CLIMATE CHANGE IMPACTS

ASSESSMENT REPORT

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1 INTRODUCTION

1.1 Scope

This document aims to present the situation of climate change in Albania and also in Korca Region where are included all the areas and villages where the SaveSafeWater investment has been implemented by rehabilitation and improving the existing water supply infrastructure in some villages and also adding new water supply infrastructure at some others.

The situation will be presented by taking into account:

- Assessment of the current situation of climate change in Albania and specifically in the Korca Region
- Assessment of the negative impacts of climate change and the key factors that affect it.
- Management and mitigation of the risk posed by climate change.
- The impact of climate change on the SaveSafeWater project.
- Conclusions about the measures taken or the mitigation and prevention measures that should be taken in the future to reduce the risk that may come from climate change factors.

1.2 Methodology

The methodology followed for the elaboration of this report consists in collecting baseline information from studies on climate change, meteorology, hydrology and environmental assessments conducted in Albania and in the Korca Region, as well as based on information received by questionnaires and meetings with relevant institutions such as: Korca Regional Directorate of Environment, Korca Water Supply and Sewerage Company, Water Resources Management Agency, etc.

2 COUNTRY OVERVIEW

Albania is a small county with a fragile economy reliant on the services, industrial and agriculture sectors, and faces a range of challenges in addressing climate change risks. Following the dissolution of the Socialist Republic, free market reforms in the 1990s began opening the country to foreign investment, but economic growth has been uneven. Albania's mostly mountainous landscape is endowed with abundant water resources, a diverse flora and fauna and an extensive coastline on the Adriatic and Ionian Seas. Its terrain is conducive to seasonal flooding.

Albania challenges include both man-made and natural soil erosion, underregulated coastal development, tenure insecurity and contamination of the water supply, compounded by low public awareness of climate change. The vulnerability of Albania's energy supply and agriculture sector to climatic changes, combined with a series of recent heavy floods and landslides, are elevating climate change preparedness as a priority within Albania's development planning.

2.1 Climate summary

Albania's climate follows the country's topography, with temperatures and precipitation varying by altitude and distance from the sea. The majority of the country's rainfall occurs between November and March, with lower amounts during the June to September growing season.

The climate of Albania is typically Mediterranean. It is characterized by mild winters with abundant precipitation and hot, dry summers. Albania's Territory is divided in four climatic zones: Mediterranean Field Zone, Mediterranean Hilly Zone, Mediterranean Pre-Mountain Zone, and Mediterranean Mountain Zone. The area of SaveSafeWater project, falls in the Mediterranean Mountain Zone.

2.2 Historical Climate

Historical climate trends since the 1960s include:

- Increase in annual mean temperatures by 1°C.
- Across the eastern Mediterranean, a six- to eight-fold increase in the intensity, duration and number of heat waves.
- A slight but statistically insignificant decrease in annual mean precipitation.
- Rising Adriatic Sea levels, linked to increased storm surges and damage from the Bora, a cold, dry northeasterly wind, and Sirocco, a south-southeasterly wind.

2.3 Future Climate

The changing dynamics of rainfall in Albania are uncertain, but the latest scientific evidence suggests a tendency to see milder winters, warmer springs and hotter and drier summers and autumns.

Climate scenarios by 2050 project:

- Intense increases in temperature (2.4°C to 3.1°C) from June to August.
- Decreased annual precipitation (less than 10 percent), with largest decreases from June to September.
- An increase in precipitation falling as rain instead of snow, potentially reducing snowpack.
- Increase in intensive rain episodes.
- Flooding along coastlines from sea level rise of 48 to 60 cm by the year 2100.

2.3.1 Scenarios for the water sector

Projections suggest that water needs for both domestic and industrial use are within existing capacity and that there is no need to increase water production but to reduce water losses through infrastructure improvement. Vulnerability and risk stems primarily from:

- A non-existing or weak monitoring system for both surface and groundwater in quantity and quality, including calibration of measuring systems and evaluation and management of data;
- Non-existing or weak water infrastructure and poor maintenance, especially in water supply and wastewater management; this has to be seen in the context of the poor implementation of economic instruments, the dramatic increase in construction activity, which has been poorly planned and regulated, fast structural changes and absence of waste collection in rural areas;
- A poor regulatory and financial framework in the water sector together with the lack of a longterm strategy which should act as a schedule for all activities and projects in the water sector.

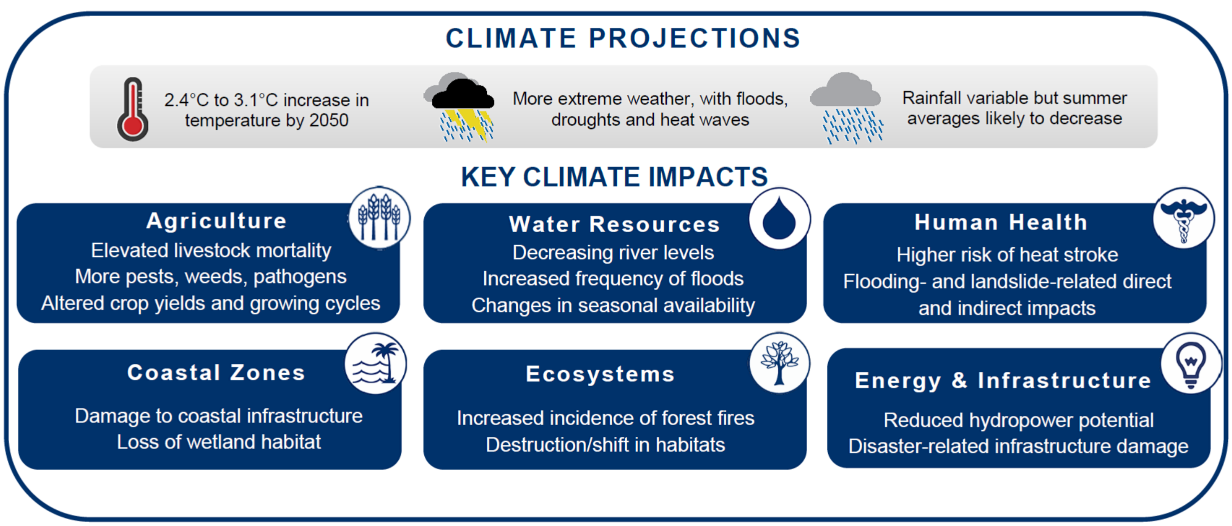


Figure 1. Climate projections and key climate impacts

2.4 Sector impacts and vulnerabilities

In the table below will be presented and overview of climate stressors and climate risk of all vulnerable and impacted sectors from climate changes in Albania.

Table 1. Climate stressors and climate risks.

SECTORS	STRESSORS	RISKS
Agriculture production	• Increased winter and summer temperatures • Reduced water availability during critical summer months	• Accelerated crop development, shortened growing cycle • Increased yields of some crops (wheat); reduced yields of others (maize) as well as reduced forage for livestock • Increased soil salinization and desertification • Elevated livestock mortality and reduced productivity • Increased exposure to new pests and diseases
Water resources	• Reduced precipitation and shift from snow to rain • More frequent droughts and flooding	• Altered or lowered river flows, especially in summer • Groundwater affected due to decreased water percolation and loss of soil moisture • Shift in runoff patterns: potential spring decrease, winter increase • Damage to water infrastructure from flooding
Human health	• Increased	• Increased mortality from heat

SECTORS	STRESSORS	RISKS
	temperatures • More frequent, longer and intense heat waves	stroke and exacerbation of pre-existing conditions • Higher temperatures affect concentration/ dispersion of air pollutants • Increased range of vector-borne disease carriers (e.g., mosquitos)
Coastal zones	• Rising sea levels • Increased intensity of storm surges • Increased sea surface temperature	• Damage to coastal infrastructure, including tourism facilities and agricultural land • Altered lagoon, wetland and coastal forest ecosystems • Increased salinity of coastal freshwater aquifers • Increased coastal flooding by 2100
Energy and infrastructure	• Increased temperatures • More frequent droughts • Increased frequency of extreme weather events	• Reduced hydropower potential • Changes in seasonal demand for heating and cooling/refrigeration • Competition for water resources between hydropower and agriculture (irrigation) sectors • Reduced efficiency of transmission and distribution lines with increased heat • Flood-caused infrastructure damages
Ecosystems	• Increased temperatures	• Increased risk of forest fires • Habitat shifts, loss and

SECTORS	STRESSORS	RISKS
	• Increased frequency of extreme weather events	fragmentation, disrupting species migration patterns • Reduced stream flow, threatening wetlands

2.4.1 Agriculture production

Agriculture, a highly climate-sensitive sector, contributes 22.6 percent to GDP and is the main source of employment for Albania's rural population. Farming is predominantly subsistence-level and dedicated to livestock (more than 50 percent of production value), field crops like wheat and maize (around 30 percent) and fruit production. The topography of the landscape limits mechanization potential, and opportunistic land reclamation and pasture conversion have accelerated deforestation and erosion, exacerbating risks from floods and landslides. A 2016 government plan aims to improve irrigation works and drainage to reduce damage from periodic flash floods and landslides.

2.4.2 Water resources

Albania has ample freshwater resources, but there are seasonal variations and water use inefficiencies that climate can magnify. Powerful rivers are highly erosive, and seasonal flooding is common – the highest risk is in the western and southern plains. Poor management and lack of investment in flood protection, irrigation and drainage infrastructure exacerbated the damage and losses from heavy rainfall in 2014, 2015 and 2016.

2.4.3 Human health

The government's Health Vulnerability National Adaptation Process identified extreme weather events, air quality and communicable diseases as priority health risks under a changing climate. Heat- related deaths, especially among the elderly, are the most-researched direct health impact predicted for the Balkans in general; information on other direct or indirect effects of climate change on human health is limited.

2.4.4 Coastal zones

Climate impacts may affect much of the 97 percent of the population that lives within 100 kilometers of the coast. Unregulated urban development up to the shoreline exposes infrastructure and the population to high risk of damages from storms, flooding and – in the future – sea level rise. Deforestation of coastal areas, agricultural development and use of gravel and sand for construction have contributed to coastal erosion, thereby increasing vulnerability. Climate change impacts to the mostly artisanal fishery sector have not been studied in detail, but the sector could be affected by projected sea surface temperature increases.

2.4.5 Energy and infrastructure

Albania relies on the Drini River Basin for more than 90 percent of its domestic hydropower supply. This river basin could see reduced flows due to climate change that would affect energy supply. Albania is already vulnerable to fluctuations in precipitation, evidenced by the 2007 drought that led to severe energy shortages. Along with the damages to coastal infrastructure, landslides and floods in the plains and lowlands caused extensive infrastructure damage in past years. Albania's urban congestion, aging vehicles and dust from gravel roads contribute to air pollution, which may be exacerbated by higher temperatures and longer periods without precipitation.

2.4.6 Ecosystems

Nearly 10 percent of Albania is terrestrial or marine protected area, but nearly 19 percent of flora and fauna species are endangered, due in part to pollution, overfishing and land conversion. Plant stress and drying due to high temperatures were associated with a record number of forest fires in the summer of 2007. Illegal or underregulated construction, particularly in coastal zones, has increased human and ecosystem vulnerability to storm surges.

2.4.7 Disasters

Albania currently suffers from heat waves, droughts, landslides and floods, which may be exacerbated by climate change. Soil erosion, deforestation and unregulated construction compound the impact of extreme weather events, as does the concentration of urban migrants in vulnerable informal settlements. Data collection and sharing between institutions to monitor risks and enhance early warning systems is a challenge. Hydrological and meteorological station functioning has declined in recent decades. Albania currently has donor financing aimed at strengthening disaster risk management systems, however.

2.5 SWOT Analysis

The SWOT analysis is focused on the current state of the water resources in the Albania with a view of climate change impacts; it is used to identify internal strengths and weaknesses, as well as external opportunities and threats within the country with regard to strategic tools and measures for mainstreaming climate change adaptation. SWOT analysis is based on the following components:

- Collection of official strategic documents (Guidelines to mainstreaming gender in climate change adaptation and mitigation programmers and plans in Albania, National Communications to the United Nations Framework Convention on Climate Change, etc.),

- Identification of SWOT aspects with a view to institutional, regulatory, technical, and governance issues related to water management.

Climate Change Impacts on Water Resources in the Albanian country

Water resources of Albania are abundant, almost in all the regions of the country, with an uneven seasonal distribution. The available quantity of surface water and to a less extent of groundwater also, strongly decreases during the months of summer. Thus, only about 6-9 % of the annual runoff is observed during the dry season (July-September).

Albania is rich in water resources and this is one of the strength points of it. The hydrographical basin that feeds the water courses of Albania has a total area of 43,305 km2 and is about 50 % larger than the country's territory. Seven rivers (Buna, Mati, Ishmi, Erzeni, Shkumbini, Semani, and Vjosa) and their tributaries drain towards the Adriatic Sea.

The long-term average discharge into the Mediterranean is Q = 1,244 m3/s. The total volume of water flow is W = 39,220 x 106 per year. The mean annual flow of all rivers is 1'300 m3 /s, which corresponds to a module of 29 l/s.km2, one of the largest in Europe. These water resources are mainly used for energy production, irrigation, industry, drinking water etc.

One of the weaknesses related water in Albania is, that groundwater in Albania is the only source of drinking water. The average discharge from groundwater aquifers varies from 200 to 400 m3/day to 800 m3/day. The water is generally fresh and soft. Exploitable reserves of these waters are enormous; flow from wells varies from 10 to 100 l/s. currently, little is known about the actual availability, and groundwater extraction capacity nationwide.

Climate change is likely to result in less rainfall, increasing temperature and frequency of droughts and floods. These effects increase water stress through reduced water availability quality groundwater management.

Further analysis shows that since the turn of the century there has been a positive trend of increasing temperature for all seasons (winter: from +1.60 to +2.5oC; spring: from +2.00 to +3.0oC; summer: +3.0oC; and autumn: +2.0oC).

A consequence of the predicted temperature and precipitation changes are that more hot days and heat waves are very likely over the coastal area. More frequent and severe droughts with a greater fire risk are expected. The increases in the air temperature are also projected to lead to an increase in the "cooling degree days".

The main consumer of water and a weakest point in the same time is the abuse in the agriculture sector. According to the draft National Water Strategy, Water for irrigation accounts for 72% of total use while water for industry and domestic purposes accounts for 28%. However, 50% of agriculture use is dependent on rainfall and surface water. Due to the methods used, the efficiency of water-use for irrigation is very low.

The time periods when water demand is highest are the same periods when water supply is most at risk of being inadequate. Furthermore, it is expected that the impacts of climate change on urban water supply will be negative.

Regarding to all that we mentioned before, there is no need to increase water production, but there is a need to reduce water losses through sustainable water management policies and investment in the water supply network.

The analysis suggests that the available water resources in Albania are sufficient to cover future demand, but there is an urgent need to establish a precise database for the state of water services and water management for indices such as water consumption measurement, non-revenue water and drinking water quality.

3 POLICY CONTEXT

Albania received European Union candidate status in June 2014. The Albania EU accession process is a driving force in reform of the environment sector and of cross-sectoral coordination necessary for climate change adaptation responses. Integration directly implies close cooperation with EU regulations.

During recent years Albania has developed and adopted a number of primary and secondary pieces of legislation regarding the environment that have an impact on responses to climate change. Additionally, it should be emphasized that legislation regulating other sectors that have a considerable impact on climate change, such as energy, forest and other sectoral legislation, have also been enacted.

3.1 Institutional Framework

The Ministry of Tourism and Environment, the State Inspectorate of Environment, Forest, Water and Tourism and the National Environment Agency, through their Climate Change Units, are the national UNFCCC focal point. The Unit collaborates with an interdisciplinary and inter-institutional technical team to fulfill Albania's duties as a UNFCCC member. The State Environmental Inspectorate identifies and responds to issues related to environment and climate change. The responsibilities of the National Environmental Agency include permitting, environmental impact assessment, and public information. Albania's draft 2014–2018 national strategy for disaster risk reduction and civil protection emphasizes the need to retrofit and expand the existing observational network of weather and hydromet stations.

3.2 National strategies, plans and legislations

It is worthwhile to mention that recently a number of primary pieces of legislation onenvironment that are relevant to climate change impact have been adopted, and whichtranspose a number of EU Environmental Directives. These pieces of environmental legislation include, among others, the following acts:

- Law no. 10431, dated 9.06.2011 "On environmental protection" as amended;
- Law no. 10440, dated 7.07.2011 "On environmental impact assessment";
- Law no.10448, dated 14.07.2011 "On environmental permits" as amended;
- Law no. 8897, date 16.05.2002 "On protection of air from pollution" as amended;
- Law no.27/2016 "On chemicals management";
- Law no.111/2012, "On integrated water resources management";
- Law no.68/2014"On some amendment and changes in the law no. 9587, dated 20.07.2006 "On protection of biodiversity";
- Law No.162 dated 04.12.2014 "On protection of ambient air quality";
- Decision of the CoM no.352, dated 29.04.2015 "For the assessment of ambient air quality and requirements for certain pollutants related with it";
- Decision of the CoM no.1075, dated 23.12.2015 "On measures for the control of Volatile Organic Compound (VOC) emissions resulting from the storage of petrol and its distribution from terminals to service stations";
- Decision of the CoM no.594, dated 10.09.2014 "On approval of National Strategy on Ambient Air";

Nevertheless, it should be emphasized that the concept of climate change and climate change related issues are not widely addressed in Albanian environment legislation but it should be noted that Albania has taken some steps forward in terms of climate change by taking the following actions:

- Albania joined the United Nations Framework Convention on Climate Change (UNFCCC) in year 1995 and also joined the Kyoto Protocol in year 2005.
- Albania has ratified the United Nations Framework Convention on Climate Change (UNFCCC), First National Communication (2002) and Second National Communication (2009). The second communication focuses on the Drini River Cascade area. Preparation of a Third National Communication began in 2014 and is complied, peer-reviewed and finalized in October 2016. Third Communication i focused in colstal areas of Albania and the capital city, Tirana.
- The Ministry of Health's Albanian Strategy for Health System Adaptation into Climate Change (2011) presents an action plan for 2011–2021.
- Climate Change Adaptation in the Drini Mati River Delta and Beyond (2013) proposes policy strategies to mainstream climate change adaptation considerations into national, regional and commune-level development planning.
- The Albanian parliament has ratified the Paris agreement (AGENDA SDG 2030) in 14th July 2016.
- In 2014, by order of the Prime Minister, an inter-ministerial working group was set up to draft strategic policies and coordinate at the inter-institutional level the implementation of actions related to climate change.
- Draft DCM no.466, date 03.07.2019 "On the adoption of the strategic document and national plans for greenhouse gas mitigation and adaptation to climate change", has been prepared.

4 GENERAL INFORMATION ABOUT THE KORCA REGION

The Korca region lies in the Southeastern Region of Albania. It has a north-south extension of 32 km and east-west 40 km, with a territorial area of 730 km^2. This geographical position has played a decisive role in its social, economic and cultural development. The geostrategic position of the

Municipality of Korca, in a cross-border area with Greece and North Macedonia, has led to the passage of important transport axes in its territory, which connect Albania with the Southeast Balkans and beyond. The capital of the region is the city of Korca with about 100,000 inhabitants.

4.1 Location

The Municipality of Korca is a local administrative unit located in Southeastern Albania. It is bordered on the North by the Municipality of Maliq, on the east by the Municipality of Devoll, on the south by the Municipality of Kolonja and on the southwest by the Municipality of Skrapar. In the East there is a natural division with the highland ridge of Morava, in the West with the highland ridge and the ridge of Ostrovica in the northwest. The plateu (part of Korca hollow field) is a landing that is preserved to the west by the Voskopoja mountains and to the south by the mountains of Vithkuq. Between them are the valleys with the drecreasing relief and the outflow of aquifers to the west.

The altitude range of Korca region varies from approx. 850 m (min) to approx. 1,500 m (max) and an average of approx. 1150 m above sea level. The morphology is mainly composed by mountains and the aquifer is mainly composed by ground waters.

This aquifer basically has a composition of Illusive concentrations, single or combined with silica, iron, aluminium, humus, carbonate, gypsum or silicon; also has composition of oxide coatings which make the layer significantly lower on value, the highest in chrome or red in colour than the above layers or below without noticeable iron emissivity. In terms of geology, there are three rock species involved in the geological construction of Korca region: sedimentary, magmatic and metamorphic.

4.2 Main watersheds

The relief of the Korca region is part of two major national watersheds related to the Devoll River and the Osumi River in the South. Thus, the valley of Upper Devoll passes in the flanks of the plain, but it receives the waters flowing from the relief of Morava and the plain of Korca, from the valley and catchment of Cemerica and the sides of the Ostrovica Crest. Meanwhile, in the south, the relief of the Vithkuq Highlands follows the forms and waters of the southern valleys in the Osum River. The main watersheds are:

- Hollow filed watershed collection,
- Morava watershed,
- Upper Osum watershed,
- Cemerica watershed towards the middle Devoll watershed

4.3 Water Resources

The Korca region with an area of 806 km^2 is under the Seman water basin. Seman Water Basin is characterized by three main types of aquifers: Quaternary, Charbonate and Magmatic. There is a total of 211 irrigation reservoirs in the Seman Water Basin. However, due to erosion in the basin and sedimentation the actual volume of water available for irrigation is only about 50% of the design capacity reservoirs with a total average of 0.73 km3 of water used for irrigation. Subterranean waters are located in the Quaternary basin of Korça City, in Berat City water supply system, and Rrogozhina City groundwater body, the carbonate aquifer and the magmatic aquifer.

4.3.1 Surface waters

In addition to lakes as important water resources in this region are rivers such as the Devoll and Dunavec. The Devoll River crosses the northern part of the lowland, from the Cangonj gorge in the east to Maliq in the west. Based on the data of the hydrometric station of Orman - Pojan, the minimum levels and flows of the river Devoll, in the lowlands of Korca meet in August – September and have respectively the values 6 – 2 cm and 1.88 – 3.11 m^3/sec, while the maximum values meet in the months of November - April and have the values 339 – 416 cm and 22.9m^3/sec.

The Dunavec River originates in the south of the Korca lowlands, in its mountainous part composed of ultrabasic and limestone rocks. During its flow from South to North, small tributaries flow into this river, such as the rivers of Kamenica, Dersnik, Voskop, Drenova, Dvorani, etc. The hydrological regime of the river Dunavec as well as the river Devoll, is completely dependent on atmospheric precipitation, the maximum levels and inflows of this river meet in March, reaching respectively the values 393 – 448 cm and 6.96 m^3/sec.

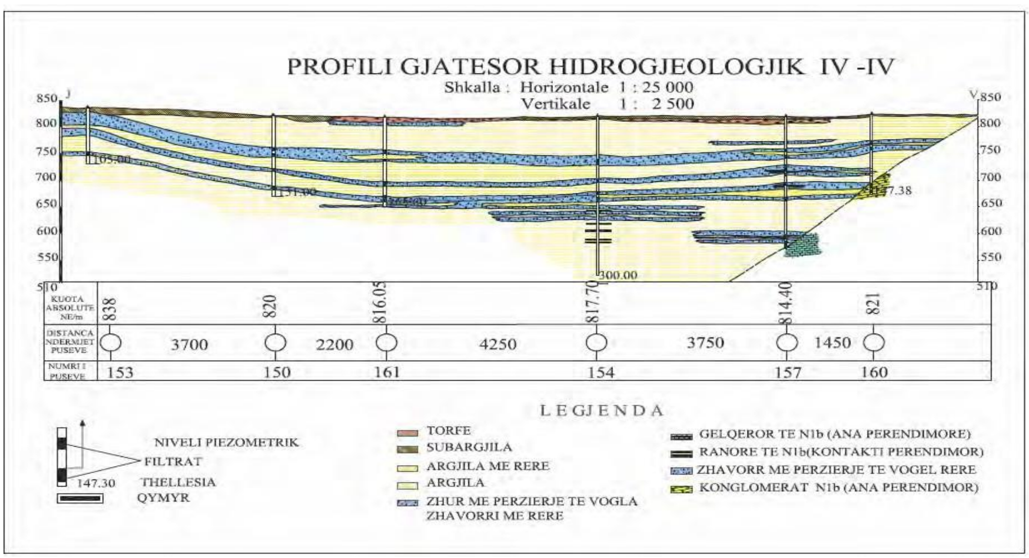
4.3.2 Ground waters

The Korca region is known for its considerable dynamic groundwater resources. Karst and intergranular aquifers are valued for very high-medium water content and are of great importance in the supply of large inhabited centers with drinking water. Other cities such as Devoll, Erseka and partly Korca are also supplied by karst springs. From the Quaternary aquifers, the city of Korca is supplied with water from the wells of Turan in the amount of Q = 300 l / s and all the municipalities that surround the pit-pit of Korca. A large number of "illegal" drillings have been carried out in these aquifers, which are used by private persons. Their quantities are not recorded. Water resources are also widely used in agriculture for irrigation.

The Korca Aquifer is part of the inland pits of Albania and is otherwise called the Korça and Devoll hollow filed and is classified as having average water content. It consists of alluvial deposits of the Devoll and Dunavec rivers, where the Devoll river has a total length (196 km) and an average perennial inflow into the Seman River of about 49.5 m^3/s. The thickness of alluvium concentrated in 4-8 sub-basins ranges from 5-20 m according to drilling data (2003). The waters associated with this aquifer are those that are spread almost throughout the lowlands of Korca.

(Source: Albanian Geological Service)

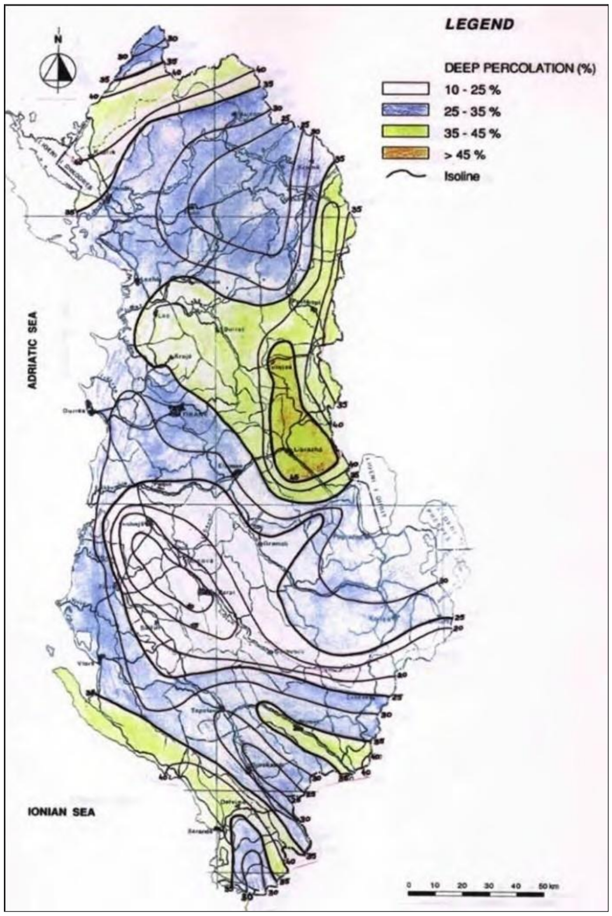
Figure 2. Hydrogeological map of Korca region in scale 1:200 000.



(Source: Albanian Geological Service)

Figure 3. Longitudinal profile of the aquifer with intergranular porosity with average water permeability of Korca.

Main results of the intensive Hydrogeological investigations performed in Albania are synthesized on the Hydrogeological Map of Albania scale 1:200.000. In the figure above is shown part of this Map for Korca area.



(Source: UNDP, S. GURI)

Figure 4. Groundwater permeability map.

4.3.3 Sources of water pollution

The general characteristics of surface and ground waters are as follows:

- High turbidity. This is because the flow regime is intermittent and the water transports large amounts of suspended matter;
- High bacterial contamination. This is caused by human activities or industries active in the area;
- Low temperature. These waters originate from springs or melting snow or glaciers;

4.4 Drinking water

The city of Korca has the best supply of drinking water in Albania in terms of resources, duration (24 hours) as well as the distribution network and quantity per inhabitants (11 European directive for water is 200I / d / b). The length of this network reaches about 190 km and has enabled the reduction of losses in the network, the improvement of the pumping station as well as the amount of storage. This water supply of the city of Korca is realized by the water supply of the city located in the village of Turan where the pumping station is set up. In total there are four artesian wells, which are about 150 m deep, where one is located in the village of Turan, while the other three near the village of Porodine. The wells are fenced and airtight. Of these wells for reasons of rational use, two are in use while the other two are left in reserve. In city wells samples are taken 2-3 times a year directly in the well. Water passes through these wells from the Turan pumping station where the water is chlorinated. From there, with pumps, it climbs to the water depots in the hills of the city and through the network, which is within every parameter, hermetic with pipes that are spread throughout the city of Korca from where the water is distributed. The pipelines are new and contemporary and in addition to the city of Korca have extension in the two surrounding villages as Turani and Cifligu which are supplied by the network of the city of Korca. The water supply is monitored daily by the Korca Water Supply and Swerage Company (UKKO) by taking water samples at 16 points, of which 15 points are fixed and 1 point is mobile according to the problems presented by citizens. This monitoring is done in the morning and in the afternoon.

On regard to the problem faced by the utility in terms of quality of waters remain the values microbiological analyses, values of which remain still higher than the Albanian Water Standard even though do not represent an issue due to the fact that the values can be avoided by the disinfection process.

Based on the Albanian and European standards, the water quality parameters of Korca do not exceed standard values, referred to physical and chemical parameters.

There is no human health risk implied. (Also shown in the tables below: Microbiological analysis of Korca water resource; Drinking water table parametres;)

Table 2. Microbiological analysis of Korca water resource

Microbiolocigal Analysis				
Total coliforms UFC/100ml	Fecal coliforms UFC/100ml	Total bacterial load in 22^0 C UFC/ml	Total bacterial load in 36^0 C UFC/ml	Clostridium sulphite reducers UFC/100ml
0	**0**	**210**	**190**	**0**

Table 3. Drinking water table parametres, City of Korca

Drinking water – City of Korca		
Parameter	**Actual value (mg/l)**	**National Rate (mg/l)**
pH	7,9	6,5-8,5
Residual Cl	0,1-0,3	>1
NH_4^+	0	Max 0,05
NO_2^-	0	>50
NO3 -2	1,4	>5
CO2 -2	12,2	>500
HCO3 -2	267,3	>500
O_3	1,7	
German strongness	13,8°	>20°

(Source: Albanian Geological Service)

Despite the fact that currently the water situation and water purity of this area is within the standards, according to UKKO the aquifer area is threatened by construction and uncontrolled activities in the area. This is because in these protected areas there are no effective measures regarding water drainage, type of construction and their destination and consequently industrial and urban waste has increased, threatening the cleanliness of this area. In villages, there is generally no problem with sources for water supply, but the problem is often depreciated distribution pipes, lack of meters and abuse of drinking water for irrigation, etc.

4.5 Water Resources Availability

4.5.1 Water demand (annually)

A. Number of inhabitants in the Korca area:

According Institute of Statistics in Albanian (INSTAT), in 1st January 2020 in Korca region were 101, 774 inhabitants.

B. Number of tourists in the area:

The region of Korca have been visted by over 100, 000 turist in 2018 and by approx. 80,000 tourists in year 2019. The number of tourist is reduced dramaticly in 2020 due to the pandemic situation of COVID-19.

C. Annual water consumtion

Produced		Billed	
Min –	07.43 m^3	Min –	4.00 m^3
Max –	20.26 m^3	Max –	9.34 m^3
Avrg. –	13.84 m^3	Avrg. –	6.67 m^3

D. Problem in water use

Water resources are abundant in Albania and will continue to be through 2050 under a wide range of climate change scenarios. In many cases, however, farmer training is needed in the Intermediate and Lowlands agro-ecological zones to ensure more efficient use of water during dry seasons, and additional investment is needed in these regions in irrigation and water storage infrastructure to take best advantage of these water resources in the agricultural sector.

Another problem is the water loss that shold be reduced by the improvement of water supply infrastructure.

4.5.2 Water Resources Availability

Estimate Water Exploitation Index (WEI) for total water demand for drinking water demand.

$$WEI = WD / WR,$$

where: WD – is the water demand and; WR – is the renewable water resources;

Present situation

$WEI_1 = WD_0 / WR_{present}$

$WEI_1 = WD_0 / WR_{present} = 205.015\ m^3 / 780.000\ m^3 = 0.26$

Scenario 0: WD_0 is the present water demand

$WEI_2 = WD_0 / WR_{future}$

$WEI_2 = WD_0 / WR_{future} = 205.015\ m^3 / 728.746\ m^3 = 0.28$

Scenario 1: WD_1 is the present water demand increased by 25%

$WEI_3 = WD_1 / WR_{future}$

$WEI_3 = WD_1 / WR_{future} = 256.269\ m^3 / 728.746\ m^3 = 0.35$

Scenario 2: WD2 is the present water demand decreased by 25%

$WEI_4 = WD_2 / WR_{future}$

$WEI_4 = WD_2 / WR_{future} = 153.761\ m^3 / 831.254\ m^3 = 0.18$

Table 4. Water Exploitation Index scenarios.

Country	Region /area	WEI (1)		WEI (2)		WEI (3)		WEI (4)	
		Total use	Drinking water	Total use	Drinking water	Total use	Drinking water	Total use	Drinking water
Albania	**Korçë**	**0.26**		**0.28**		**0.35**		**0.18**	

4.6 DPSIR (Drivers, Pressures, Status, Impacts, Response) methodology

Water Resources is structured according to the DPSIR model, it highlights the underlying causes and current consequences of the climate change policy adopted.

This model is based on the assumption that there are causal relationships between the different elements of the socio- environmental system. The changes impact humans and the environment, for instance water pollution, the occupation of land, health deterioration etc. These in turn lead to social and policy Responses. The DPSIR framework in this way offers the potential to clarify and organize the elements of the water resources in UKKO, shedding light on its complexities and enabling a more thorough assessment of the full range of issues at stake.

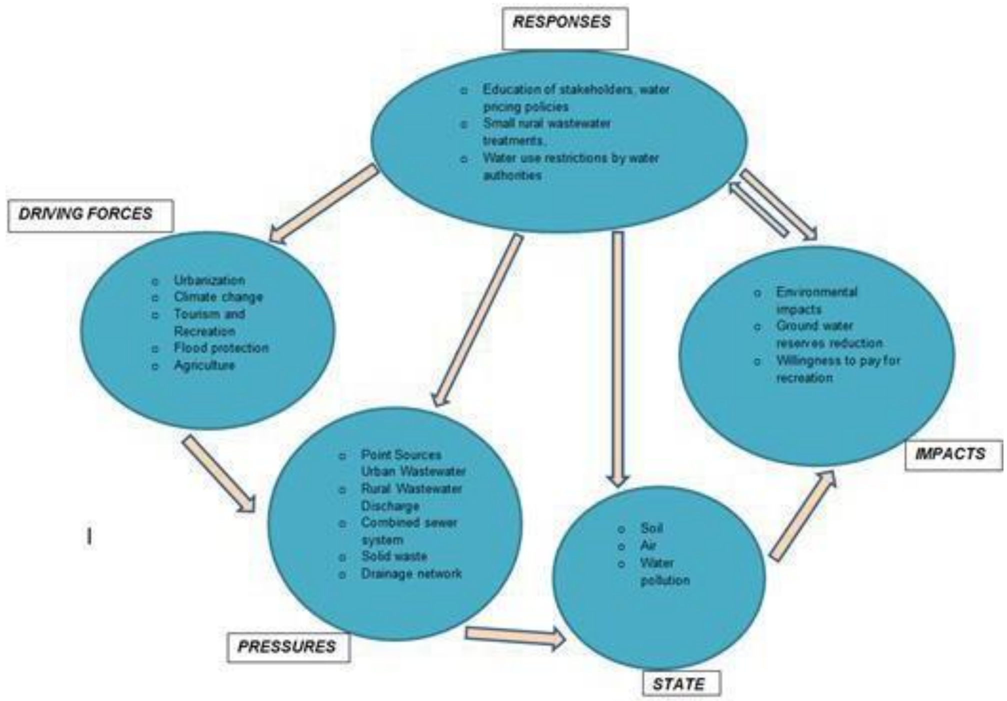


Figure 5. DPSIR (Drivers, Pressures, Status, Impacts, Response) methodology

5 OVERVIEW OF ENVIRNMENTAL ASSESSMENT IN KORCA REGION

5.1 Air quality

The number of days that exceeds the daily EU standard (50 μg/m^3) remains problematic, where the number of days exceed from the 35 days allowed there are 102 days at the Korca station. Whereas, the degree of exposure of the population to pollution remains a problem, as a result of exceeding the annual norm of polluted days.

In general, the main causes of air pollution are:

- industrial activities
- motor vehicles and increase the amount of traffic in general
- heating equipments/systems in buildings

5.2 Greenhouse gases

Since 2001, Albania has implemented the national ozone plan, which includes the national plan for the elimination of substances that deplete the ozone layer. High ozone levels can cause respiratory health problems by reducing lung function. Ozone is also a greenhouse gas contributing to global warming, becoming a significant factor in the impact of climate change.

5.3 Clime

Based on the geographical regionalization of Albania, the territory of the municipality of Korca is part of the Southeastern Pits of Albania and the Central Mountain Province. The territory of the Municipality of Korca consists of these large morphological units:

- Korca hollow field,
- After mountain province,
- Mountain province.

The geographical position, the predominance of hills and mountains makes the territory of the municipality of Korca to enter the area where the winter is cold and the summer is cool. The climate of the terrestrial territory is of the local continental type, with an average annual temperature of 11.4 ^{o}C.

The hollow filed area has a continental climate, with dry and hot summers. The average summer temperature is 23 – 24 ^{o}C. Winters are wet and often cold.

Hilly area, on average 1200 m above sea level. The average temperature is 3 – 4 grades lower than in coastal areas and with more frequent frosts.

The mountainous area is characterized by a continental climate with 600 – 1000mm of rainfall. The highest temperatures reach 25 ^{o}C in July, while the minimum temperatures in Winter reach several degrees below 0.

5.3.1 Temperature

The thermal regime represents a satisfactory uniformity in the Korca area. The average annual temperature values generally fluctuate around 13.0 ºC. The region is distinguished for cold winters and cool summers. Average monthly temperatures reach approximately 21.2 degrees in July and August, with peaks reaching 34.4 degrees in August. The lowest average temperature is during January, around 1.5 ºC, with a minimum of -17.2 ºC.

Regarding the average seasonal temperature, it is around 1.7 ºC in winter, 9.3 ºC in spring, 19.3ºC in summer and 11.5 ºC in autumn. Extreme temperatures reach: absolute minimum -24.2 ºC and absolute maximum 35.5 ºC. These minimums are a consequence of the penetration of cold air masses and its strengthening from the shape of the Devoll valley.

In the table and the figure below are presented information about temperature in the Korca Region.

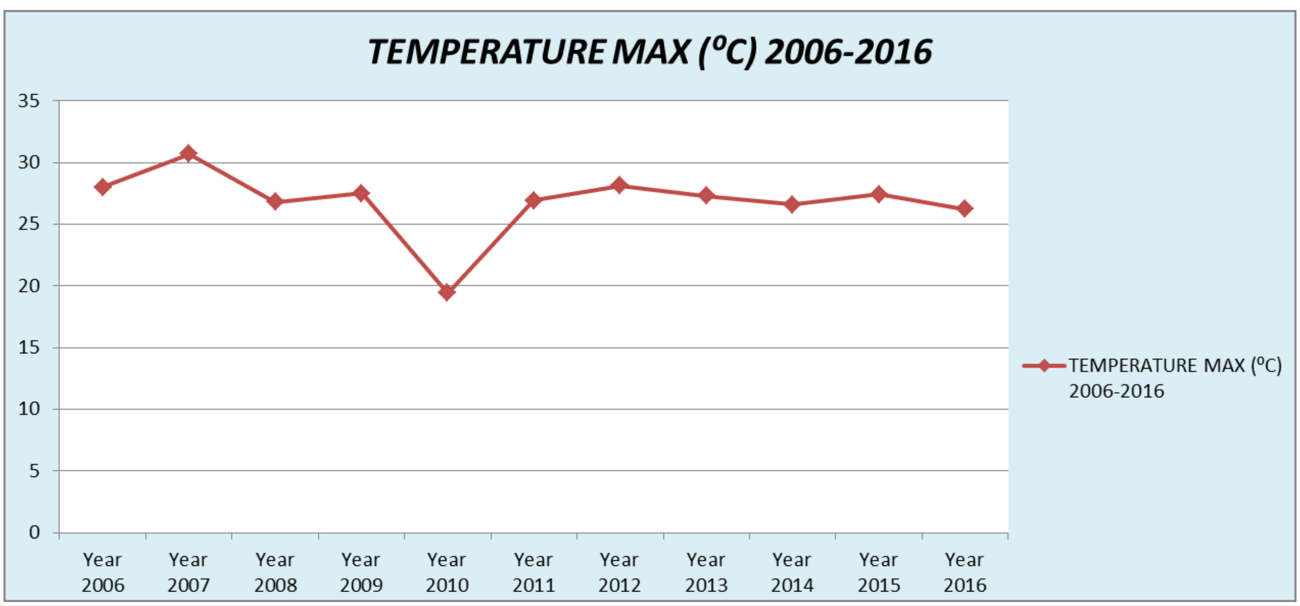


Figure 6. Temperature MAX (º C) in Korca region

Table 5. Temperature MAX (^{0} C) in Korca region

Year	TEMPERATURE MAX (^{0}C) 2006-2016
Year 2006	28
Year 2007	30.7
Year 2008	26.8
Year 2009	27.5
Year 2010	19.4
Year 2011	26.9
Year 2012	28.1
Year 2013	27.3
Year 2014	26.6
Year 2015	27.4
Year 2016	26.2

5.3.2 Wind

The most frequent wind is the one that blows from the north, especially in autumn and winter. Winds blowing from the south and southeast dominate during spring and summer. Southeast and east winds are considerable. Quiet and windy periods vary during the day, especially in summer. mornings are characterized by fluctuations between winds blowing from the north and calm periods. The weather conditions change quite a bit in the afternoons, when the calm is broken by the south and southeast winds.

Wind characteristics

The average annual wind speed is about 2.1 m/s. The highest speed is reached in the spring season with 2.5 m/s, in winter 2.2 m/s, in summer 1.7 m/s and in autumn 2 m/s. The winds with the highest average annual speed are those with south-west direction (5 m/s) and south-east (4.8m/s), while those with the lowest average annual speed are those with north-east direction (2.8 m/s).

5.3.3 Precipitation

Precipitation is one of the main factors influencing the climatic regime of the area. Rainfall varies throughout the year and plays an important role in the water balance of the lake and its catchment area. The highest rainfall is normally recorded in November-January and late spring, usually in May. Precipitation reaches its lowest level during July and August.

The main factors that condition the amount, intensity, annual, seasonal and monthly distribution of rainfall in the Korca region are: geographical position and features of the relief. It is clear that for a pond, in general, precipitation is the main factor of the hydrological regime, because they are themselves the main material that creates the flow in space and time. A general characteristic of rainfall distribution in the Shkumbin basin is that their height increases from West to East to the basins of the Gostime and Rapun (inclusive) tributaries and then descends from North to South. Atmospheric precipitation is one of the most important elements of weather and climate.

Korca has a transient Mediterranean climate (or Mediterranean continental climate) with large changes in temperature. The hottest month is August, while the coldest month is January. The average annual rainfall is 710 mm, which reaches a minimum in Summer and a maximum in Winter, making Korca a generally dry city compared to the rest of wet Albania. Temperatures in Korca, which absorb 2300 hours of solar radiation, generally remain lower than the rest of western Albania, but higher than the northwestern part due to the average altitude in the Korca plain.

During the winter there is snowfall, where in the region of Korca the thickness goes to over 0.5m while at high altitudes the thickness goes up to over 1 m. During the year in the area of Korca precipitation is numerous and their average amount ranges from 900-1300 mm and more precipitation falls in November and December of the year. The snow starts to fall at the end of

November and continues unstable until February. This territory, almost all year round, but especially in the period late autumn-early spring, is beaten by cold winds.

The distribution of rainfall within the year in the region of Korca is typically Mediterranean, with heavy rainfall during the cold half of the year and little rainfall during the warm half with drought that can last several months.

It is distinguished by the very low average annual rainfall of about 700 mm per year. The continental influence of climate is mitigated by the Mediterranean rainfall regime where in summer it falls 12.5% of the annual rainfall.

In the table and the figure below are presented information about rainfall in the Korca Region.

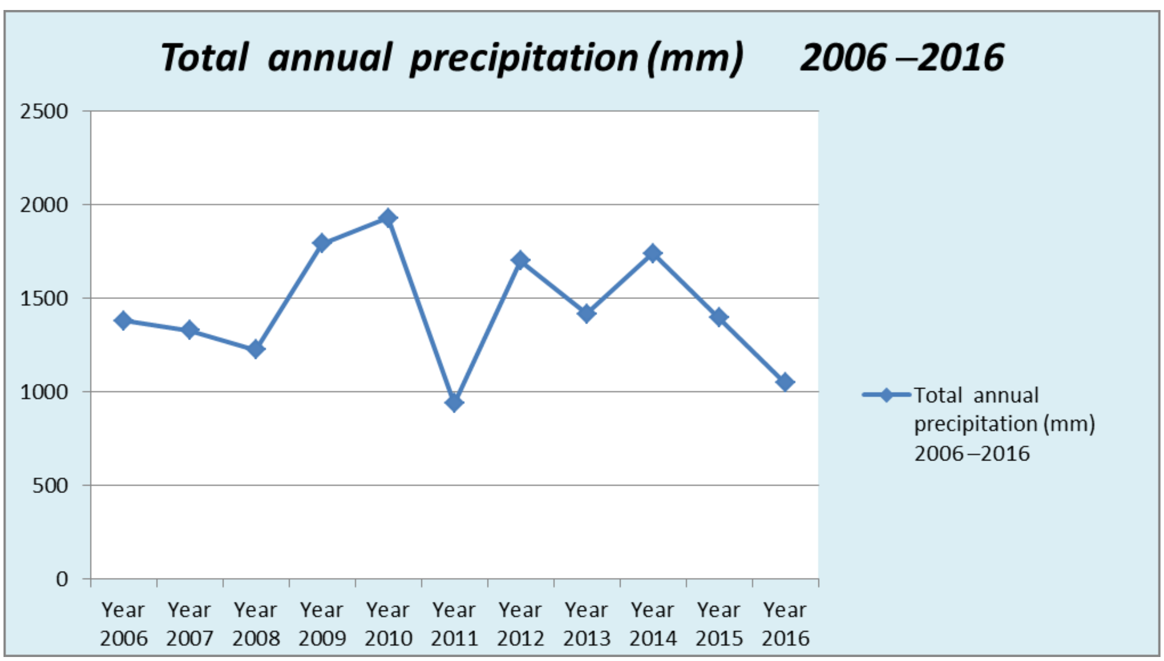


Figure 7. Total annual precipitation in Korca region (2006 – 2016)

Table 6. Total annual precipitation in Korca Region (2006-2016)

Year	Total annual precipitation
Year 2006	1 380.5
Year 2007	1 329.4
Year 2008	1 223.6
Year 2009	1 791.7
Year 2010	1 928.3
Year 2011	939.7
Year 2012	1 700.7
Year 2013	1 415.9
Year 2014	1 740.9
Year 2015	1 396.9
Year 2016	1 048.9

5.4 Unusual climatic events

Unusual climatic phenomena include those related to the rainfall regime. Korca region as a country with continental climate, is characterized by a rainfall disorder from the point of view of annual distribution. This distribution is characterized by a maximum in the winter months (30-40% of annual rainfall) and a minimum in the summer months (10%). Irregular rainfall is observed in unusual cases such as intense rainfall within 24 hours accompanied in some cases by floods, or vice versa as a pronounced lack of rainfall that leads to prolonged drought.

These climate changes also affect water reserves causing:

- Reduction of surface water flow during summer drought by 2% by 2030 and 5% by 2100;
- Exacerbation of water problems, mainly drinking water, both during the summer season due to reduced rainfall, and in autumn due to increased water turbidity;

- Increased evapotranspiration due to increased temperature leading to a decrease in the amount of water

5.5 Climate change scenarios

After the first and second finalization of the National Communication of the United Nations Convention on Climate Change, Albania has begun the process of preparing the third UNFCC Communication, part of which will be possible scenarios, as a result of climate change. All scenarios show a decrease in annual rainfall over 1990 for all time horizons. Summarizing the results, it turns out that annual rainfall can be reduced to:

- -8.5% in 2050
- -18.1% in 2100

General impacts

As a result of changes in temperature and precipitation regime, the following impact are foreseen:

- Increase of the daily minimum temperatures
- Frequent long droughts with high fire risk
- The number of days with temperatures above 35 ^{o}C is projected to increase 10 days a year to 2100.
- Reduction of the number of cold waves as a consequence of the increase of the number of hot waves.
- Increase in the number of days with heavy rains that cause floods.
- Increased spring temperatures will affect the growing season of the crops. The extension of this period is predicted to be 26 days compared to 1990.

- As a result of the reduction in total annual rainfall, coastal areas may experience a general decline. The demand for water can increase, especially in summer.

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