HELLENIC REPUBLIC
MINISTRY OF ENVIRONMENT AND ENERGY
GENERAL SECRETARIAT FOR NATURAL ENVIRONMENT AND WATER

Project FLOODGUARD

"Integrated actions for joint coordination and responsiveness to flood risks in the Cross-Border area"

D.3.6.2 Preparation of a detailed study on:

1) Comparison and evaluation of flood risk assessment methods and models in Greece and cooperation with Bulgarian partners,

2) Comparison and evaluation of climate change mitigation and adaptation policies, and implementation progress in Greece in cooperation with Bulgarian partners,

3) Analysis of the environment and the state of legislation for prevention, preparedness and response in case of extreme events.

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ABBREVIATIONS

Abbreviations	Definitions
JPMT	Joint Project Management Team
JWG	Joint Working Group
AA	Audit Authority
MIS	Monitoring Information System
AF	Application Form
CP	Cooperation Programme
PPIM	Programme and Project Implementation Manual
CA	Certifying Authority
CP GR-BG 2014-2020	Cooperation Programme INTERREG V-A Greece-Bulgaria 2014-2020
ESIF	European Structural and Investment Funds
ETC	European Territorial Cooperation
EU	European Union
FLC	First Level Control
GoA	Group of Auditors

1 INTRODUCTION

1.1 General Details of the Project

The FLOODGUARD project is implemented within the framework of the Partnership Program "Interreg V - A Greece - Bulgaria" 2014-2020. The legal framework of the project is the following:

- REGULATION (EU) no. 1303/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 December 2013, establishing common provisions for the European Regional Development Fund, the European Social Fund, the Cohesion Fund, the European Agricultural Fund for Rural Development and the European Maritime and Fisheries Fund and for the repeal of Regulation (EC) no. 1083/200 of the Council.
- REGULATION (EU) no. 1301/2013 OF THE EUROPEAN PARLIAMENT OF THE COUNCIL of 17 December 2013 on the European Regional Development Fund and on special provisions aimed at Investments for growth and employment and repealing Regulation (EC) no. 1080/2006.
- REGULATION (EU) no. 1299/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 December 2013, on specific provisions for the support by the European Regional Development Fund of European territorial cooperation objectives.
- COMMISSION DELEGATED REGULATION 481/2014 of 4 March 2014 supplementing Regulation (EU) no. 1299/2013 of the European Parliament and of the Council on specific rules for the eligibility of expenditure for cooperation programmes.
- COMMISSION DELEGATED REGULATION 2019/693 of 7 February 2019 amending Delegated Regulation (EU) No 1299/2013 of the European Parliament and of the Council, on specific rules for the eligibility of expenditure for cooperation programs (CP), to amend the delegated regulation (EU) no. 481/2014 to supplement the regulation (EU).
- Regulation for the establishment of the GREEK MANAGEMENT AND CONTROL SYSTEM.
- Approval decision EC (2015) 6283 / 9-9-2015 of the CP and the last approved version of the Cooperation Program.

The main documents of the Program are available in the section "Main documents of the program" on the official website of the Program and include:

- Interreg V-A Cooperation Program "Greece-Bulgaria 2014-2020" and its annexes.

- Annual implementation reports.

- Documents for the operation of the Management and Control System (MCS) of the INTERREG V-A Cooperation Program "Greece-Bulgaria" 2014-2020.

- Program and project implementation manual.

- User manual for monitoring information system (MIS) implementation.

- Information and publicity guide.

- Logos (Program-Project).

- Progress report and guidelines.

The main documents of the Project include the following documents and their amendments during the project implementation process:

- The Applicant Package as applicable

- The decisions of the Monitoring Committee through the 20th written process completed on 10/07/2019 and the 22nd written process completed on 10/12/2018, and the approved Application Form.

- The partnership agreement between the PBs

- Subsidy contract no. B4.5b.01 signed on April 1, 2019.

- Application form and its annexes, including budget justification.

- Project start-up and procurement plan.

- Rules of operation of JPMT

- JWG Operating Rules.

Project documents also include operational documents such as contact lists, notes and meeting minutes, which are developed, exchanged and agreed between partners during JWG meetings. Most of these documents are uploaded to MIS.

More guidance documents are available on the Program website. All project beneficiaries are responsible for regularly checking the content of the official website of the Program in order to comply with the latest requirements and editions of the program documents.

1.2 Assignment Details of the Project

Contract number 23 SYMV013770237 2023-11-15, concerns the conclusion of a contract for the implementation of Deliverables D.3.6.2, D.3.6.3 and D.3.6.4 of Work Package 3 (WP3) of the project. This contract was appointed to LEVER S.A., Thessaloniki, Greece (https://www.lever.gr/).

This deliverable belongs to work package 3 (WP3) of the project "Integrated actions for joint coordination and responsiveness to flood risks, in the Cross Border area" with the acronym FLOODGUARD, which is implemented within the Operational Program "European Territorial Cooperation INTERREG V-A GREECE – BULGARIA 2014- 2020". CPV: 90713000, Consulting services on environmental issues, and includes "Integrated Actions for Coordination and Response to Flood Risks in the Transboundary Area",

1.3 The object of the contractor

The present study is carried out in the framework of the FLOODGUARD programme. It concerns the comparison and evaluation of flood risk assessment methods and models in Greece and cooperation with Bulgarian partners. It also assesses the comparison, evaluation of climate change mitigation and adaptation policies, and their implementation progress in Greece in comparison and cooperation with the Bulgarian partners. It includes an analysis of the environment and the state of legislation for prevention, preparedness and response in case of extreme events.

The working group for this report consists of:

Vasilis ANAGNOSTOU, environmentalist, MSc, LEVER S.A.

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2 Comparison and evaluation of flood risk assessment methods and models in Greece and the cooperation with Bulgarian partners.

2.1 The flood risk assessment models.

Traditional consideration of flood risk is concerned with flood defence projects based on specific hydrological designs and does not consider the effects of flood events that exceed the design magnitude.

Nowadays, flood risk management is carried out with a holistic approach, introducing the concept of the system in which the flood phenomenon develops. It also assesses the flood risk, which depends on the flood hazard combined with the potential impacts on the environment and human activities. Mitigation is addressed through structural and non-structural measures, but also at the operational level, which requires adequate preparation and infrastructure.

The components concerning the simulation of the flood are: a) The production of a flood from rainfall (but also other more rare cases such as, Sea waves, overflow or destruction of a dam, etc.). b) The method of transporting water (rivers, irrigation canals, etc.). c) The developed techniques and projects related to the containment of the flood phenomenon (dykes, dams, etc.) and d) The effects of the flood event on infrastructure, protected nature areas and human activity.

The levels of information that are necessary for the modeling of the flood risk are: a) The rainfall data of the area, b) The hydrological and hydraulic analysis of the area c) The geological and morphological data of the area (digital terrain model DEM, etc.) and d) The analysis of vulnerability and impacts in the area based on socio-economic and environmental criteria.

The aim of a flood risk models is: the preparation for a possible flood event through infrastructure identification and location, management plans, and hydrometeorological forecast in real time. (SOURCE: Efstratiadis, A et al. 2010)

The results produced by flood models mainly concern flood hazard maps and real-time flood forecasting systems.

The subject of hazard maps is defined in accordance with Paragraph 3, Article 6, of the Flood Directive 2007/60/EC, and it is prepared for three cases:

- Low probability of flooding
- Medium probability floods (recurrence ≥ 100 years)
- High probability flooding, depending on the case.

The hazard maps represent the area that a flood is expected inundate for the various hydrological cases considered.

The elaborated results from the flood data are posted publicly and used for the public consultation of the Flood Risk Management Plans. They are addressed to:

- the authorities dealing with the management of water resources,
- civil protection and
- the wider public.

The background of the maps is usually satellite photos, orthophoto maps or large-scale cartographic data.

Information submitted to the WISE system is submitted at a map scale of up to 1:250,000 and the information is provided through Geographic Information Systems in the form of polygons, line or point information.

(SOURCE: EBROS DRAINAGE BASIN FLOOD RISK MANAGEMENT PLAN, GREECE)

Three models (ATelier Hydrologique Spatialisé (ATHYS), Hydrologic Modeling System (HEC-HMS) and Soil and Water Assessment Tool (SWAT)) with different characteristics have significant potential in flood modelling. The comparison of the models using multiple criteria showed that all three models are capable of reproducing the observed flows.

(SOURCE: Mourad Aqnouy et al., 2023)

A model that could be used for the season is the weap.

The Water Evaluation and Planning system, or WEAP, aims to integrate these issues within the framework of a practical and robust tool for integrated water resources

planning/management. WEAP was developed by SEI Stockholm Environment Institute's U.S. Center.

(SOURCE: https://weap21.org/index.asp?NewLang=EL)

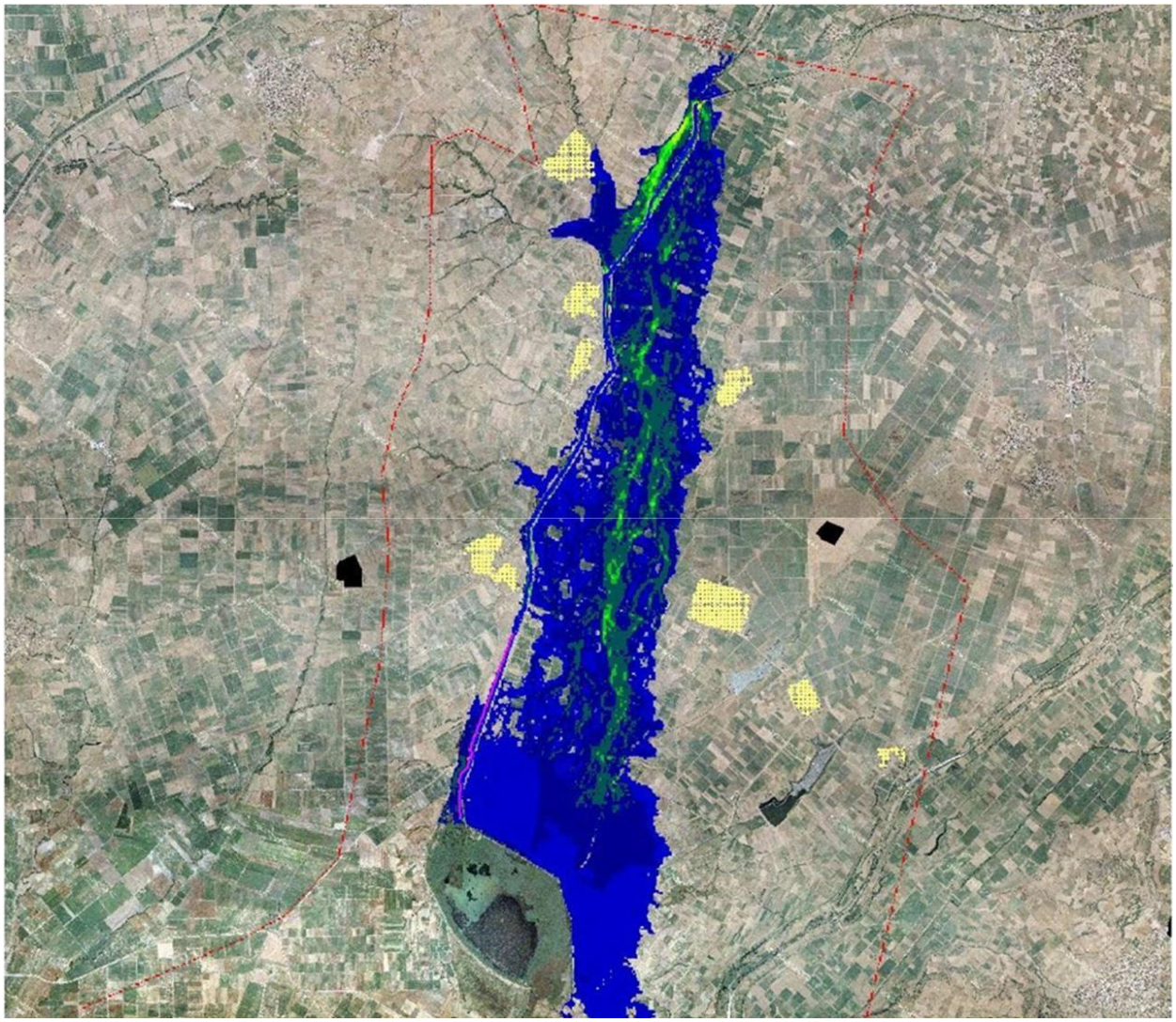

Figure 1 Flow velocities for Vozvozis River in Thrace, for T=100. (Source: Flood Risk Management Plan for Thrace https://floods.ypeka.gr/egyFloods/gr12/Reports/I_3_P05_EL12.pdf)

2.2 The flood risk assessment methods and models in the Study Area

The software that has been used for the hydraulic simulation of the Greek area of the transboundary Evros River, is the Danish Hydraulic Institute (DHI) MIKE FLOOD comprehensive flood simulation and forecasting package. MIKE FLOOD is a set of computational tools for one-dimensional (along-river) and two-dimensional (out-of-bed and on-floodplain) flow simulation of flood events. At the same time, it provides a single shell – work environment and user interface – which allows data input and execution of the computational models it includes in an integrated form. Input of background data (digital terrain model, flood hydrographs, etc.), presentation of results, control and communication of simulation models are done entirely through the single shell, facilitating the user and allowing automated transfer of results from one-dimensional in 2D analysis and vice versa.

The software used is widely used for the preparation of flood risk maps internationally. It is approved for this work by the US Federal Emergency Management Agency (FEMA). which manages the mapping of flood risk areas in the United States. It has also been widely used in the European area to identify and control the mechanisms of flooding in many European cities. Through MIKE FLOOD, the one-dimensional flow model MIKE11, which calculates the flow within the main bed of the rivers Evros and Arda, and the two-dimensional model MIKE21, which simulates the flow in the flood field, have been connected in a simultaneous simulation.

The topographic data on which the hydraulic simulation in the flood field was based are the digital terrain model (DTM) of Ktimatologio SA with a 5x5 m cell canvas for the Greek part of the basin and the ASTER GDEM v2 model with a 30x30 m cell canvas for the Bulgarian parts of the basin. In the river zone, and in some parts of the Greek basin near the bed which are not covered by the DEM of the Cadastre, the two topographic backgrounds were stitched together.

Assumptions of the simulation Hazard and risk maps should be read with the following key assumptions of the simulation performed:

- A key assumption is that main Evros River embankments – at this stage – are not subject to failure during the simulation, only to overtopping. This is because there is a potentially infinite number of possible fracture locations that can be simulated as such. Therefore, it is preferable to do this in an organized

manner focusing on points given from historical data, or where it would be desirable to happen.

- The failure of the levees allows conclusions to be drawn about the adequacy of the levees altitudinally – that is, for what period of reset they can withstand as an absolute elevation under present-day conditions. This would not be possible to estimate with the breach simulation, because in this case part of the flood discharges at the point of the breach and therefore affects downstream embankments.
- Another key assumption is that volumes of water that overflow into the floodplain remain there (for the most part) and do not return to the river.
- The above assumption has the practical consequence that it does not allow the full clarification of the balance of flows between the river and the floodplain. Determining this balance with sufficient accuracy is difficult due to the lower resolution of the altimetry in the neighboring countries, which does not allow an accurate determination of the flood depth, and consequently of the overflowing volume of water towards them. In addition, to determine the overflow volume accurately, a very large area would have to be hydraulically simulated.

An important flood model for the study area is ARDAFORECAST, which is a reliable flood warning system developed for the Arda River.

ARDAFORECAST is a cross-border early warning system on the Ardas River, developed by the cooperation of Greece and Bulgaria. This system was developed to secure people and infrastructure along the floodplain. The operational flood forecasting technology for the Arda river basin can provide warning five days before the flood event. The project essentially contributes to the safety of the local population from flood events. The project started in 2012, under the supervision of the Bulgarian National Institute of Meteorology and Hydrology (NIMH), in collaboration with the EABD in Plovdiv, Bulgaria, the Greek Regional Development fund (RD) in Komotini and the Democritus University of Thrace (DUTH) in Xanthi, Greece.

The project gives results for the entire Ardas basin and transmits the information in real time. The project contributes to reducing the consequences of floods: on people's health, the environment, economic activity and the cultural heritage of the region. It promotes cross-border cooperation and education of the local population about flood risks.

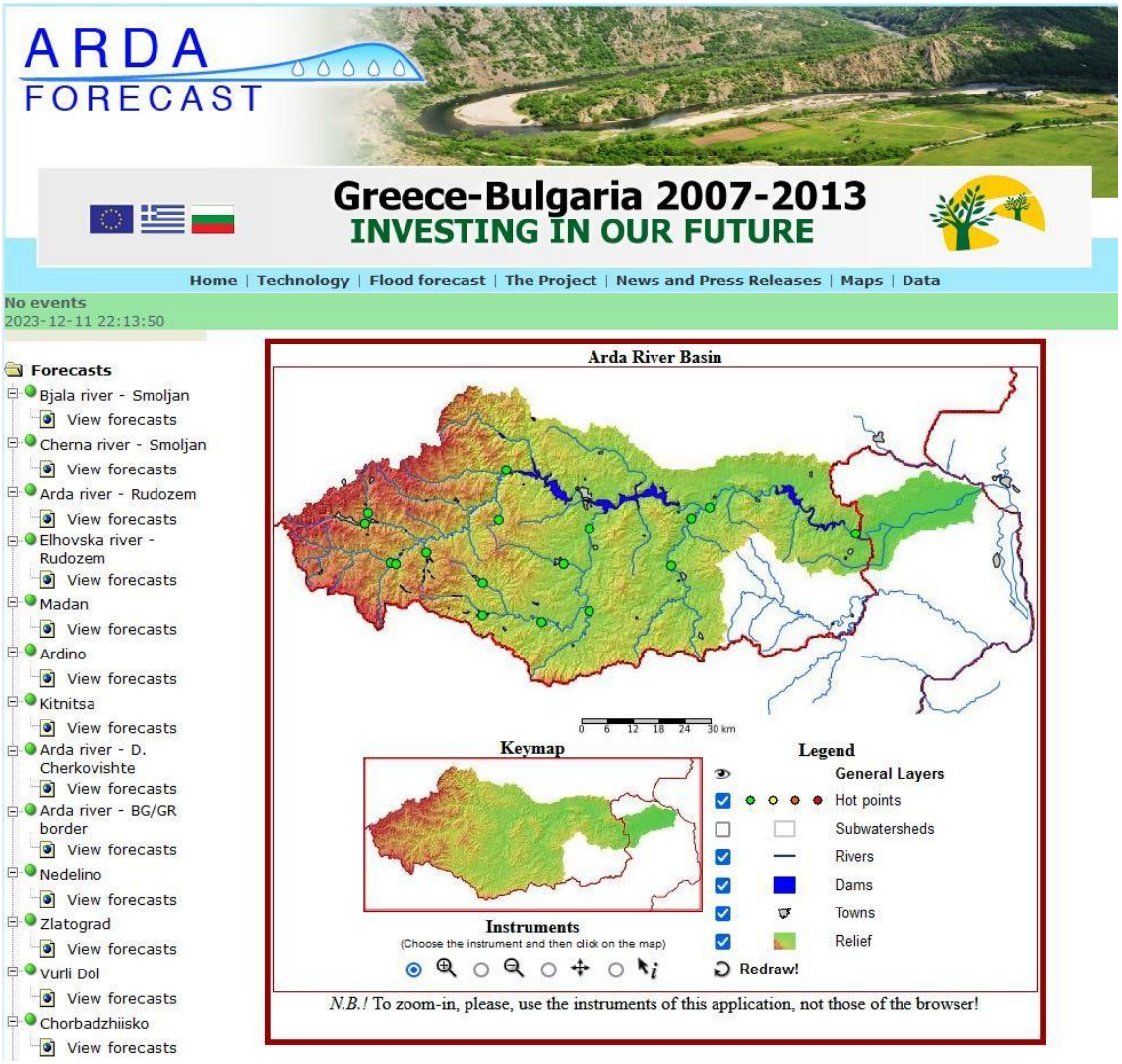

Figure 2 The ARDAFORECAST early warning system (Source: https://arda.hydro.bg/index.php?glaven=alertmap)

For the successful operation of the ARDAFORECAST project, reliable forecasting tools have been installed and operated for accurate and timely flood forecasts with adequate response time. This was achieved by improving the density and frequency of the existing monitoring network, installing additional automatic measurement stations, establishing a hydrometeorological data system, developing a GIS database and forecasting models to facilitate data dissemination in the transboundary area, in real time.

The ARDAFORECAST project includes outreach measures aimed at local residents to further prepare and protect them from the risks that exist in the event of a flood. In this way, an efficient approach to the dissemination of flood forecast information and flood warning messages has been established for end users.

The following image shows the operation algorithm of the Early Warning Systems.

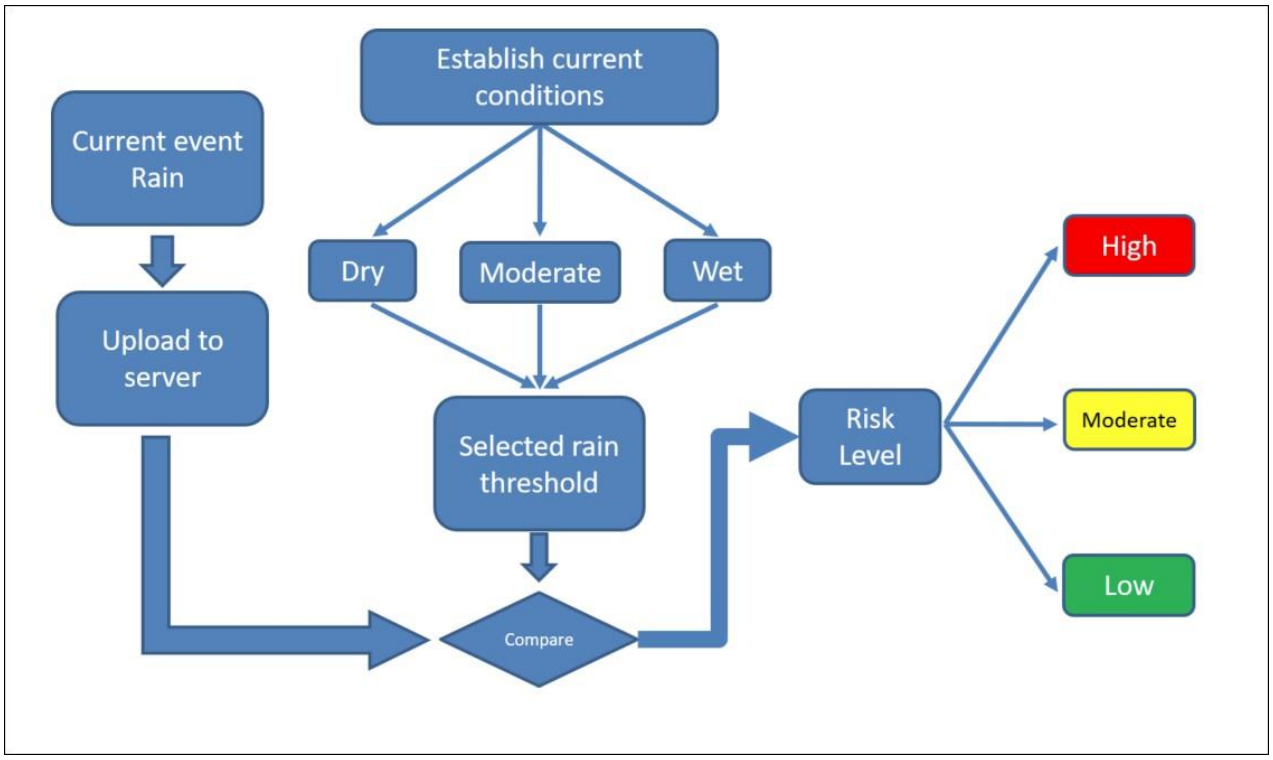

Figure 3 Early Warning System Algorithm (SOURCE: https://ermis-f.eu/)

The FLOODGUARD project has contributed significantly to the exchange of vital data for setting up hydraulic models in the Bulgarian Basin. Then this hydraulic model will be connected to the corresponding Greek ones.

The following images show the Early Warning System hydraulic model developed in the context of FLOODGUARD and captures the hydrographic characteristics of the cross-border area of Bulgaria and Greece.

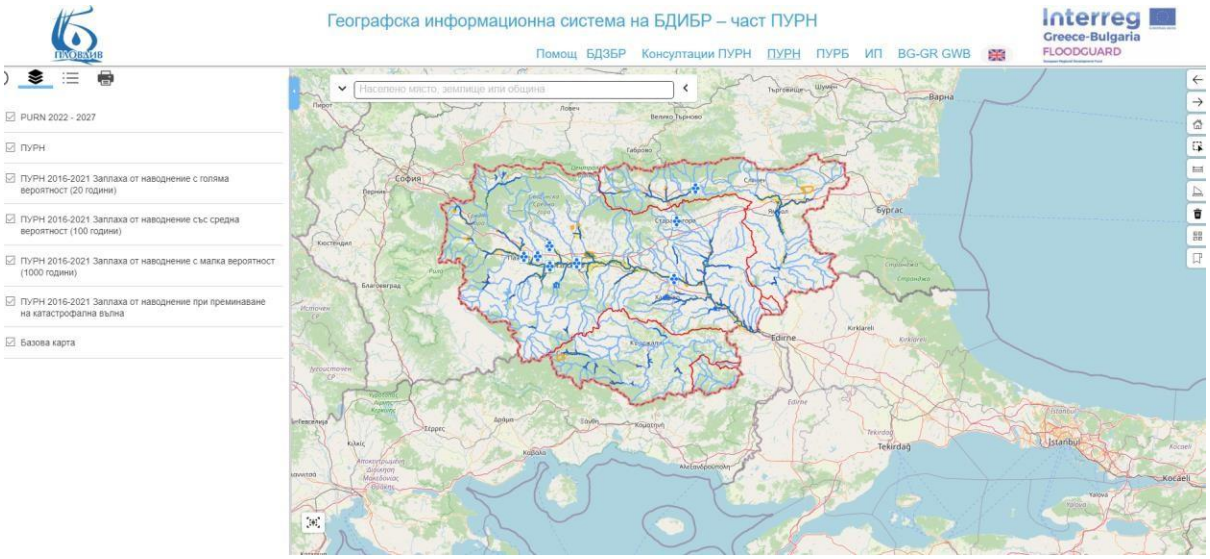

Figure 4 The environment of the hydrographic model, which was implemented in the framework of JWG collaboration.

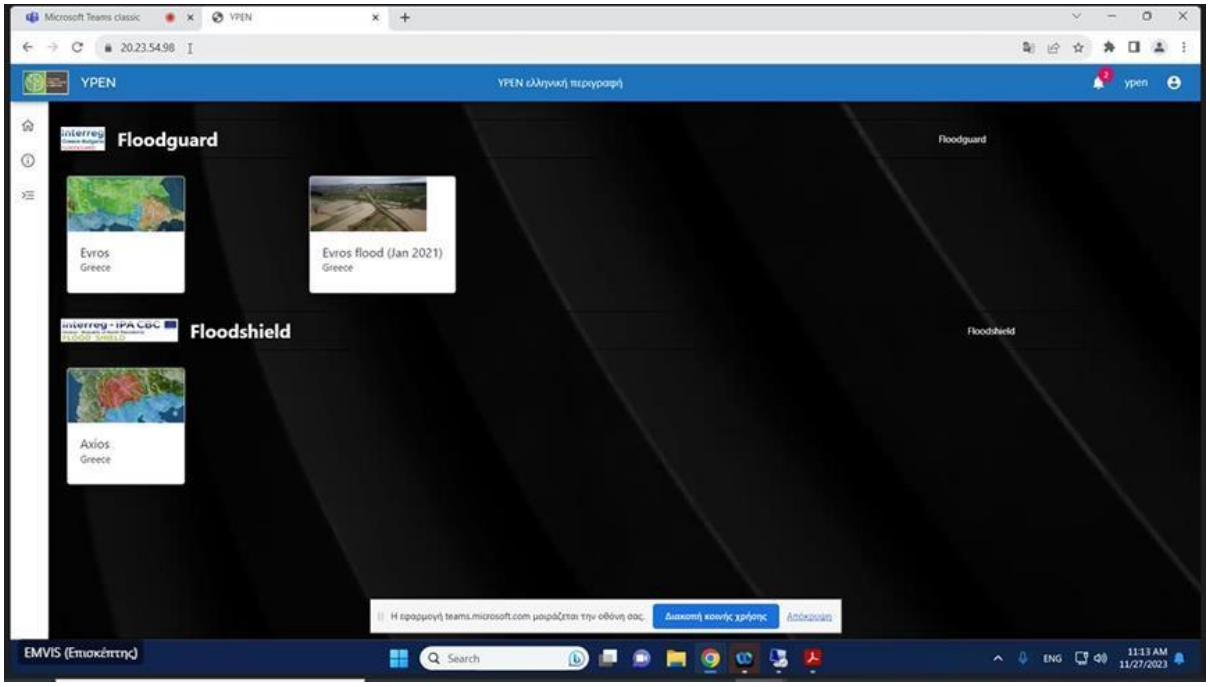

Figure 5 Presentation of the Early Warning System software – The major thematic areas, as seen from the YPEN page.

Another important outcome of FLOODGUARD is that it contributes to the implementation of anti-flood projects, which do not affect the European Environmental Acquis of the region.

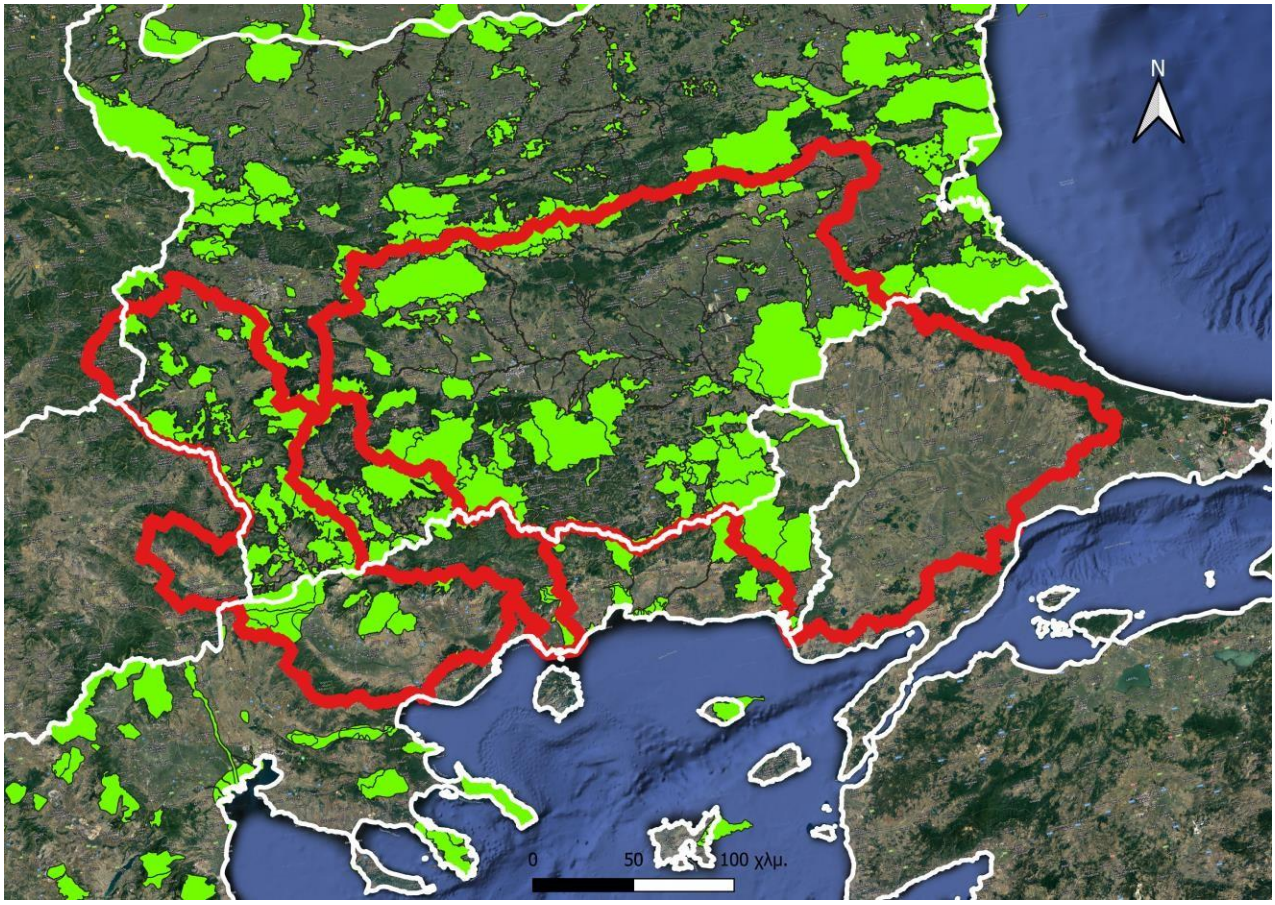

Figure 6 The Natura 2000 protected areas (light green color) in Bulgaria and Greece and the transboundary river basins (red color) between the countries (white color).

Flood protection projects are implemented after an analytical study of the flood risk has been carried out. Maps are drawn up to show the areas at risk. This is followed by an analysis of the natural and man-made environmental elements in the project area and an evaluation of alternative solutions. The environmental impact assessment is carried out during all phases of the project (construction and operation), and appropriate measures are proposed: prevention, mitigation and restoration of the environment. Design of flood protection works takes into account:

- The operational hydrographic system at a river basin level.

- The restoration of the existing river bed into the rivers natural place of the hydrographic network.
- The relevant restoration projects of the historical river beds.
- The implementation of technical projects that do not affect the environmental acquis of EU member countries.

The main objectives of the project are:

- The anti-flood shielding of the area with the aim of substantially reducing the flood risk.
- The protection and promotion of streams and the recognition of their values for the functions of the natural system.
- The safe management of the stormwater of the study area, the improvement of the flow conditions and the control of the process of erosion and deposition of transported materials in the streams.
- The technical works should concern:
- The restoration of the natural hydrographic network with demolitions, opening of dammed streams and general modification of the urban plan, taking into account the streams.

- Slope strengthening projects
- Construction of terraces and leveling of slopes.
- Technical projects for water drainage.
- For the River Evros, which belongs to the water division EL12, a special Flood Risk Management Plan has been prepared and drawn up, where more specific
- the objectives, which result from:
- The experience that exists in the area from previous flood events
- The geospatial analysis of the area and the creation of Flood risk and vulnerability maps
- The requirements of Directive 2007/60/EC.
- The prioritization for the implementation of measures

(SOURCE: SDKP of the Evros River Basin).

The data exchanged within the framework of the FLOODGUARD program contributes to the proper design of flood protection projects.

2.3 The cooperation framework with the Bulgarian partners.

Regarding the production of the Hazard and Flood Risk Maps, the coordination actions that have been carried out between the two countries to date are as follows:

1. The two sides coordinated the Recovery Periods (RPs) of the risk analysis, taking into account that the RP of the high-probability flood is set as 20 years by Bulgaria and 50 years by Greece. Thus, they included in their analysis both PEs for the border section of the river Evros.
2. Information was exchanged on hazard and flood risk assessment methodologies.
3. Greece has informed the Bulgarian side about: (a) the topographic data available in the border section of Evros and the methodology for producing the digital terrain model and river cross sections, and (b) the data of the hydraulic simulation model (roughness coefficients , boundary conditions, etc.).
4. Bulgaria has communicated to Greece the peak flows for the 20, 50, 100 and 1,000 year PEs at the border for the rivers Evros, Arda, Strymonas and Nestos (estimated peak flows but not hydrographs). Cooperation between Greece and Bulgaria also existed within the framework of the Greek-Bulgarian program "Flood warning system establishment in Arda river basin for minimizing the risk in the cross border area).

The general objectives of the project are to improve the management of flood risks in the border area, to increase the effectiveness of flood mitigation measures and finally to define flood prevention policies or measures to improve safety and quality of life.

In the framework of the FLOODGUARD program, a very constructive cooperation has developed between Greece and Bulgaria.

In the framework of this cooperation, an exchange of information has been carried out on the methodological approaches of the two countries regarding Flood Risk Assessment

Figure 7 The catastrophic Thessaly, Greece, flooding of 2023 expected in T=1.000 years

The JWG team has managed to achieve high goals at the level of its operation so far. A very important result is the substantial and direct exchange of data, information and know-how. This fact already contributes to a better assessment of the flood risk compared to the past, the lack of information that existed in the past created significant weaknesses in the modeling of the flood risk.

The operation of the team is based on the substance of the FMPs (Flood Risk Management Plans), and will contribute substantially to their update, producing more complete data for the transboundary area.

Figure 8 A work meeting of the JWG for FLOODGUARD

The exchange of experiences, know-how and practices related to dealing with flood phenomena, can upgrade the operational capabilities of both countries, and increase the level of cooperation for their joint prevention and response.

The JWG team is interdisciplinary, as it includes a wide range of specialist scientists with recognized expertise in their field: engineers, geologists, environmentalists, foresters, communication specialists, stakeholders, etc. The interdisciplinary approach followed contributes essentially to finding solutions at the levels of prevention and response to flood events.

3 Comparison and evaluation of climate change mitigation and adaptation policies and implementation progress in Greece in cooperation with Bulgarian partners,

3.1 The implementation of climate change mitigation and adaptation policies – The cooperation framework with the Bulgarian partners.

Climate transition is a key priority of the European Council and the Council of the EU.

The EU is working on an overhaul of its climate, energy and transport legislation with the so-called "Fit for 55" package to bring existing law into line with the EU's 2030 and 2050 climate goals. The package includes:

- the revision of the EU Emissions Trading System (ETS)
- the effort sharing regulation
- the directives on renewable energy sources and energy efficiency
- the regulation on land use and forestry
- the regulation on CO2 emissions of cars and semi-trucks
- Fit for 55 (general information)

The aim of the European Climate Law, as one of the components of the European Green Deal, is to enshrine in legislation the goal of a climate-neutral EU by 2050.

The regulation establishes a European Scientific Advisory Committee on Climate Change, which will provide independent scientific advice and report on EU climate action. It envisages setting an interim climate target for 2040 in the following years.

Council approves European climate legislation (press release, 28 June 2021)

The EU Climate Change Adaptation Strategy will help the EU to be better prepared to deal with the impacts of climate change.

In February 2018, the EU adopted revised rules for the EU Emissions Trading System (ETS). The EU ETS was established in 2005, is the world's first major carbon market

and remains the largest. It sets an overall cap on CO2 emissions for heavy industry and power stations. The total volume of permitted emissions is distributed to companies in the form of permits, which can be traded.

Reform of the EU Emissions Trading System: Council approves new rules for 2021 to 2030 (Press release, 27 February 2018)

In December 2019, the EU and Switzerland agreed to link their emissions trading systems. This agreement will be mutually beneficial for the EU and the Swiss Confederation, as linking systems with global caps and emission trading rights can increase the available emission reduction potential and enhance the cost-effectiveness of their trading.

Connecting Switzerland to the EU emissions trading system – entry into force on 1 January 2020 (press release, 9 December 2019)

The aim of the regulation is to ensure that these sectors contribute to the reduction of greenhouse gas emissions. These sectors are, among others, buildings, agriculture (non-CO2 emissions), waste management and transport (excluding air transport and international shipping).

Effort Sharing Regulation: Council approves emission reduction targets (press release, 14 May 2018)

Land use and forestry.

In May 2018, a new regulation was issued to improve the protection and management of land and forests. Through this regulation, greenhouse gas emissions from land use, land use change and forestry (LULUCF) were integrated into the 2030 climate and energy framework.

Driving the transition to a low-carbon economy (general information)

EU Member States must submit and regularly update their National Energy and Climate Plans (NECPs) to demonstrate their contribution to energy efficiency and renewable energy targets and emission reduction targets. The ESECs were established in the framework of the Energy Union strategy and the first of them cover the period 2021-2030.

Energy Union (general information)

The Council has also established further policy actions in relation to the fight against climate change and in the context of the European Green Deal strategy. These

include the Just Transition Mechanism, the Farm to Fork Strategy, the Biodiversity Strategy and the European Industrial Strategy.

European Green Deal (general information)

The EU is leading the fight against climate change.

The EU is determined to lead the global effort to tackle climate change. EU leaders aim to make the EU climate neutral by 2050, as set out in the Paris Agreement. EU countries want to work together in the coming decades to reduce greenhouse gas emissions as much as possible and take measures to offset the remaining emissions

(SOURCE:https://www.consilium.europa.eu/el/policies/climate-change/eu-climate-action/)

- In this context, the European Commission has started the processes of formulating the necessary climate and energy policies towards 2030. Once this policy mix is clear and written, it is expected to contribute both to addressing climate threats and to promoting competitiveness and energy security in the EU
- With the Green Paper issued by the European Commission at the end of March 2013, it launched a public consultation process on what it should include.
- The Green Paper asks a number of questions, including but not limited to:
- what will be the type, nature and level of climate and energy targets that should be set for 2030?
- how can coherence between different policy instruments be achieved?
- how can the energy system best contribute to EU competitiveness?
- how should the different capacities of the Member States be taken into account?

etc.

In light of the views expressed by the member states, the EU institutions but also all stakeholders and the general public, the Commission intends to present its proposal for the 2030 climate and energy policy framework by the end of 2013.

(SOURCE: https://ypen.gov.gr/perivallon/klimatiki-allagi/politikes-kai-draseis-antimetopisis-klimatikis-allagis/)

The main sectors affected by climate change are: Water Sufficiency, Nutritional Sufficiency, Energy, Environment and Health and Safety. Measures to adapt and

mitigate the effects of Climate Change are needed in the Region. Below are analyzed the effects in each sector and proposals for measures to mitigate the effects and adapt to Climate Change.

Sufficiency of Water Resources: The reduction of water reserves worldwide is an issue that humanity is already facing due to the effects of climate change.

Climate change brings important issues to the adequacy of water resources. The reduction of atmospheric precipitation combined with the transformation of the climate into a warmer and drier one, will significantly reduce the water reserves of the region.

Food sufficiency: Climate change has significant implications for food sufficiency, as large areas that were cultivated until now will be desertified

Energy: The sufficiency of energy resources will be an issue, which is related to climate change, which is accompanied by a large increase in energy resources

Environment: The change of the natural environment is intensified by the change of the climate and brings great effects and rearrangements in the biotic and abiotic system.

Health and safety: The climate crisis will bring important issues concerning the health and safety of humanity, food and water sufficiency is expected to decrease and natural disasters (fires, floods) will increase.

For dealing with natural disasters, the most important proposals recorded by the Economic and Social Committee of Greece are: 1) Strengthening of civil protection structures at central, local and operational level, with specialization of actions and responsibilities without overlapping.

2) Reconstitution and staffing of the competent public services in the light of the management of multiple threats,

3) Education, training, institutional strengthening of public administration executives and services

4) Creation of monitoring and evaluation mechanisms for projects financed by public and private resources

5) Strengthening the development of collective initiatives at the level of cooperatives, chambers, etc.

6) Reduction of bureaucratic obstacles for small and large-scale investments in the field of alternative energy sources

7) Exchange of know-how between countries in international and regional

8) Cross-border cooperation for the protection and resilience of international infrastructures (railways, energy pipelines, transport).

9) Strengthening of regional infrastructures with financing means and resources.

10) Funding of environmental and epidemiological studies and programs to deal with the effects of climate change on health.

11) The digital transition as a driver and accelerator of the green transition,

12) Planning interventions in local and supra-local infrastructures) to strengthen the resilience and sustainability of quality tourism.

13) Reduction of the environmental footprint of public spaces and buildings in general.

14) Introduction of educational material at all levels of education, administration and security forces to respond to new environmental changes and to raise awareness of natural resource management, waste, etc.

15) Introduction of training programs in business units for staff and employers. In addition, we mention the creation of collaboration networks at the level of scientific, university and production products so that we have access to data and knowledge that will accelerate technological development, while creating open databases (such as meteorological information) that are more efficient scientists and derivatives. (SOURCE: https://www.oke.gr/el/opinions/klimatiki-allagi-kai-politikes-antimetopisis-tis-stin-ellada-kai-tin-eyropaiki-enosi)

4 Analysis of the environment and the state of legislation for prevention, preparedness and response in case of extreme events

4.1 Analysis of the particularities of the area (Natural, man-made system)

The study area concerns the Regional unit of Evros, which is characterized by important natural areas, which are under protection status. Based on Directive 2000/60/EC and PD 51/2007, a register of areas requiring special protection based on specific provisions of Community legislation for the protection of their surface and underground waters or for the preservation of habitats and species directly dependent on water.

The climate of the wider area is characterized as Mediterranean (mid-Mediterranean) with continental winters due to the northerly winds. The annual amount of precipitation exceeds 700 mm. The average annual temperature ranges from 13.7 to 15 °C.

The economic activity of the region is inextricably linked to the natural environment, with great development in the primary sector (agriculture, livestock and logging), as well as in the tertiary sector. Most crops in the area are annual, while a smaller percentage of orchards and vineyards are recorded. In recent years, crops and livestock are shrinking, correspondingly, logging is also decreasing. Beekeeping is an important activity for the region, which is particularly flourishing, especially around the National Park area.

Regarding the Geology of the area, the area is located in two main geological zones:

- the north, where it is characterized by strongly eroded ophiolitic complexes that have formed a gentle relief and
- the south, where volcanic and sedimentary rocks predominate, forming a varied relief with rocky outcrops.

The topography of the area is characterized by alternations of small and large valleys, as well as a highly developed hydrographic network with small and large streams. The vegetation in the area is rich and diverse and has typical species of the eu-Mediterranean and para-Mediterranean zone. Much of the vegetation is forest, the composition of which is due to the influence of the river Evros, the climate, the

geomorphology, the geology and the composition of the soil horizon. Characteristic species in the area are: Scots pine (Pinus brutia), black pine (Pinus nigra), oak (Quercus spp.), which grows in clumps, other deciduous species and maquis vegetation.

In the area is the Evros Delta National Park, which is under special protection, administratively it belongs to the Region of Eastern Macedonia and Thrace. The area is bounded to the east by the river Evros, where it is a natural boundary and defines the Greek-Turkish border.

The Evros delta is a very important natural area, as it supports a variety of wetland systems, great biodiversity. And it supports a series of man-made activities, such as: Agriculture, fishing (in marine, lagoonal and inland water environments), animal husbandry, Environmental Education, scientific research, Ecotourism, etc. It faces significant pressures and threats, due to the activities that develop in great intensity and extent.

An area of very high ecological value, on a local, national and international level, is the National Forest Park of Dadia - Lefkimi - Soufli, which is located in the middle of the prefecture of Evros and occupies an area of 428,000 acres. Rich biodiversity is recorded in the area, with a very large number of different species of flora and fauna and of particular interest in the rich avifauna of the area, where rare predatory species are found, it is worth noting that significant populations of Black Vultures are recorded in the area. The area is also characterized by high geodiversity, with a wide variety of landforms (rock formations, ravines, multifaceted relief, etc.)

The summer fires that took place in 2023 caused a very large impact on the forest in the area, the restoration of which will take several decades to take place. Degradation of the forest system due to fires significantly intensifies the flood risk.

The following table presents the areas of the Natura 2000 network, located in the study area.

Areas of the Natura 2000 LAP Evros network

n/a Code Type Name Area (ha)

1 GR1110002 ΖΕΠ Dasos Dadia – Soufli 41,111.58

2 GR1110003 EZD Three Faucets 9,912.62

3 GR1110005 EZD Evros Mountains 42,372.5

4 GR1110006 ZEP Delta Evros 12,557.92

5 GR1110007 Evros Delta and Western Arm EZD 9,857.56

6 GR1110008 ZEP Riverside Forest of Northern Evros and Arda 25,931.73

7 GR1110009 ZEP Southern Forest Complex of Evros 29,275.36

8 GR1110010 ZEP Orinos Evros – Dereio Valley 48,907.49

9 GR1110011 ZEP Erythropotamos Valley. Asvestades, Koufovouno, Vrisika 9,587.1210 GR1130011 ΖΕΠ Filiuri Valley 37.565,9

In addition to the special natural environment, the area of the National Park is of special archaeological interest, as a number of archaeological sites dating from the prehistoric to the post-Byzantine period have been recorded.

4.2 Analysis of land uses in the study area (Corine 2000)

The main land uses in the area are livestock and agriculture, which are the most developed sectors of the local economy. It is an important site for the breeding and wintering of raptors and other forest-related bird species.

The main areas in the Evros river basin consist of irrigated land, permanently irrigated land, coniferous, broad-leaved and mixed forests, other crops and shrubland.

The cultivated areas are fed by rainfall (cereals, tobacco, sunflowers, etc.) and are concentrated on the plains. Irrigated crops such as cotton, corn, sugar, rice and vegetables are grown on the flat areas of Lake Vistonida, Xanthi, Komotini, Alexandroupoli and along the rivers where irrigation water sources are available. (SOURCE: Astaras & Lamprinos 1988)

The following figures show the land use maps of the region.

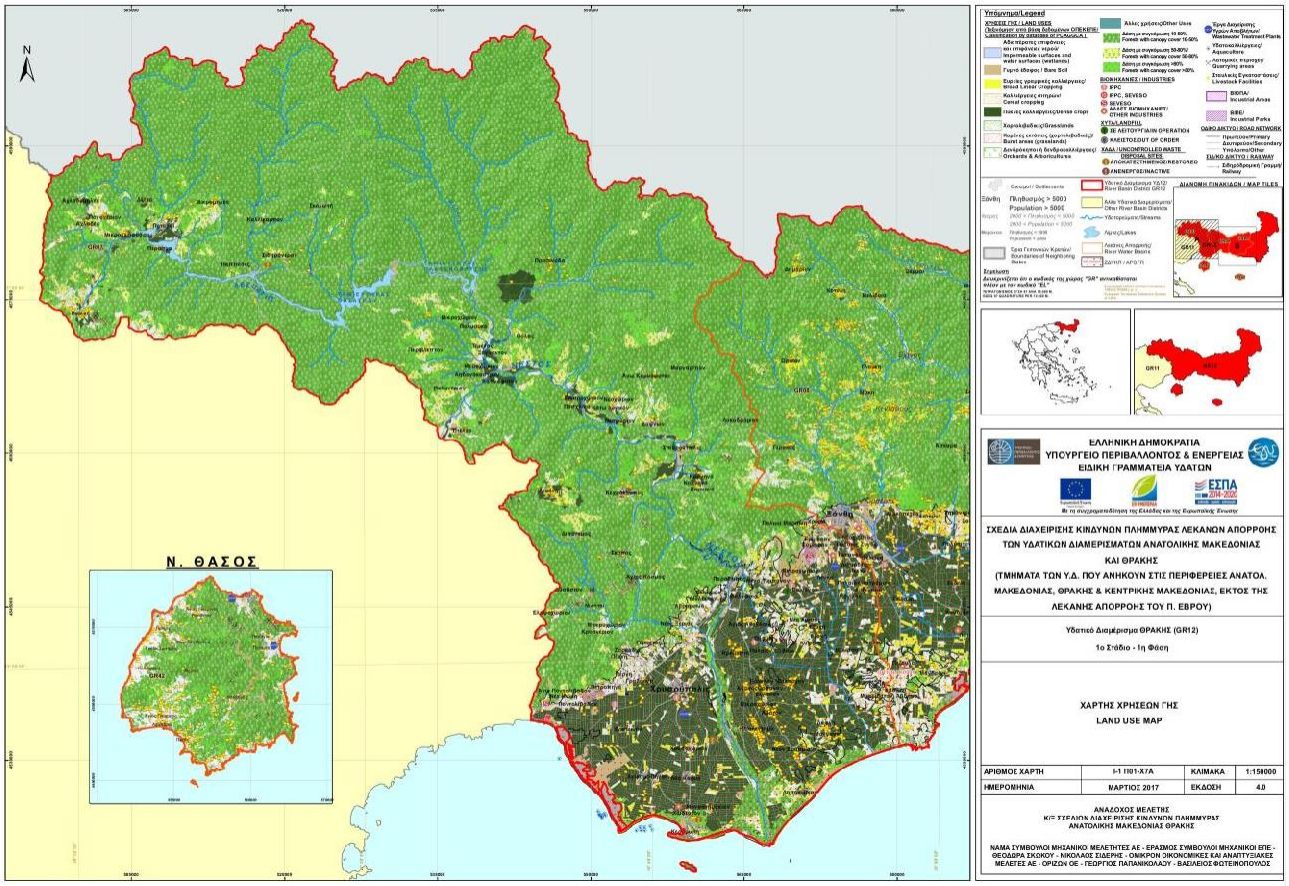

Figure 9 Land use of Evros,first part (SOURCE: https://floods.ypeka.gr/index.php?option=com_content&view=article&id=266&Itemid=1114)

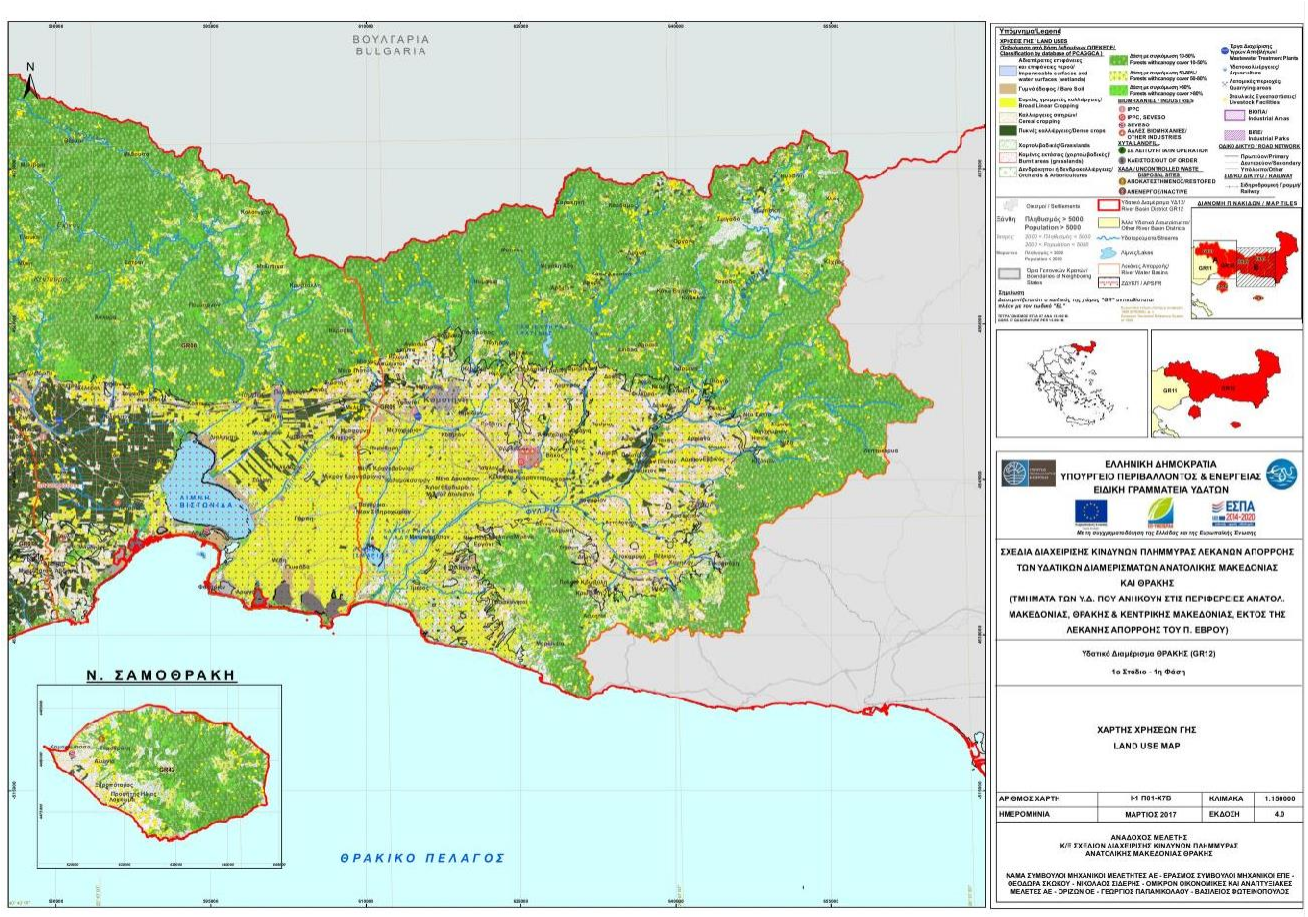

Figure 10 A Figure 11 land use of Evros, second part (SOURCE: https://floods.ypeka.gr/index.php?option=com_content&view=article&id=266&Itemid=1114)

4.3 Description of the National legislation concerning the prevention, reaction, and response to flood phenomena.

The National legislation regarding the prevention, reaction and response to flood phenomena is:

• Eng. D1(a)/GP house 47627/2023 (Official Gazette /-- 14.9.2023)

Post-Flood Public Health Protection Guidance to Citizen Services

• Eng. D1(d)/GP house 46748/2023 (Official Gazette /-- 8.9.2023)

Taking measures to safeguard Public Health after severe weather and flooding

• WILL. 1299/2003 (Official Gazette 423/B` 10.4.2003)

Approval of the Civil Protection General Planning from 7.4.2003 with the watchword "XENOCRATIS"

• Law 2576/1998 (Official Gazette 25/A' 9.2.1998)

Improvement of the procedures for the assignment of the construction of public works and other provisions

• Flood protection instructions (Ministry of Climate Crisis and Civil Protection).2nd Edition of the General Plan for Confronting Emergencies and Immediate/Short-Term Management of the Consequences of the Event of Flood Phenomena with the code name "DARDANOS 2"

• Flood and Tornado Guidelines (Fire Academy)

• Information on the content of Directive 2007/60/EC on the assessment and management of flood risks.

• The K.Y.A. H.P. 31822/1542/E103/2010 (Government Gazette 1108 B'/2010) by which Directive 2007/60/EC was incorporated into national law as amended and in force by Government Decree 177772/924/2017 (Government Gazette 2140 B΄/20).

• Information on the Preliminary Flood Risk Assessment (PFRA) implemented by the Special Water Secretariat of the Ministry of Environment. Information on the Hazard Maps (FHMs) and Flood Risk Maps (FRMs) prepared for the Potentially High Flood Risk Zones (APSFRs)) in all Water Departments of the country. The Flood Risk Management Plans (FRMPs) in all Water Divisions of the country.

• All Technical Reports and Maps accompanying the Flood Risk Management Plans (FRMPs).

• Interactive Maps with information on Flood Risk Management Plans (FRMPs).

• The electronic files of the Reports and Maps drawn up by the Special Water Secretariat in the context of the implementation of the Flood Risk Management Plans - FRMPs.

Figure 12 The Flood Risk Management Plan for River Evros in Greek (source: https://floods.ypeka.gr/index.php?option=com_content&view=article&id=1106&Itemid=1145)

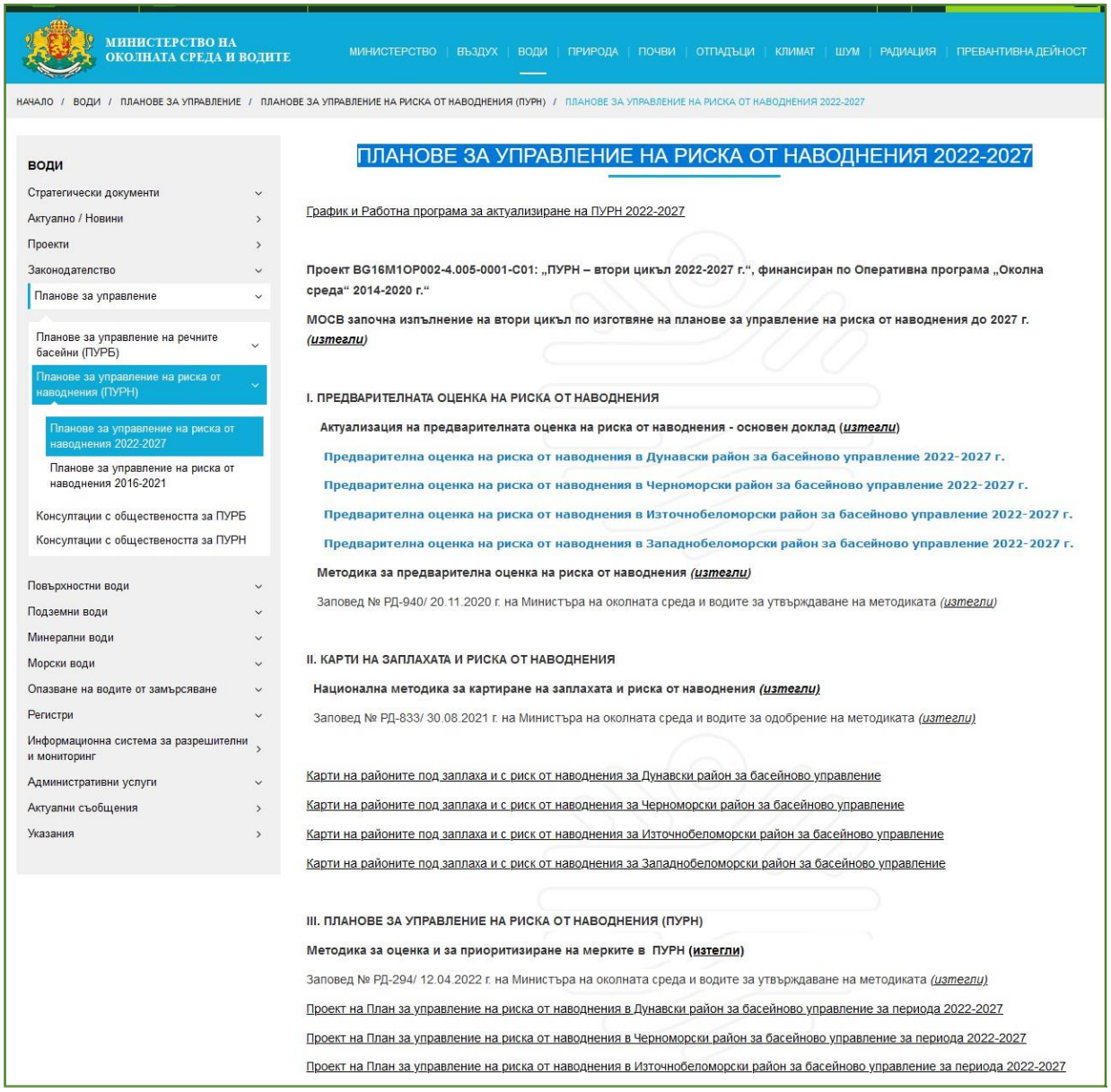

Figure 13 The Flood Risk Management Plan for East Aegean Rivers in Bulgarian (source: https://www.moew.government.bg/bg/vodi/planove-za-upravlenie/planove-za-upravlenie-na-riska-ot-navodneniya-purn/planove-za-upravlenie-na-riska-ot-navodneniya-2022-2027vmchvch/)

5 Conclusions

The outcomes of FLOODGUARD are valuable for both countries. The conclusions and the shared practices co-shaped operationally the JWG group and formulated a basic level of information, that should be taken into account in the flood defense of neighboring countries, at all levels of planning.

Unfortunately, in the River Basin Management Plans (RBMP) at both countries, the fact of the shared transboundary Balkan rivers is not taken into account, even in the case of Member States of the European Union. (SOURCE: Consultation in Alexandroupoli 17/10/2023).

It should be an important goal of the FLOODGUARD project to highlight its results, so that they can be used at all levels, from planning and prevention, to restoration, against flood phenomena.

At a national level, all relevant bodies and stakeholders, such as the Ministry of the Environment, the Directorate-General for Water, other ministries, the regional governments of the area, the fire brigade, citizens and citizens' associations directly or indirectly affected by floods, should benefit the shared scientific, the accumulated knowledge and the experience in protection from floods. Flood risk management plans should be updated and interact with FLOODGUARD, so that information shared by both countries is delivered in order to promote safety and viability in the region. The results of FLOODGUARD should be updated regularly and taken into account in the planning and prioritisation of flood risk issues. The flood risk management plans of both countries should be based on the information obtained from the transnational cooperation of both countries through the work of the JWG.

The JWG between Greece and Bulgaria can function institutionally, organizationally and efficiently and bring significant positive outcomes for both countries. Nevertheless, in order to be able to continue the specific project and to produce data critical to the flood preparedness of the two countries, it is necessary to continue the existence of the JWG.

The common institutional approach between Greece and Bulgaria significantly strengthens the response to flooding phenomena in the cross-border zone.

The intensifying floods of recent years, due to climate change and the poor management practices adopted over several decades by both countries, increase the

need for a good collaboration with the JWG's interdisciplinary team. And proposals and solutions concerning adaptation to the climate crisis can emerge and be highlighted, without affecting the environmental acquis, as defined by the European Union

Strengthening the knowledge of the local community and recording its opinions on matters of observation of the natural environment, are important requests of the JWG, where it can benefit society through targeted updates on the flood risk, but without creating a feeling of insecurity among citizens. At the same time, it can cover some gaps in terms of information that is useful and managed (such as historical flood records, etc.), by citizens, by recording the ideas and attitudes of the societies around the area of interest of FLOODGUARD.

The DWG team contributes substantially to the assessment, monitoring, prevention and response to flood phenomena. FLOODGUARD should be continued and strengthened to achieve all these results that have significant Socio-Economic and Environmental benefits for both countries.

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