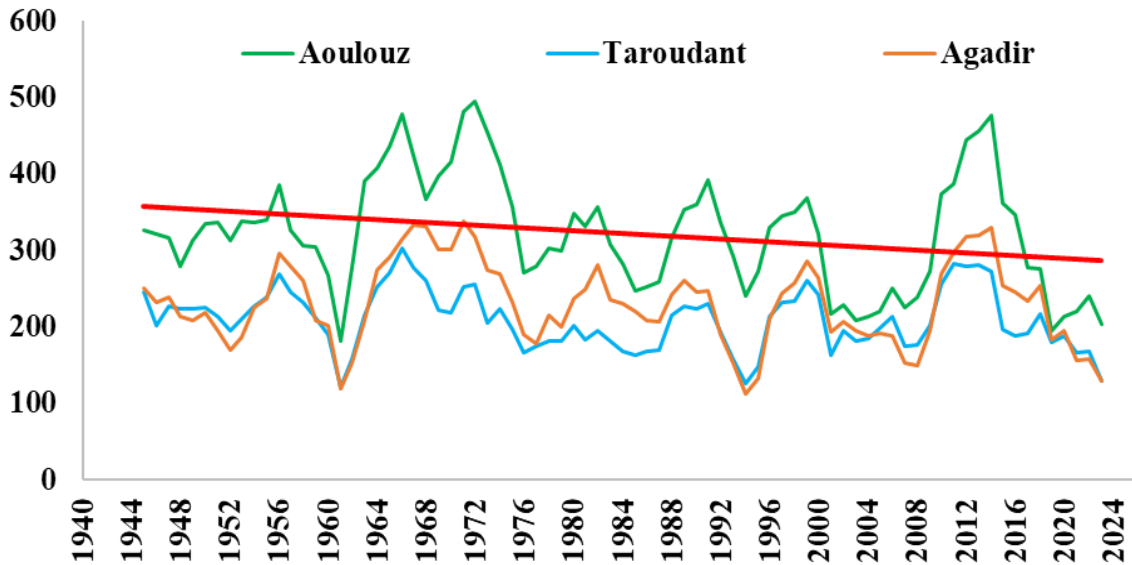
- ❑ Since 1980s, as the state retreated from direct investment and regulation of agri-food, the sector is opened to private actors for production and marketing.
- ❑ With GMP, the state invested though incentives to expand economic figures and boost export.
- ❑ Food sovereignty is abandoned and replaced by « *Export to better import* » to export high value crops and import key foods (e.g cereals);
- ❑ Food price increase due to speculation in international market and depletion of water resources;
- ❑ Severe water crisis and socio-economic consequences, including domestic water cutout in some regions;
- ❑ Since 2022: Large projects was started for the use of desalinated water for agriculture and domestic water.



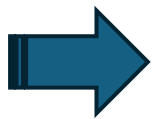
# Results and implications: Physical water shortage



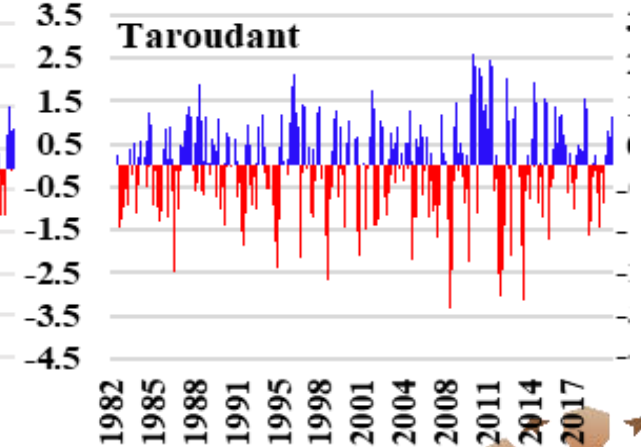
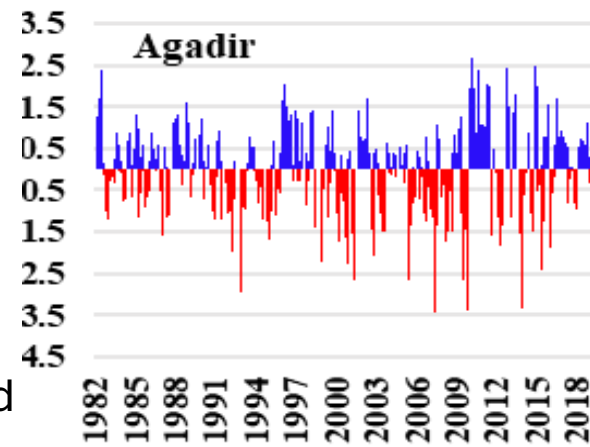
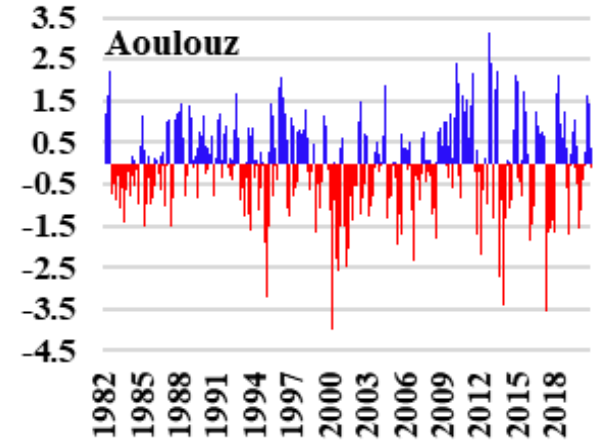
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 Marrakech, Morocco | 5-10 December 2025



Five-year moving average for the meteorological stations of Souss basin from 1940 to 2023, the red line represents the overall trend (Ait el kadi et al, 2025)



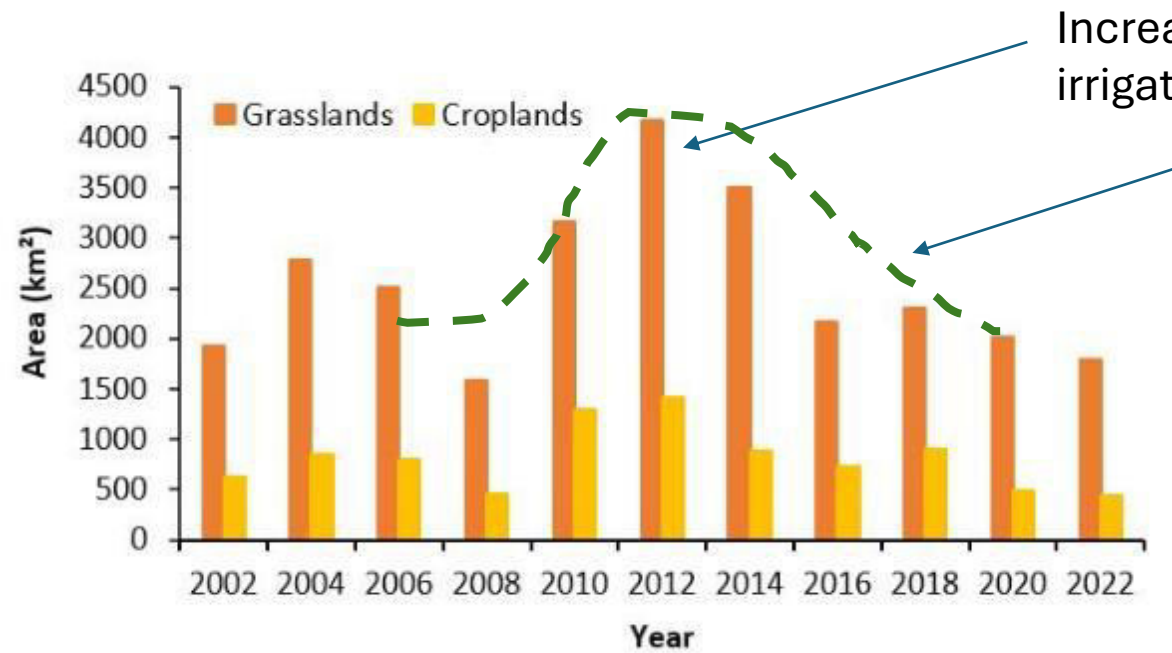
Clear evidence on physical water shortage and frequent drought occurrence.  
 More vulnerability to climate shocks



SPI (standardised precipitation index) for a cumulative period of 3 months in the Souss basin.



# Results and implications: Land use shift



Increase of irrigated land partially due to incentives for irrigation introduced by Morocco Green Plan

Decrease due to severe drought and depletion dams and groundwater: dry up of water points

Agricultural land use classes based on MCD12Q1 MODIS product between 2002 and 2022. Credit: Ait el kadi et al, 2025  
\*Grass and croplands classes as proxy for irrigated areas.

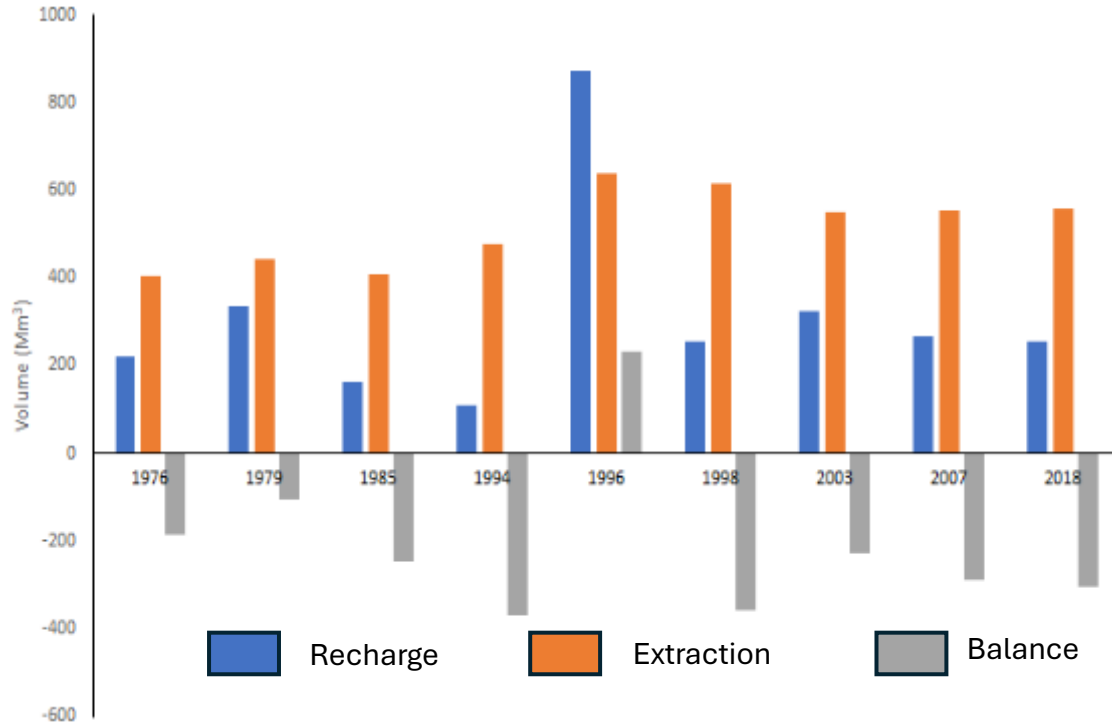


Sentinel NIR/SWIR/R composite shows the intensive irrigated perimeters (Elguerdan, Ouled Teima and Issen) in the Middle Souss.

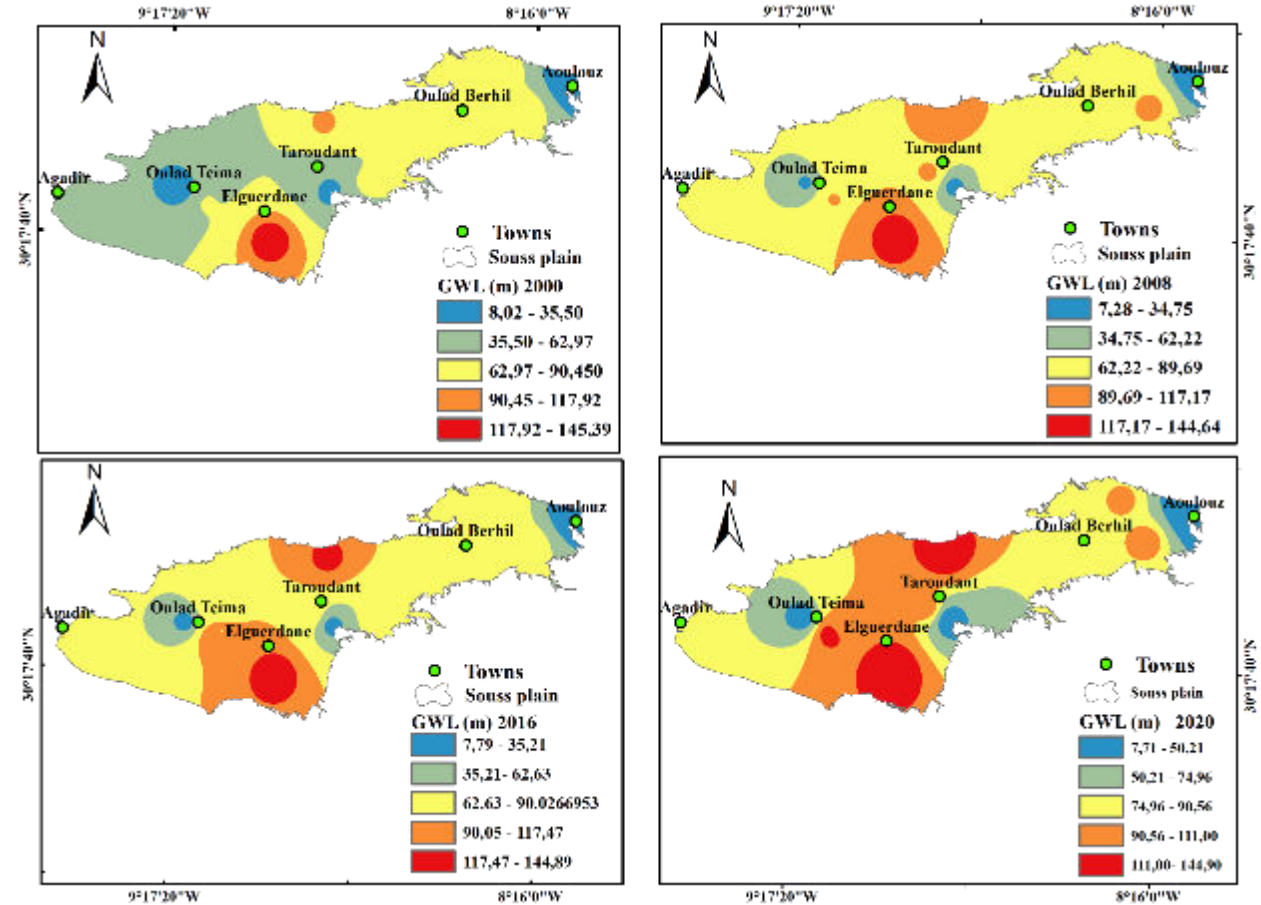
Image: <https://agricultural-production-hotspots.ec.europa.eu>



# Results and implications: groundwater depletion



Souss Aquifer balance: from 70s, the annual deficit fluctuate between 150 to more than 300Mm<sup>3</sup> (Ait el kadi et al, 2025). In 50 years, only one year (1996) of positive balance!



Water table mapping indicate continuous depletion with a rate from 1m/y up to 5m/y. (Ait el kadi et al, 2025)

Private irrigated perimeters (e.g Elguerdane) is the highest degraded water table. In several wells are dried up starting from 2000s.



# Results and implications: Interviews

Three different Agro-ecosystems were investigated



## 1- Elguerdan and ouled teima

- **Location:** Plain, Middle and downstream;
- **Water:** Private irrigation perimeter (dams water+ aquifer);
- **Agriculture:** intensive monoculture Citrus, fruits and vegetables under greenhouses.



## 2- Aoulouz-Aouzioua

- **Location:** Upstream-High Atlas;
- **Water:** Associations to manage collective irrigation;
- **Agriculture:** Traditional agroforestry based on Argan and olive groves, livestock and cooperatives for milk production.



## 3- Tidissi Oasis

- **Location:** Middle, Anti-atlas;
- **Water:** Ancient Khattera (*Qanat*) to exploit aquifer;
- **Agriculture:** Argan based & Small subsistence agriculture and livestock.



# Results and implications: Interviews

	1. Elguerdan and Ouled teima	2- Aoulouz-Aouzioua	3- Tidissi Oasis
Available water resources	Dam water through PPP project : Ceased for 2 years! (From Jan 2022) Aquifer (very low productive wells)	Springs and well leakage from the dam Water scarce due drought and dam	Khettara (3 springs from Limestone Aquifer) Stable flow of springs
Management practices, features and challenges	PPP: contract between farmers and private manager Power balance in favour of private company Hydraulic basin agency: central state regulations Aquifer contract to control extraction but not effective due to low adherence of stakeholders.	Communities of users (Users associations) Collective accountability through association general assembly Financial and technical needs for everyday management activities Water and land grabbing's by some political elites	Users association Low adherence of users in the association Breakout of water channels Pollution risk of Khettara Degradation of collective water heritage including material heritage; Less support from government.

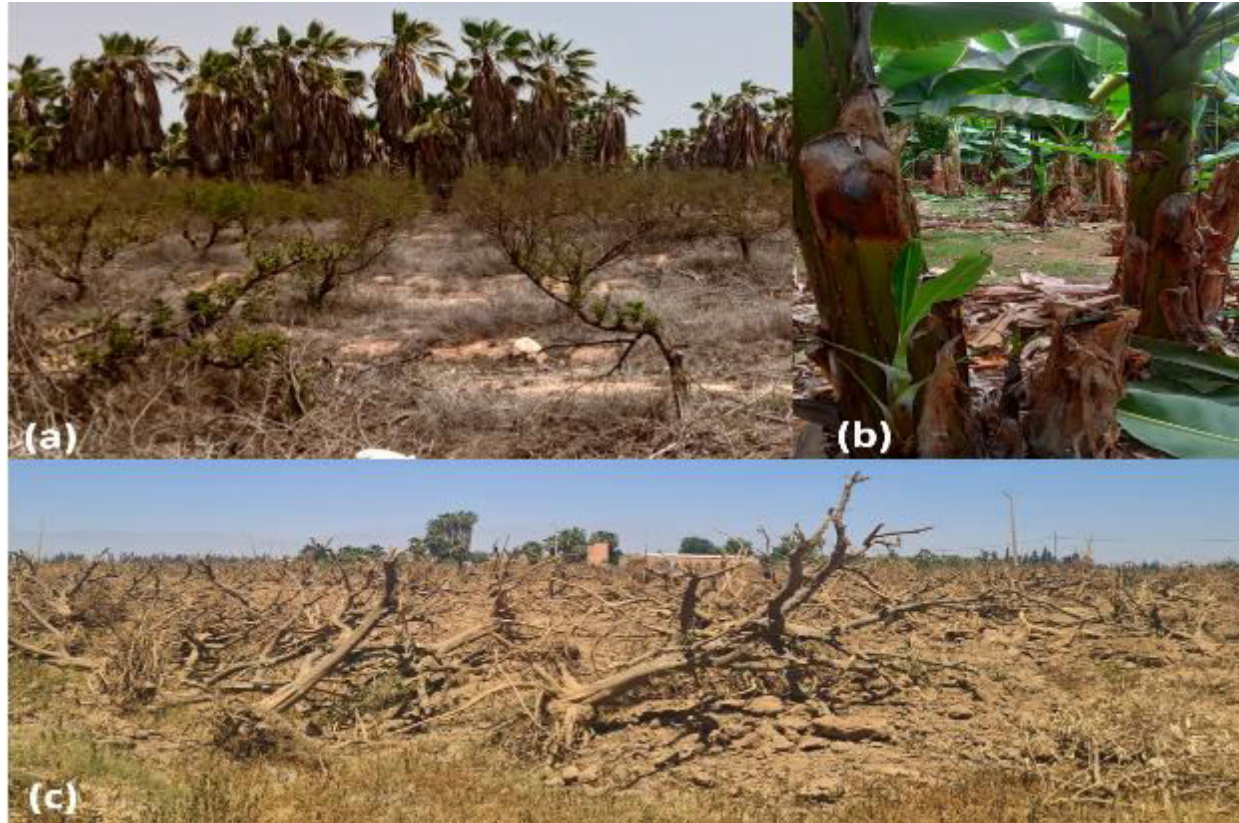


# Results and implications: Interviews

	1. Elguerdan and ouled teima	2- Aoulouz-Aouzioua	3- Tidissi Oasis
Socio-economic implications	collapse of Citrus orchards and other crops; Farmers financial crisis; Unemployment; Exodus; Cutout or low flow of domestic water; Overall economic recession.	Conflicts with political elites Inequality in dam water sharing with PPP; Livelihood losses; Social vulnerability aggravated by 8 September 2023 earthquake; Domestic water challenges: dry out of wells.	Conflicts between community of users and some political elites; Exodus to cities; Widespread of abandoned land, only 30% still cultivated; Mass exodus and less attractiveness of agriculture.
Farmers perspective and adaptation strategies	Advocate for farmer voice through professional association; Shift to climate resilient crops: Cactus, carob... Invest in other regions where water can be exploitable. Change to other economic activities (commerce, construction..).	Establishment of water irrigation organisation through WUA (Water users Association) Diversification of crops and association of tree, cereal and legumes; Advocate for the right to dotation from the dam: 18Mm3/ year.	Project to rehabilitation (20%) of irrigation channel; Reduction of irrigated area; Livestock as a complementary activity.



# Conclusion



Crop failure in Elguerdane, (a): Citrus orchard, (b): Banana in greenhouse, (C) uprooting of citrus trees (Credit: Moussa Ait el kadi, April 2024)

Agriculture policies ignore socio-environmental vulnerabilities



Overexploitation and depletion of water resources, unsustainable land uses



Increase vulnerability vis-à-vis drought and scarcity  
Socio-economic consequences

**Physical water shortage worsened by agricultural policies and directly impact livelihoods of rural communities.**



# Perspective

Despite the crisis, farmers in different agro-ecosystems are partially aware of the importance of water resources preservation for agri-business and ecosystem;

The challenge would be how to invest in that awareness to take actions to reverse the trend?

Our perspective is to explore the local approach of water governance and explore to what extent local institutions can handle the task?



Discussion session during the annual assembly of WUA of Taferzazet in Aoulouz (Credit: Moussa Ait el kadi, May 2024).

Ait El Kadi, M., Bouchaou, L., El Hafyani, M., Gouahi, S., Fernandez, V., Meskour, B., Aglal, C., & Hssaisoune, M. (2025). The Impact of Agribusiness Development Policies on Water Resources: Governance Challenges and Lessons From Morocco's Water Crisis. *The Journal of Environment & Development*, 10704965251386548.

<https://doi.org/10.1177/10704965251386548>



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Thank you!

Email: [Moussa.aitelkadi@edu.uiz.ac.ma](mailto:Moussa.aitelkadi@edu.uiz.ac.ma)



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