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# The impact of overexploitation of groundwater resources on the resilience of agricultural farms in semi-arid zones

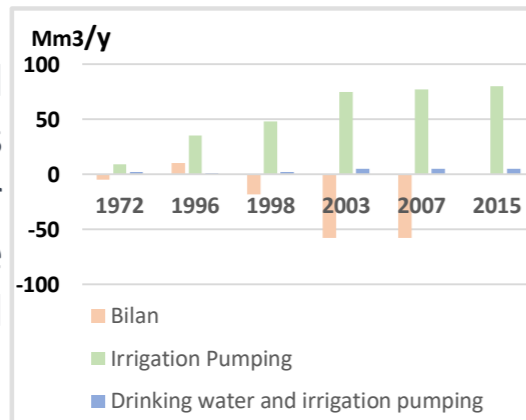
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## Topic of research

- Water resources in Morocco are rather well known, but limited, irregular, and fragile.
- The expansion of irrigated agricultural land has increased the groundwater use, resulting in the overexploitation of local aquifers.
- Water scarcity is expected to have a negative impact on food production and threaten the resilience of the local agricultural system



**Figure 1** : Evolution of groundwater withdrawal and water balance

## Objective

The main objective of the research is to evaluate the impact of groundwater overexploitation on the resilience of agricultural households in Morocco.

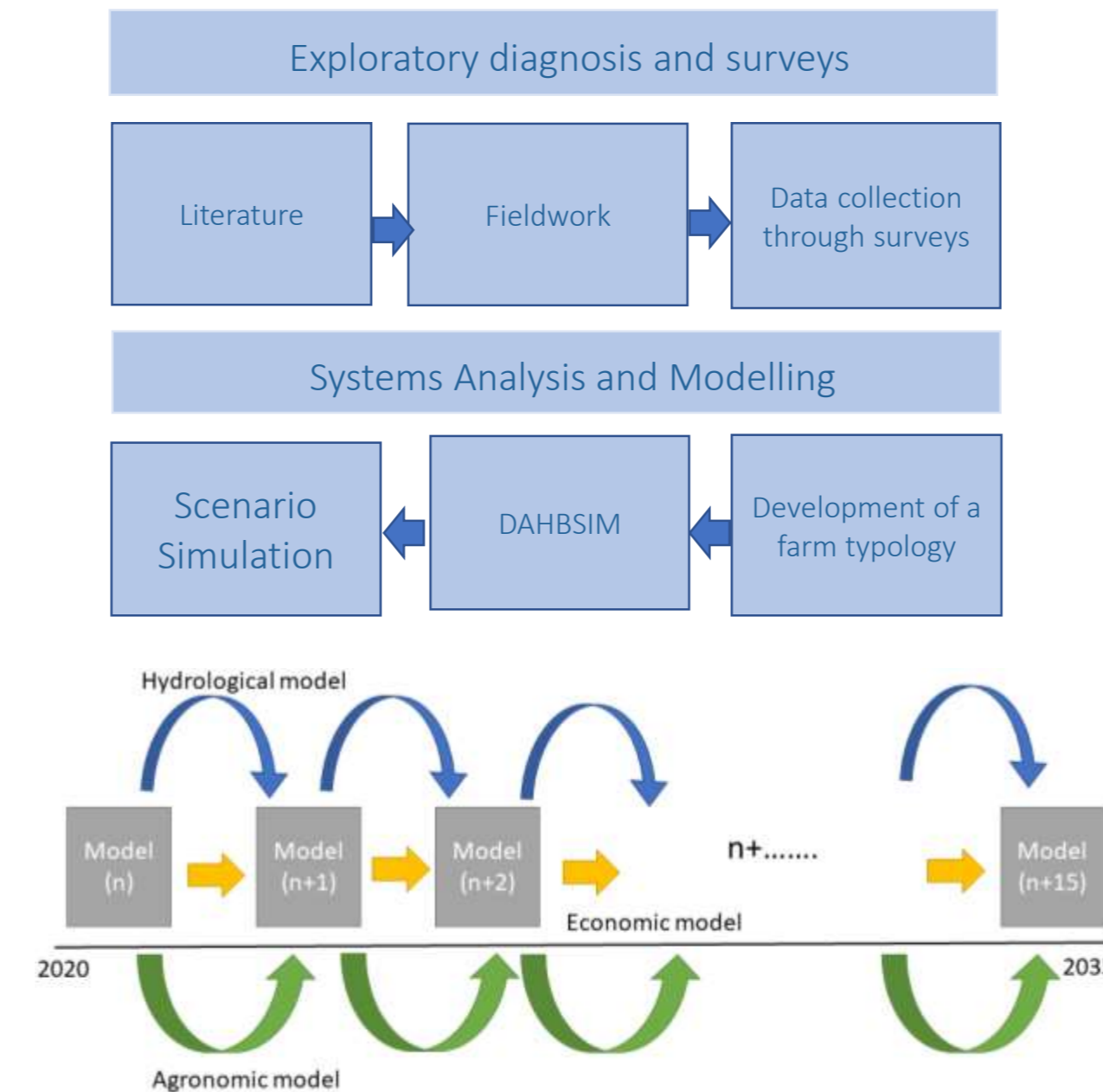
### Case study :

- South of the Atlas mountains
- Semi-arid to arid climate
- Average rainfall of 200 to 250 mm/y
- Quasi-absence of surface water
- Importance of groundwater resources
- Water consuming activities



## Methodology

Our approach, to analyze the resilience of farmers, focuses on the household level where the main decision-making is taking place.



In order to study the resilience of agricultural farms in the Souss Massa region (Morocco), we used DAHBSIM bio-economic model (Komarek et al. 2017). It is based on mathematical programming methods and maximizes the expected utility of household income.

## Results

We identified 3 farm-types in the area; intensive production system based mainly on vegetables, semi-intensive cereal monoculture households and one perennial crops.

**Table 1** : Farm income and pumping costs

	Indicator	Scenario of reference (Sc_REF) 2020	Business As Usual (BAU) (2035)	Average annual cost of degradation	Cost of degradation Sc_REF - BAU
Water cost(dh/ m3)	26.57	61.93	40.85	43.7	6,536,000,000
Pumping costs (dh/m)	1827.53	2268.65	388.01	441.12	-
Farm incom (dh/farm)	34243.87	26871.14	3686.36	7372.73	112,433,980

**Table 1** : Income variation with precipitation after simulation

Intensification level	Crop	Income (Decrease or stable Dh/ha)
Intensive (Type 1)	Vegetables	- 2777,95
Semi-intensive(Type 2)	Cereal monoculture	- 980
Extensive (Type 3)	Perennial	+2050

**References** : Bouchaou et al., 2011/ Hssaisoune et al., 2020/ Komarek et al., 2017 / El Ansari et al., 2020/ Malki et al., 2017