Problematic and Risks of Agricultural Activity in Fragile Environments Case of the Administrative Territory of Mila Province, Northeast Algeria

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Abstract

This study examines the approach of two contradictions in agricultural activity. The former is between the imperativeness of using agricultural technology as a necessity to overcome natural obstacles and secure the increasing food needs. The latter is, however, between the imperativeness of protecting natural resources as a guarantee for global and sustainable development. This is through investigating the effects and manifestations of environmental degradation in the administrative region of the province of Mila, which turned out to be an excellent agricultural field with considerable agricultural areas and enormous water resources. However, it poses the problem of exploiting these natural resources due to terrain obstruction and climatic conditions. Diagnosis and exploitation of available natural resources, agricultural activities, practice, and inputs of agricultural technology used in production enabled us to record several observations on the threats to fragile agricultural and ecosystems. Through field research and treatment of physical and chemical analyzes of surface water in three different areas of study, it turns out that the latter know several aspects of environmental degradation, including water and soil pollution, biodiversity degradation, groundwater depletion, in addition to soil erosion and its contribution to the mudding of the largest dam in Algeria.

Key words: agricultural activity, agricultural technology, fragile environment, environmental degradation, soil degradation, sustainable agricultural development

Introduction

Researchers , who adopt a scientific perspective , are forced to stand at the outputs of the effort exerted by the Algerian state in the agricultural and rural sectors, embodied in the application of successive agricultural and rural policies since the beginning of the third millennium in order to achieve food security and promote the national economy on the one hand, and to achieve regional balance and social justice on the other from the environmental side and their repercussions on the economic and social aspects. In light of the development of the relationship between man and his environment which became mutually in the influence and Impact after using agricultural technology classified by Ashraf (2019) into five main groups: mechanical technology, biotechnology, chemical technology, infrastructure technology and finally regulatory technology. He also stressed that their use would increase the quantity and quality of agricultural and attains highest level of quantitative and qualitative satisfaction of humans.

While other experts recommend the use of agricultural technology as a necessity to go beyond natural determinism, Whether due to constraints that impede the easy and proper exploitation of natural resources as a terrain barrier, or because of limited natural resources just as Gintaras (2016) stated.

Other experts warn against the Dangers of relying on methods and technologies for improving agricultural productivity without taking into account the principles of achieving sustainable development. These dangers consist in the degradation of soils and the death of living things caused by the chemical technologies, thus an imbalance in the ecosystem including the cultivated area (Savci, 2012; Rainer, et al., 2019). Moreover, Air pollution and soil loss generated by the mechanical technology due to faulty and repeated plowing which stimulates the erosion (Kern et al., 1993), and heavy watering leading to the soil salinity (Zalidis et al., 2002). Finally, current and future risks arising from the use of Antibiotic Use in Agriculture and Its Impact on the Terrestrial Environment and the resulting genetic leakage (gene flow) put the biodiversity on the line (Kumar et al., 2005).

Jean-Luc et al., (1999) asserted that citizens in France are rejecting some options of agricultural production techniques; especially those do not guarantee both quality and safety.

FAO (2011) declared that over the last half century, intensive input-based agriculture has increased global food production and average food consumption per person. However, this process has depleted the natural resources of many agricultural ecosystems, posing a threat to future productivity and an increase in greenhouse gases that cause climate change.

Considering this variation in the influence and Impact of these agricultural inputs and cultivated environments, we discussed this study in the context of examining the contradictions between the inevitability of using agricultural technology as a necessity to overcome natural obstacles and secure the increasing food needs, and the imperative of protecting natural resources as a guarantee for inclusive and sustainable development, by trying to answer the following questions: Is this variation in the influence and Impact caused by variation in the characteristics of agricultural ecosystems? Or is it caused by the type and quantity of inputs of agricultural technology?

Our selection of the administrative province of Mila as a sample of our study was motivated by the diversity of its relief units and highlighting the geomorphologic impediment of northern Algeria, the fact that it represents a problem of the deterioration in the physical environment (the density of rills and gullies, Sliding soil, Water erosion), the depletion of its natural resources due to wrong agricultural practices and stimulating natural barriers , as well as being a vital media (Beni Haroun Dam1000 Hm^3, Hamam Grouz Dam 45 Hm^3) which should be protected from environmental risks whose consequences may be of regional aspects.

1. Materials and Methods

To answer the problem, we discuss three main axes in this study:

1.1. Diagnose the natural resources available for agricultural exploitation

1.1.1. Tools and data used

Topographic map of Sidi Marouane and Sidi Driss 1/50000, Topographic map of Constantine 1/200000, Geological map of Constantine 1/50000, Land Occupation map 1/150000, Map of dry months (Moubarki, 2005), Digital elevation models (DEM), Notes Field search, Geographic Information Systems.

1.1.2. Methodology

- Create and analyze of DEM to identify homogeneous zones, and to identify homogeneous subzones.
- Extract of the natural and physical characteristics of homogeneous subzones after matching several maps; classify them according to the cohesion of the land into four categories, as shown in Table 1.
- To deduce the region's agricultural capacity in terms of natural resources and the extent to which it can be exploited in agricultural activity.

Table 1. *Indicators of sensitivity of the medium*

		Stable	Moderately Stable	Unstable	Fragile
Indicators	**Slope (%)**	0-3	3-12,5	12,5-25	>25
	Lithology	Gneiss+ Dolomite+ Sandstone	Clay	Quaternary Formations	Marl+ Gypsum
	Pluviometry (mm/y)	500-700	700-800	800-1000	>1000 / <500
	Land Occupation	Forests+ Fruit trees+ protection trees	Pastures+ Miscellaneous crops	Large-Scale	Undeveloped Land

1.2. Diagnosis of agricultural activities practiced and their risks to the environment

1.2.1. Tools and data used

Data and statistics of the Directorate of Agricultural Services (DAS) for the agricultural season 2010/2017, Directorate of Water Resources (DWR) 2008/2017, National Water Resources Agency (NWRA) 2007/2017, National Agency of Dams (NAD) 2014, Forestry Governorate(FG).5th General Census of Population and Housing (RGPH) 2008, N°537/43.National Water Plan (NWP), carried out by the Ministry of Water Resources in 2005.The information and observations collected during the field outputs of farms and agricultural investors.

1.2.2. Methodology

After the collection and processing of statistical data were analyzed according to the inductive approach, where the risk of agricultural activity was evaluated by simulating the methodology of agricultural environmental indicators (AEI), the aim of AEI approaches is to characterise the environmental impact of a farming system from a set of indicators (Payraudeau and van der Werf, 2005).

1.3.Highlighting the environmental impact of agricultural activity and its economic and social dimensions

- Surface water pollution**:** by tracking the evolution of the concentrations of Oxydable Organic Matter (OOM), nitrogenous material (NM), Phosphorus Material (PM),for water from Beni Haroun Dam(BHD), Ouad Endja Valley(OEV), Hammam Grouz Dam(HGD), and based on the quality standards set by the World Health Organization (WHO, 1994), we classified water quality into four categories.

- Groundwater depletion: by analysing the statistics of the Directorate of Water Resources and field research.
- Biodiversity: By linking some evidence with scientific facts and analysis of water and soil quality, in addition to the results of field investigation and comparison with the results of previous studies.
- Soil degradation: based on the analysis of the values of studies that have been studied and evidence from the field and linked to the subject of our study.
- Dam miring: Based on the results of measurements of studies of the BHD and the HGD (The Detailed Project Study (DPS) was conducted from 1983 to 1986 by an American study 'HARZA Engineering Company, U.S.A.').

2. Results and Discussion

2.1. Location, nature and relief

The study area is astronomically between two longitudes (06 ° and 34 minutes) and (05° and 45 minutes) east of the Greenwich line, and between two latitudes (36 ° and 37 minutes) and (36 ° and 53 minutes).

Geographically, it is located in the north-eastern part of Algeria, limited by the Numidian chain from the northeast and the Atlas series from the northwest, and the Upper Plains of Constantine from the south and southwest, make up the most important part of the large hydrographic basin of Kebir Rhumel No. 10, it includes the Babur Basin No. 03 in the far north and the Basin of the Constantine Plains No. 07 in the south.

Administratively, it is bordered by the wilayas of Skikda and Constantine on the north-east and Jijel on the north-west, bordering Oum el Bouaghi on the southeast, Setif on the southwest and Batna on the south (Figure1).

Its longitudinal extension over a distance of more than 80 km from the Atlas chain that follows north to the upper plains south highlights the topographic and climatic diversity of this area, Through the DEM Analysis, three homogeneous zones and 16 Homogeneous subzones (Figure 2a+2b) were identified :

- **Northern zones**: high mountain range.
- **Central zones**: internal plains, hills, and slopes of mountains.
- **Southern zones**: upper plains group.

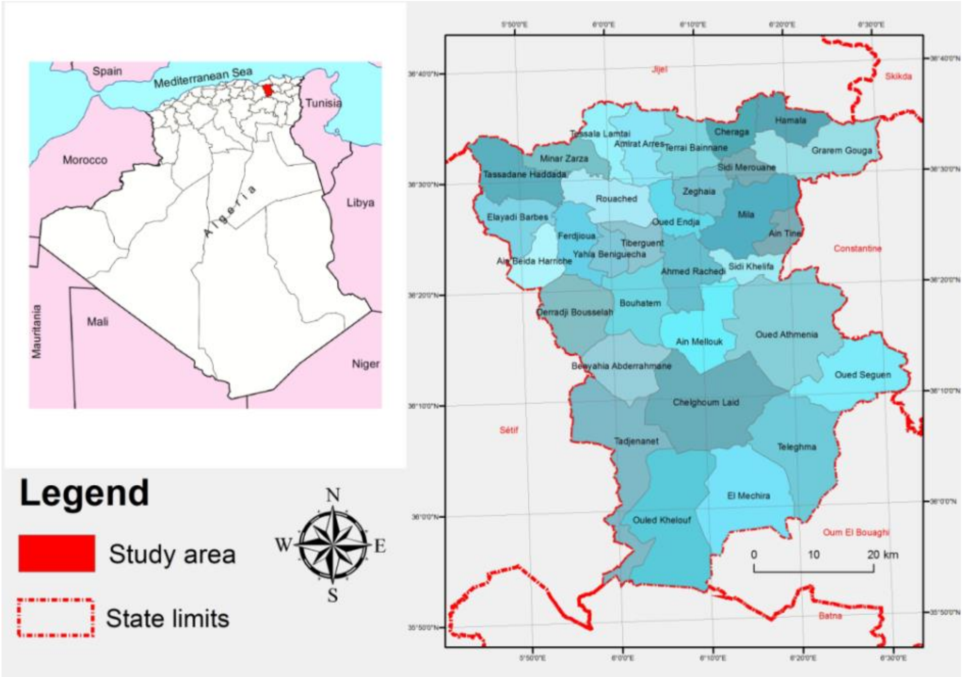

Figure 1. *Location of the study area*

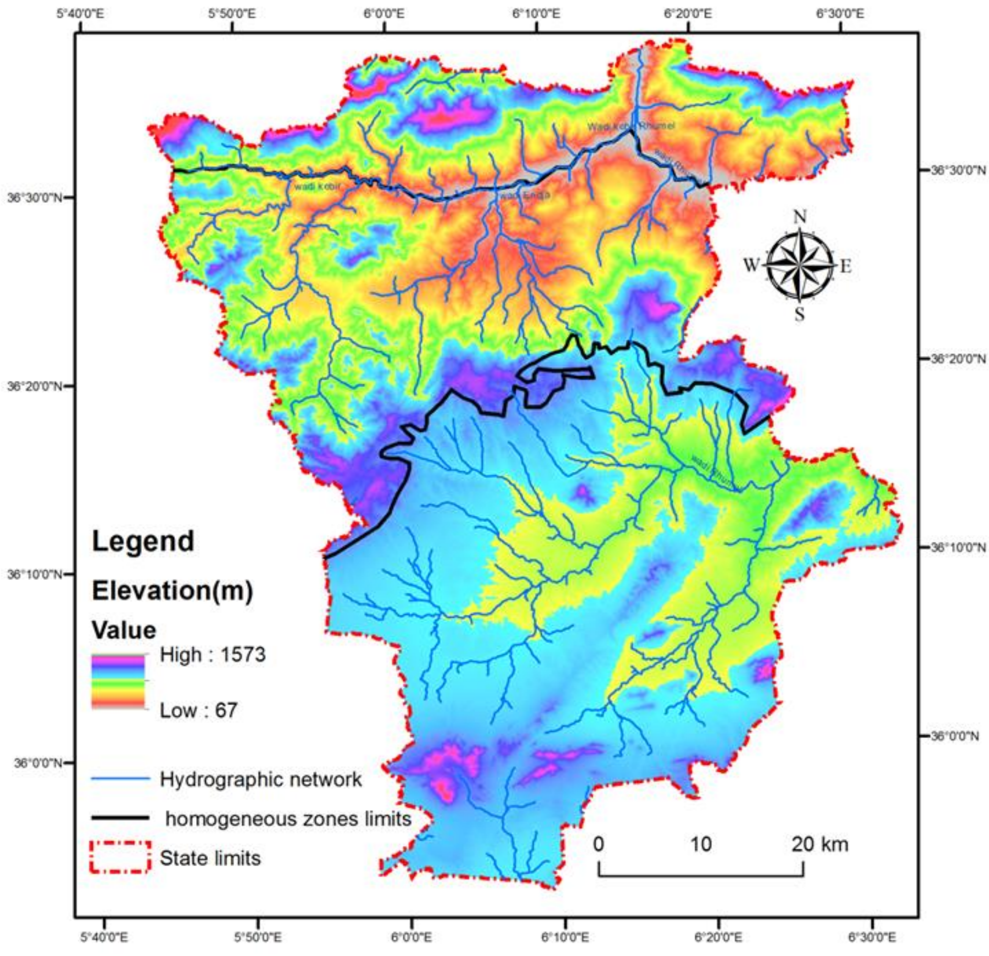

Figure 2a. *Elevation map and hydrographic grid*

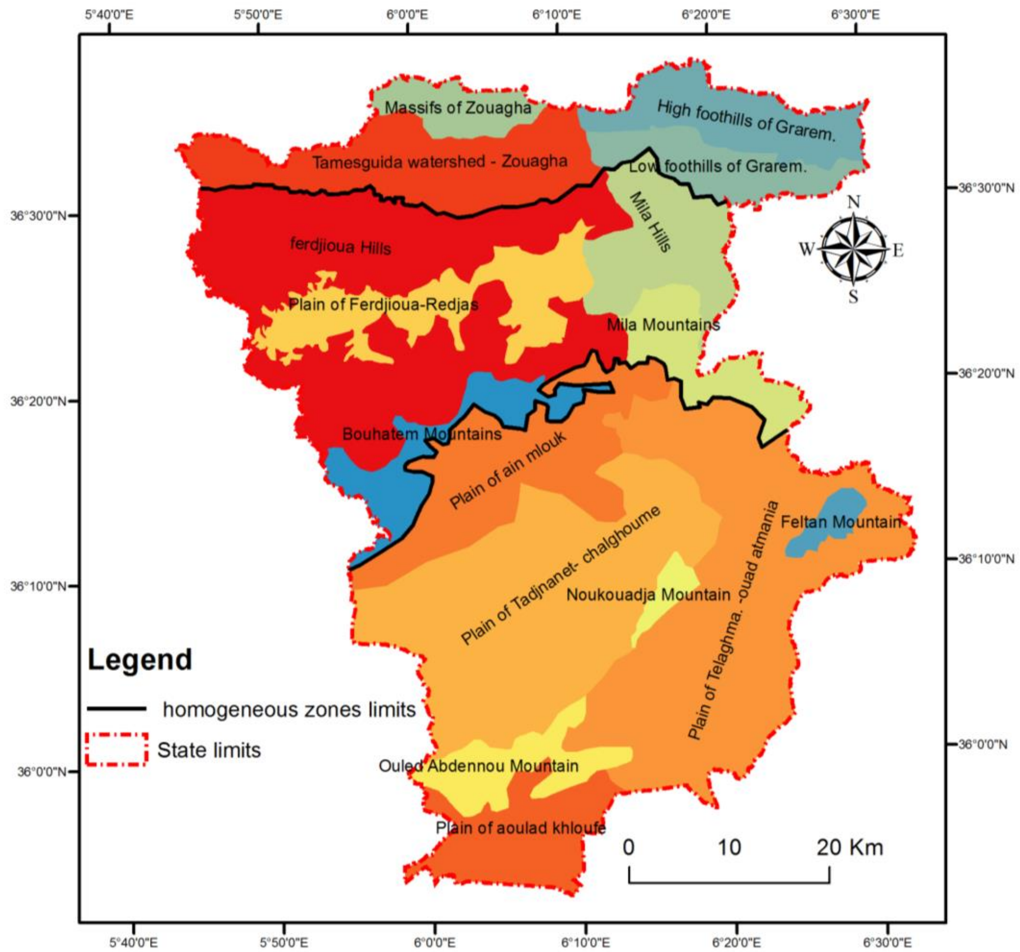

Figure 2b. *Borders of homogeneous zones and sub-homogeneous zones*

2.2. Available natural resources and possibilities of exploitation

2.2.1. Farmland

The study area covers an area of 348045 ha, of which 275,957 ha of arable land is equivalent to 79.28%, and 39,788 ha of forest land equivalent to 11.43% according to DAS 2017, Matching Figure 3 with available maps and field output observations, enabled us to identify The natural and physical characteristics of homogeneous subzones and their classification according to the soil stability into four categories as shown in Table 2 and Figure 3, and record the following results:

- 54.37% of the land is fragile and unstable, dominated by soft formations such as Marne and fourth time formations, in addition to clay formations, sandstone, conglomerate, etc. Its exploitation generates the processes of water erosion, slipping and grooving of the soil.
- 45.63% of the agricultural land is stable and of high quality, mostly located in the southern zone where the average rainfall does not exceed 500 mm annually and this limits the possibility of agricultural exploitation, and imposes the use of agricultural technology to overcome the climatic impediment.
- 74% of the territory of the northern zone with slopes of more than 25%, a mountainous populated area with very difficult social and economic conditions, which imposes the practice of agricultural activity.
- Only 1% of the land in the northern zone allows agricultural intensification.

- 38% of the central zone with steep slopes of more than 25% impedes the use of mechanical technology.
- Only 20% of the territory of the central zone allows the practice of agricultural intensification.
- 87% of the southern zone is suitable for agricultural intensification.
- The slopes of the central and northern zones drain all rainwater into the valleys, thus it cannot be utilized during the drought period.

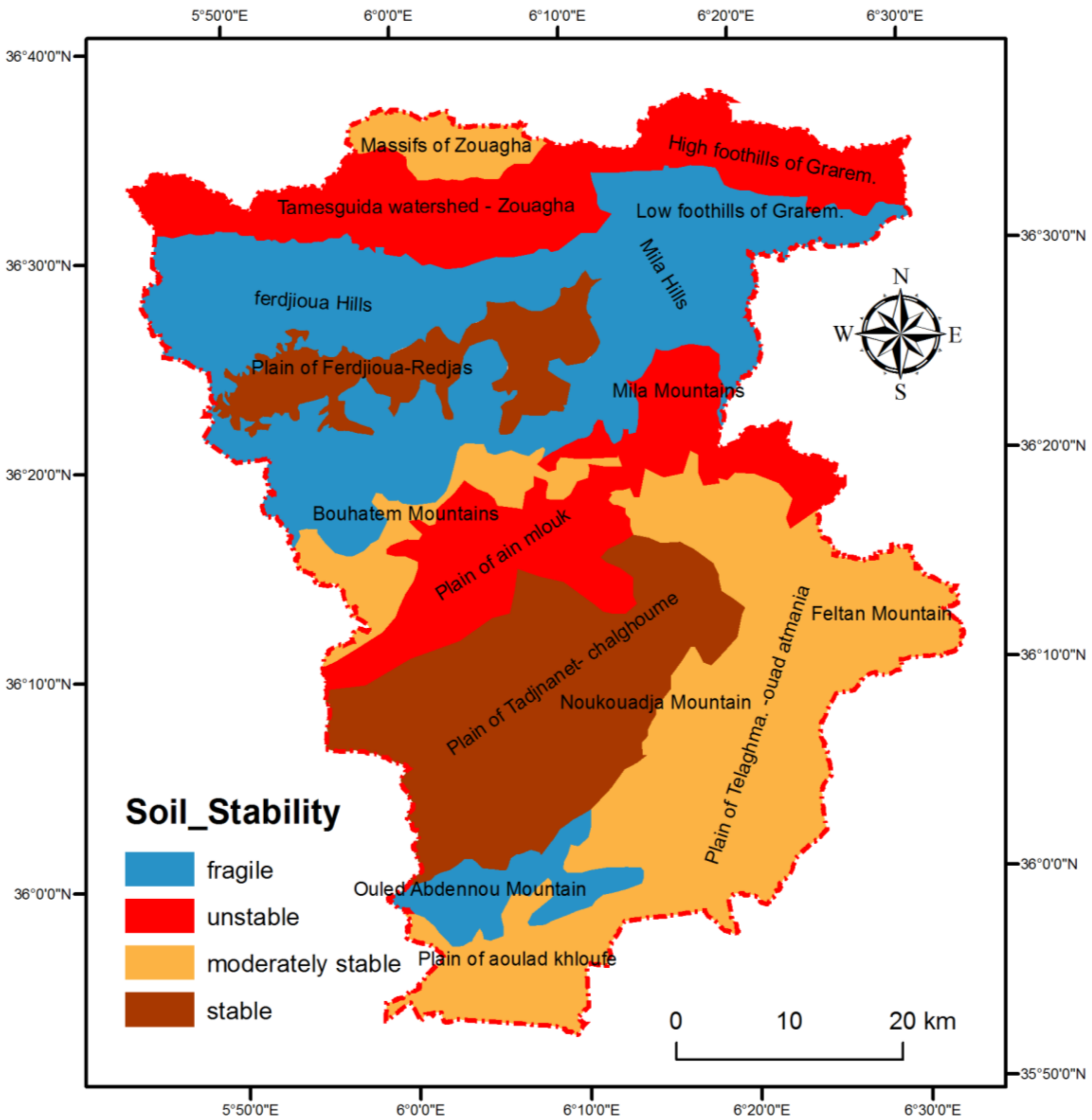

Figure 3. *Soil Stability*

Table 2. *Summary of characteristics and potentialities by homogeneous subzones*

		Homogeneous subzones	Area (Ha)	Slope (%)	Lithology	Climate Pluviometry (mm/y)	Land Occupation	Soil Stability
homogeneous zones	Northern zone	Massifs of Zouagha	6887	> 25	Gneiss+ Sandstone	Cool, Humid >1000 4 Months of Dryness	Forests + Mountain Pastures	Moderately Stable
		Tamesguida watershed - Zouagha	25736	> 25	Conglomerate+ Dolomite + Marl	Cool, Humid >800 4,5 Months of Dryness	Forests + Pastures+ Mountain Agriculture	Unstable
		High foothills of Grarem.	14668	12,5-25 > 25	Dolomite+ Marl+ Gypsum		Forests + Pastures+ Mountain Agriculture	Unstable
		Low foothills of Grarem.	10736	3-25	Marl+Clay+ Gypsum		Large-scale Agriculture+ Irrigated Agriculture	Fragile
	Central zone	Mila Hills	16330	3-25	Marl+Clay+ Gypsum	Sub-humid 500-800 5 Months of Dryness	Large-Scale Agriculture+ Pastures	Fragile
		Mila Mountains	11027	12,5-25 > 25	Marl+ Gypsum		Traditional Farming+ Pastures	Unstable
		Plain of Ferdjioua-Redjas	18397	0-3	Quaternary Formations+ Marl		Intensive Farming	Stable
		Ferdjioua Hills	61993	12,5-25 > 25	Marl+ Gypsum+ Dolomite		Large-scale Agriculture	Fragile
		Bouhatem Mountains	11407	> 25	Marl+ Clay+ Gypsum		Pastures	Moderately Stable
	Southern zone	Plain of Ain Mlouk	26381	3-25	Quaternary Formations+ Clay		Large-scale Agriculture	Unstable
		Plain of Telaghma. -Ouad Atmania	61859	0-3	Quaternary Formations+ Gypsum	Semi-arid 300-500 6 Months of Dryness	Intensive Farming+ Large-scale Agriculture	Moderately Stable
		Plain of Tadjnanet-Chalghoume	55744	0-3	Quaternary Formations+ Gypsum+Marl		Intensive Farming+ Large-scale Agriculture	Stable
		Plain of Aoulad khloufe	15121	0-3	Quaternary Formations		Intensive Farming+ Large-scale Agriculture	Moderately Stable
		Feltan Mountain	2588	12,5-25 > 25	Marl+ Gypsum		Traditional Farming+ Forests	Moderately Stable
		Noukouadja Mountain	2172	12,5-25	Gypsum+ Hard Dolomite		Forests + Pastures	Moderately Stable
		Ouled Abdennou Mountain	9757	12,5-25 > 25	Alluvium, Sand, Limestone + Hard Dolomites.		Forests + Undeveloped Land	Fragile

2.2.2. Water resources

Given that the location of the study area is within the most important part of the hydrographic basin kebir Rhumel, It is considered to be a large water reservoir because of the flows and the nature of its geological storage, a catalyst to expand the agricultural area and the practice of agricultural intensification in the flat southern zone. Table 3 represents the volume of water resources available in the state.

Table 3. *The volume of water resources available for exploitation in agricultural and social development.*

Water Resources		Place	volume of Water(Hm3)	Uses	Supply
Superficial	dam of Beni Haroun	Central zones	1000	Drinking	Six neighboring states
				Irrigation	irrigation perimeter of teleghma
	Dam of Hammam-Grouz	Southern zones	45	Drinking	States of Constantine
				Irrigation	States of Mila
	Dam of Sidi Khalifa	Central zones	70	Reserve reservoir for the dam of Beni Haroun	
Groundwater	929 Wells 306 Deep Well	Central zones +Southern zones	45,79	Irrigation	Agricultural lands in the central and southern zones
Water Barrages	4 Water Barrages	Central zones	1,53	Irrigation	Agricultural lands in the central zones
Natural Sources	-	Northern zones+ Central zones	10,67	Drinking+ Irrigation	-

Despite this important amount of water exceeding 1000 hm^3, the possibility of exploitation remains the biggest obstacle for farmers for several reasons, including:

- The absence of large-scale watering systems has complicated the exploitation of reclaimed surface water in the BHD and the irrigation of large agricultural areas in the southern zone.
- Teleghama irrigation perimeter, which came into service in 2018 an area of 4447 ha, is currently directed only to supplementary watering of cereals.
- Competition for water by industry and household items, where the three dams of the state are part of the system of diverting water from the BHD to several states in the northeast and the upper hills.
- The water of HGD located in the southern zone is intended to supply the province of Constantine with drinking water, in addition to being exposed several times to pollution in 2013, 2014 and 2017.
- Non-renewable groundwater resources and over-exploitation put them at risk of depletion.
- Surface water is susceptible to contamination by wastewater and industrial wastes, considering the source of the important valleys “Wadi Kebir” originating from the

governorate of Setif, “Wadi Rhumel” which originates from the Ferdjioua mountains and passes through Constantine before flowing into the BHD (Mebarki, 2000); Thus, the exploitation of watercourses in irrigation during the scarcity period poses a threat to the ecosystem.

2.3. Practiced agricultural activities and their risks to the environment

The statistics of RGPH 2008 classified Mila as rural considering its rural population, which represents 57.16% of its total population. 25 Of the 32 municipalities are rural with agricultural activities dominated by agriculture and animal husbandry.

The population density is concentrated in the north with 246 inhabitants / km^2, 219 inhabitants / km^2 in the center and 77 inhabitants / km^2 in the south. This heterogeneous distribution of the population and the difficult socio-economic conditions that impose the exploitation of all agricultural areas require an examination of the agricultural practices nature, their distribution, as well as the techniques used in production in order to identify their risks to the environment.

2.3.1. Type and size of agricultural investments

Approximately 90% of the total arable area is exploited by 17158 agricultural investors of varying sizes and means of production, including:

- 86% of private sector investors, with small properties of less than 5 h; the family inherited from the ancestors and its production system horticulture, especially concentrated in mountains foothills situated in both the northern and central zone.
- 12% of individual and collective agricultural investments, an ancient pattern of exploitation of state-owned land under the policy of restructuring socialist farms in 1987; Individual agricultural investments are prevailing in the central zone with an average of 9h on the farm, and collective investments in the southern zone with an average of 117 h.
- 2% of the investments of reclamation through concession, a new pattern for the exploitation of state -owned land within the framework of the National Plan for Agricultural Development, concentrated especially in the northern mountainous zone.
- 10 model farms their functions are to modernize, to develop agricultural production, to produce seeds and to provide agricultural outreach.

The remaining 10% of the arable land represents agricultural areas without ownership titles (sub-tribes' lands) and their unregulated exploitation. This disparity in the pattern, size, and distribution of agricultural investments was imposed primarily by natural conditions namely the terrain and the climate, In addition to the land ownership system and the social conditions of the mountain population. As stated in the Agriculture Directorate statistics 2010, 16579 different sized and heterogeneous farms were registered. The classification of these farms into five categories based on the size criterion enabled us to compare the number of these farms and the total area which occupied by each category with the number and the total area of all the farms (table 4), and to put the following observations on record:

Table 4. *Classifying farms into categories of different sizes, according to 2010 statistics.*

Size of farm (Ha)	< 5	5-10	10-20	20-30	30-40	≥ 50	Total
Number of farms	7512	3529	2617	1111	829	981	16579
%	45	21	16	7	5	6	100
Area of farms (Ha)	18000	33940	75034	29252	22891	115185	294304
%	6	12	25	10	8	39	100

- 45% of the farms under 5 h represent only 6% of the total farms' area, mostly private property in the northern mountainous zone where the inhabitant's harsh social conditions making them exploit their small properties throughout the seasons in order to achieve Self-sufficiency, however, this intensive exploitation contributes to the depletion of limited natural resources, and frequent soil flipping causes water erosion and thus degrades agricultural land.
- 6% of the farms exceed 50 h, representing 39% of the total area of farms, including 3% collective agricultural investments in the southern zone, where appropriate terrain and soil quality allow the practice of agricultural intensification. However, the absence of large irrigation systems forces the practice of rainfed agriculture. This is the only type of cultivation that can impoverish soil fertility and expose it to the risk of erosion and desertification. In addition to economic and social risks in the event of deterioration of production, either due to climatic conditions or because of diseases and epidemics known to this type of agriculture.
- 49% of the medium-sized farms (5 - 40 h), occupying 55% of the total area of farms and distributed in the central and southern zones on the finest agricultural land, play a pivotal role in raising and developing agricultural production in several divisions such as cereals, garlic, and milk, but the special and individual style of these investments, the liberal-oriented agricultural policy adopted by the Algerian state, is mortgaging this development in future production. Considering that the peasant has complete freedom to run his land according to the Islamic Sharia system (the right of inheritance and intercession) which results in divisions and fragmentation each time until they become small property does not allow the introduction of mechanical technology (Bassoud, 2003).
- Expanding the agricultural area in the northern mountainous areas by rehabilitation and granting semi-forest land under the concession law leads to a reduction of grazing area and thus discourages animal husbandry. Moreover, a change in the nature of the ecosystems of these lands causes an environmental imbalance.
- The freedom granted to peasants in their agricultural investments makes some of them use irrational means and techniques that would have very serious environmental repercussions; the field research revealed that some peasants use valleys for irrigation without control, in addition to the use of poultry residues as fertilizers in a floodplain near the Lake of the BHD.

2.3.2. Crop agricultural pattern

The cultivation of cereals accounts for almost half of the agricultural area used during the 2016-2017 season 237557 ha. Fodder, fruit trees, vegetables and dry legumes did not exceed one fifth of the remaining area used as natural pastures.

Cereal cultivation is concentrated mainly in the central zone with semi-humid and in the Southern zone with semi-arid climates, and in small areas in the humid northern zone, which is predominantly fruitful in addition to various subsistence agricultures in the form of gardens imposed by difficult economic and social conditions. Although this distribution is imposed by the relief nature and climatic conditions prevailing in the zone, the continuation of this exploitation would prevent the possibility of achieving sustainable agricultural development for the following reasons:

- Dependence on large-scale cereal cultivation, although this is a national priority strategy, it is Rainfed agriculture in the absence of a large irrigation system; Thus, Its fluctuating returns due to drought or epidemics do not ensure that the increasing demand of the population is met creating economic and social risks.
- Frequent plowing in the cultivation of cereals in the central zone stimulates the erosion processes and consequently the deterioration of the natural environment, in addition to the risk of contamination with pesticide residues used in the treatment of diseases that affect this product every year.
- The reduction of vegetables cultivation area and dry legumes in very narrow areas compared to the area of cereals , leads to production limitation ; Thus the failure of the wilaya of Mila in agricultural tasks Assigned to it in these divisions with wide consumption and high monetary value.

2.3.3. Watering technique and water sources

The percentage of irrigated area for the agricultural season (2016-2017) 5.61% of the total agricultural area used (Figure 4), which means that rainfed agriculture depends on rainwater, although it will expand this season after the opening of an irrigation area in Teleghma to irrigate another 4447 hectares in the southern zone by adopting a large irrigation system and benefit from the water of the BHD. As illustrated by the values of Figure 4 and the investigated field outputs, the following observations are made:

- The agricultural sector has little access to the water of the BHD and the absence of large-scale irrigation systems forces farmers to seek water for irrigation and depend on waterways.
- 19.42% of the irrigated areas come from waterways. This is really dangerous for plants, animals and humans in the first place (Okubo et al., 2019), especially the period of scarcity where water is less and the concentration of pollutants increases.
- The large hydraulic area for irrigation in the vicinity of Teleghma in the southern zone represents only 1.87% of the total agricultural area used, making these lands vulnerable to depletion.
- 80% of the irrigated area adopts a Sprinkler irrigation system, while the irrigation system Drip only 1% of the irrigated area. This results in a waste of water, although the pattern of large-scale cultivation leads to it.

• 19% of irrigated area adopts surface irrigation system, which harms water consumption and stimulates water erosion.

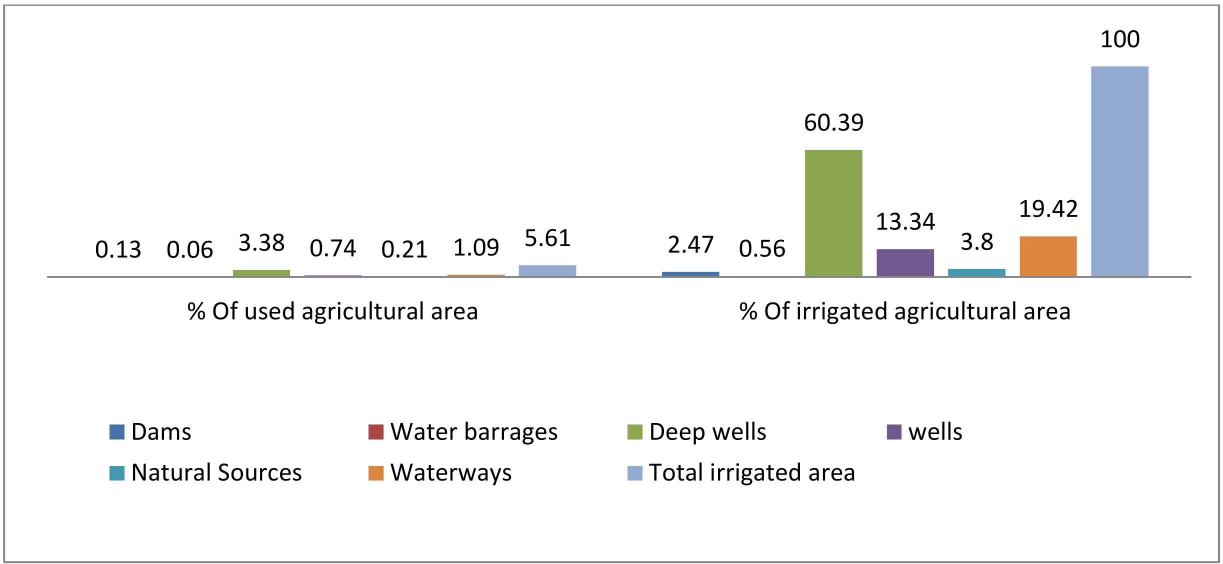

Figure 4. *Irrigated Area and Water Sources*

2.4. The environmental impact of agricultural activity and its economic and social dimensions

2.4.1. Water pollution:

Many water quality studies have found that this pollution is due to the deficit in the treatment of industrial wastewater, urban sanitation, As the Mebarki (2000) study concluded, but with the development of the use of chemical technology in agriculture (Figure 5), agricultural drainage has become a major contributor to the surface and underground water pollution (Skaggs, et al., 1994) where the residues of fertilizers, fungicides and insecticide contribute to changing the physical and chemical properties of water.

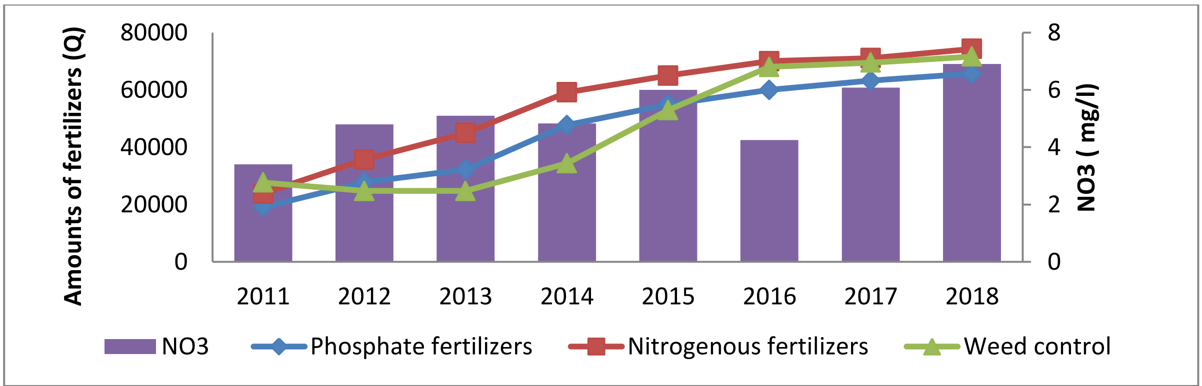

Figure 5. *Amounts of agricultural fertilizers used, and the temporal change of the average nitrate in the water of BHD*

The classification of surface water quality depends on the concentration of OOM, NM; PM (Table5) has enabled us to record the following results:

Table 5. *Assessment of water quality based on the double-entry evaluation network, one by quality classes and the other groups of alterations.*

Observation points	Different groups of alterations	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
OEV Code : 100252	OO.M	-	-	-								
	N.M	-	-	-								
	P.M	-	-	-								
HGD Code : 100315	OO.M											
	N.M											
	P.M											
BHD Code : 100620	OO.M											
	N.M											
	P.M											

Oxydable Organic Matter(OOM)= O_2diss or % Sat, MO, DCO, DBO5
Nitrogenous Matter(NM)= NH_4^+, NO_2-, NO_3-, NTK
Phosphorous Matter (PM)= PO_4^{3-} , P total
Category1 in blue: good quality, usable without conditions.
Category 2 green: moderate quality, the useof drinking requires simple treatment.
Category 3 in yellow: poor quality, whichrequires focused treatment, for industryand agriculture.
Category 4 in red: very poor quality, not usable until after very concentrated treatment.

- Very bad pollution of the HGD water, due to the high concentrations of OOM, and the significant concentrations of NM and PM. Rhumel valley is the main supplier of the HGD which stems from neighboring areas, and it crosses three municipalities (Tedjnanet, Chalghoum Laid, Ouad Athmania as certainly the cause of this severe pollution is the accumulation of pollutants from wastewater (urban, sanitary, agricultural) of the three regions, considering that the industrial activities in these areas are almost non-existent, and the increasing use of chemical fertilizers (nitrogen, phosphorus) and pesticides (insecticides, fungi), In addition to organic fertilizers (animal residues, plant residues) in these zones, It certainly contributes significantly to the occurrence of this contamination, and this is consistent with the findings of study the Aissaoui (2013).
- Very bad pollution of OEV water, due to the high concentrations of OOM, and the significant concentrations of NM and PM, In the absence of industrial activities in the region, we believe that the pollution resulting from the increasing use of chemical fertilizers and pesticides used to treat diseases affecting agricultural crops every year, In addition to organic fertilizers from animal residues and harvest residues used by farmers as a natural fertilizer.
- Very bad water pollution of the BHD during the years (2010-2013); This is due to the pollution of the water valleys leading to the dam, Especially Wadi Endja and Wadi Rhumel Which passes on the neighboring areas, which witness a high population density and industrial activity and large agricultural.
- The water quality of the BHD has improved in recent years in terms of OOM and PM. We believe this is due to two reasons: One is that Wadi Rhumel water is being treated in several stations to improve its quality before it flows into the Lake of BHD, This corresponds to the Kerdoun (2016) study, The second is to reduce the concentrations of pollutants of Wadi

Endja and Wadi Rhumel when they meet the good quality water of Wadi Kebir. And the formation of wadi kebir Rhumel which forms the Lake of the BHD.

- In addition to industrial drainage, urban and health, agricultural drainage exacerbates the dilemma of pollution of the surface water of the Kebir Rhumel basin, And Loss of her quality that allows multiple uses, This would lead to an ecological imbalance in the area, As water is a vital element, it is necessary to take preventive measures and to allocate huge additional costs to treat and improve water quality.

2.4.2. Groundwater depletion

Unlike massive surface water resources, groundwater resources are weak at the state level, Estimated at only 45.79 Hm3 (DWR, 2018), it is Identified by the NAD 2006 study at 32 Hm3, The data of NWRA 2017 (Table 6) highlights lack of available groundwater resources for exploitation and the deficit in covering the actual needs of the population in the central zone.

Table 6. *A comparison between potential groundwater resources and the actual needs of the population in several regions.*

Regions	Resources potential (hm^3)	Actual needs (hm^3)	Resources available (hm^3)
Wadi Kebir	31.1	18.7	12.4
Wadi Endja	1.1	6.1	-5
Plain of Ferdjioua	1	6	-5.3

According to the data of DWR 2018, the number of wells used in agricultural activity reached is 929Well from 841 wells in 2014, Most of them are in the Upper Plains and according to field research, farmers in the region have assured us that the water level has dropped significantly in recent years. Which led them to dig an additional 50 meters to exceed the depth of 200 meters, after it was between 100-150 meters, Considering the number of wells used in industry and services, which reached only 61 wells in 2018, The groundwater depletion is certainly caused by excessive agricultural use.

The depletion of groundwater does not only mean additional costs for its extraction, It means that they are at risk of depletion which leads to the decline of vital and economic production in the region under the influence of the semi-arid climate factor (Berbel et al., 2018), This reflects negatively on the human factor and exacerbates the problems of unemployment and rural migration (Siebert et al., 2010).

2.4.3. Biodiversity

The BHD and HGD have known the phenomenon of fish mortality from the type of *Krasan*, especially in 2013, coinciding with the emergence of plankton with large areas surfacing, and the release of unpleasant odors, these are the consequences of eutrophication (Dovonou, et al., 2011; El Ghachtoul, et al., 2005; Horppila, et al., 2019). The residents of neighboring areas attributed this phenomenon to agricultural activity and considering the areas where fish mortalities occurred they were only meters away from fields with intensive irrigation and chemical technology, In addition to the practice of raising poultry in modified greenhouses near valleys pouring into the BHD, Kherief et al. (2018) confirmed that phytoplankton in the lake of BHD releases *cyanobacteria* with *neurotoxins*, Endangering fish and animal life and human health through the food chain.

On 04/07/2019, the public health services of the state announced that citizens from Rouached and Amirat Arres municipalities were infected with *malta fever* after consumption of cow's milk and goats Without censorship, As the two areas overlook the Lake BHD and This period coincided with a shortage of valleys throughput and increased concentrations of pollutants, we believe that the cause of the disease is the germs carried by contaminated water.

Potato crops in the region have been exposed to dangerous *aphids* in recent years. According to a recent study by Aqueel et al., (2014), it confirmed that nitrogen-fertilized crops are an ideal environment for the breeding of this dangerous insect, and the proliferation of other harmful insects that feed on this *aphids* .This leads to disruption of food chain, and we believe that the spread of this insect is due to the increasing use of nitrogen fertilizers.

In an interview with the inhabitants of the northern zone, they asserted that the production of fruit trees has declined over the last ten years, and that fruit trees have become known from time to time serious diseases, which sometimes led to their loss. Especially *olive trees*, *vineyards* and *figs*, although most of them attributed the reason to the irregular rainfall, winds and the spread of diseases, we think that this is related to other reasons, including:

- The ecosystem of the BHD and HGD, in addition to the earthen dam reservoir of the BHD and the water barriers that contributed to changing the climate in the region to more humid; This explains the number and type of migratory waterbirds that have taken the path of the BHD for their commute, The winter inventory of migratory birds in 2017 was counted by the FG of Mila, 17401 birds. Among them are 12 new species in significant numbers, most notably the bird *fulligule nyroca* with a White neck and internationally protected, Its number is decreasing across the world, And Its significant presence of 348 birds enhances the region's fortunes to be classified as a wetland area under the 1971 Ramsar Convention.
- Use of biotechnology to plant fruit seedlings of exotic species in the region; In particular, *olive* tree seedlings, which were obtained by people in mountainous areas as part of agricultural support programs, and programs to protect the BHD from mud, which were supervised by the FG of Mila. In 2016, the area of fruit trees under agricultural support reached 7538.5 h. The area of protection trees is 6369 h, however, the yield is weak and we believe that these varieties do not suit the prevailing climate in the northern region.

2.4.4. Degradation and contraction of agricultural land

The diversity of the terrain and climate, and the different agricultural activities practiced between the north and south of the field of study, gave different manifestations and forms highlighting the degradation of agricultural lands such as water erosion, soil pollution, shrinking agricultural areas.

In terms of water erosion, or what is known as the erosion of the earth's surface and soil erosion caused by water, especially in the northern and central zones where the regression factor meets with the climate factor and the density of agricultural activity, And take several forms, Including diffuse runoff, Erosion by gully, Superficial slides, Sure, that Faulty tillage operations And Soil stirring using mechanical technology has a role in Decreasing the cohesion of the surface layer of slopes and hills And stimulate the dynamics of water erosion, which leads to the impoverishment of soil of organic and micro-materials, thus shrinking agricultural areas and declining quality, This corresponds to the Rotimi (2019)study.

In terms of soil contamination, Bouaroudj et al. (2018) indicated that watering on the shores of the BHD affects the physical and chemical properties of the soil, some samples had an excessive content of chloride bicarbonate and a high level of electrical conductivity in 39% of the study samples, leading to loss of quality productivity.

As a result of the 2006 Rural Renewal Policy, then the policy of agricultural and rural renewal in 2009, And embodied by the integrated rural development projects, Mainly rural housing, reducing agricultural areas in mountainous areas where small properties are exploited in gardening activities, resulting in the latter's decline.

2.4.5. Muddy dams

In addition to water erosion that reduces Agricultural area, the Surface materials and plankton swept by the flow of watercourses and valleys threaten the quality and quantity of water of the BHD and HGD, Mebarki (1982) estimated the Specific degradation in Athmenia Valley for the month of April in 1979 at 1.2 tons / km^2, and 17.9 tons / km^2 in Graram and 67.8 tons / km^2 in Tassadane, The NWP (2005) study also indicated that HGD is known as 0.6% of the mud per year.

The bathymetric campaign conducted by NAD (2014) recorded 83 hm^3 volume of silt deposits at BHD, That is, a sedimentation rate of 8.3 hm^3 / year, and the specific degradation was estimated at 1728 ton / km^2.

Compared with the results of study the DPS (1983-1986) that preceded the completion of the BHD, we concluded that the specific degradation is estimated at 1205 tons / km^2, This indicates an increase in the volume of sediment flow and plankton, and indicates a high Mud ratio in the dam, which was estimated at 0.62% each year.

Given the very high concentrations of organic matter in surface water, it is certainly because of these flows and what it carries of sediments and plankton. The agricultural activities in the central and northern zone undoubtfully play an important role in causing water erosion processes especially with the fragility and the brokenness of the land and the severity of its decline.

Conclusion

Based on research into the purpose and problem of this study, we draw the following conclusions:

The natural resources of agro-ecosystems used for the study are fragile with a heterogeneous distribution. Both flaws pose the problem of proper agricultural exploitation, and impose agricultural patterns adapted to terrain in general and climatic conditions in particular despite the environmental risks.

The use of agricultural technology inputs in the region is linked to the abundance and quality of natural resources; it aims at developing production rather than expanding agricultural land and bypassing natural constraints.

A clear lack of infrastructure technology that would enable the peasant to overcome natural inevitability and climatic conditions and create permanent jobs in the agricultural sector; for example: food and processing industry units in mountainous areas, and livestock investors in the northern zone, watering areas in the central zone, agricultural irrigation drainage systems in the central and southern zones.

The use of Agro-chemical technology has led to increased production in recent years, especially in some agricultural divisions. On the other hand, it has left many manifestations indicating environmental degradation and calling for urgent precautions to avoid the aggravation of the situation in the future eliminate the erroneous agricultural practices by private farmers.

Finally, we can emphasize that ensuring food security requires sustainable agricultural development which depends on the abundance quality and accessibility of available natural resources, further, the impact of the agricultural technology use on the cultivated and surrounding ecosystems.

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