

COMPREHENSIVE STUDY OF FLOODS IN THE REPUBLIC OF BULGARIA FOR THE PERIOD 2010-2020

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Abstract:

The study presents a classification of floods in the Republic of Bulgaria by various characteristics, analyzing the causes of the floods and their consequences. The main floods studied were those that occurred during the period 2010-2020. Special attention is paid to the strategy for prevention and management of flood risk and interaction between the various executive authorities, as well as the procedure for timely notification of the population in the event of a flood. The implementation of the flood risk management plans for the periods 2017-2021 and 2022-2027 is analyzed, with special attention being paid to specific priority activities. The final part formulates conclusions and recommendations relating to the occurrence, prevention and management options for flood risk in the Republic of Bulgaria.

Key words: floods, prevention, strategy, management, recommendations.

INTRODUCTION

As a result of accelerated climate change and human interventions that disregard the natural environment, such as urbanization, industrialization, and other activities, significant disasters, accidents, and catastrophes of varying nature, intensity, duration, and frequency are increasingly being recorded.

In 2021, the UN Climate Change Conference (COP26) in Glasgow, Scotland, unanimously acknowledged that global climate significantly affects local climates, resulting in deviations in the stability of meteorological processes. This trend is also evident in the Republic of Bulgaria, where recent decades have seen an increase in natural disasters, including extreme temperatures (both summer and winter), droughts, strong winds, wildfires, icy conditions, floods, landslides, mudflows, and hailstorms (Fig. 1).

Fig. 1: Manifestation of natural hazards in Bulgaria (2004–2016)

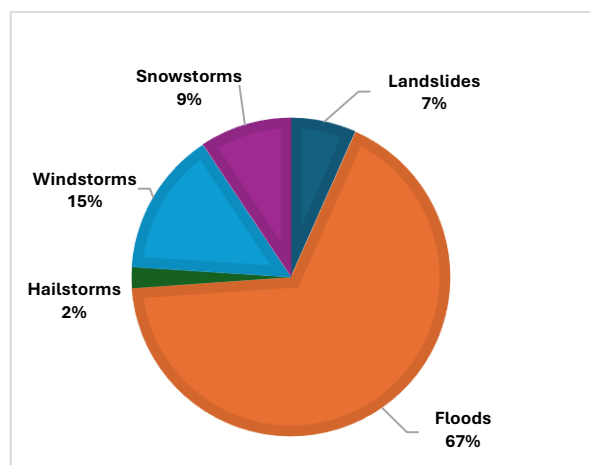
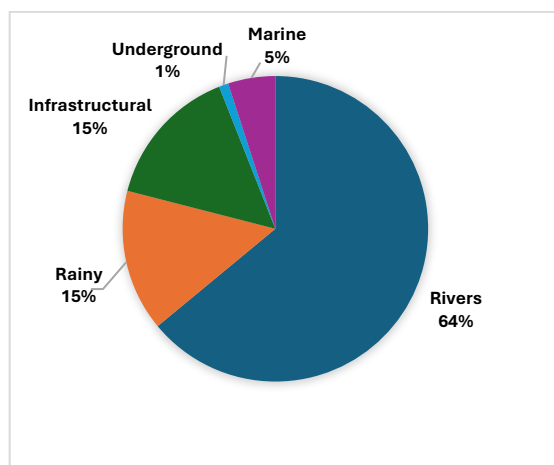


Fig. 2: Types of floods in Bulgaria (2010–2020)



Floods are among the most frequent and destructive natural disasters that affect the territory of Bulgaria (Fig. 2, Table 1-<https://www.nsi.bg/bg>). They can result from various factors, including intense or prolonged rainfall (especially from March to June), improper reservoir management, dam breaches, high

sea waves, and more. The impacts of floods can be severe and long-lasting, affecting human lives, livelihoods, and the environment (Table 2, 3, 4 - <https://www.nsi.bg/bg>).

Table. 1. NUMBER OF FLOODS IN BULGARIA BY REGION DURING THE PERIOD 2010-2020

Areas/years	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total for the country	651	382	692	547	360	266	184	159	84	108	100
Blagoevgrad	14	10	5	14	4	3	5	1	1	2	13
Burgas	82	22	77	37	19	14	42	55	3	4	7
Varna	30	16	11	15	28	47	4	2	1	1	3
V. Tarnovo	24	28	32	17	21	3	1	1	6	6	8
Vidin	1	1	4	-	2	-	-	-	-	-	-
Vratsa	-	10	5	1	5	5	1	-	1	-	-
Gabrovo	8	9	7	2	13	-	2	-	-	4	2
Dobrich	10	21	3	2	4	2	2	1	-	-	-
Kardzhali	11	12	19	9	14	13	26	16	10	16	11
Kyustendil	2	5	11	1	1	17	1	14	2	1	2
Lovech	4	1	1	-	3	-	-	-	-	3	-
Montana	14	11	6	4	30	2	2	5	3	5	3
Pazardzhik	27	11	2	4	7	2	-	1	1	1	-
Pernik	9	13	2	1	1	4	1	2	1	3	4
Pleven	14	10	1	-	19	31	3	4	13	-	7
Plovdiv	9	-	2	2	42	7	2	18	2	4	3
Razgrad	1	-	2	8	5	-	2	-	-	-	-
Ruse	6	5	5	2	11	23	14	4	1	3	5
Silistra	-	4	-	1	2	-	-	-	-	-	1
Sliven	102	51	267	335	25	36	39	21	12	23	17
Smolyan	179	97	98	88	43	29	30	9	20	9	10
Sofia-capital	2	-	-	-	-	-	-	-	-	-	-
Sofia	30	32	8	2	25	7	3	4	6	4	3
St. Zagora	7	5	115	-	8	11	-	-	-	1	-
Targovishte	2	1	-	-	-	-	-	1	1	-	-
Haskovo	3	6	5	1	10	7	4	-	-	17	1
Shumen	1	1	4	1	16	3	-	-	-	1	-
Yambol	59	-	-	-	2	-	-	-	-	-	-

Table. 2. DAMAGE FROM FLOODS IN BULGARIA DURING THE PERIOD 2010-2020 /thousand BGN/

Areas/years	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total for the country	38882	206659	20898	15285	177604	171032	30617	135530	28384	21173	16664
Blagoevgrad	12094	1061	61	116	639	384	75	-	309	404	1446
Burgas	493	140	384	13	16205	136129	807	117959	2418	2455	1030
Varna	2615	1315	1226	1369	37797	3548	4664	669	11	317	696
V. Tarnovo	224	305	1829	789	23834	2061	131	3211	5514	1734	1527
Vidin	-	133	250	-	493	-	-	-	-	-	-
Vratsa	-	230	-	4	25810	635	-	-	-	-	-
Gabrovo	139	78	606	84	6825	-	2792	-	-	-	77
Dobrich	405	499	1	216	7854	1951	34	800	-	207	-
Kardzhali	164	224	1175	1131	976	2418	5436	4230	5792	1185	740
Kyustendil	2249	435	452	301	-	116	11	677	53	254	1
Lovech	460	4	4	-	165	-	-	-	-	952	-
Montana	551	500	342	13	11123	19	-	5	5090	5090	707
Pazardzhik	968	353	-	23	1007	-	-	1000	20	-	-
Pernik	892	22	2	13	9	1	2	75	1	1594	1712
Pleven	1099	792	18	-	1384	2592	12	1440	-	-	265
Plovdiv	4446	-	152	195	17563	1416	8301	2803	2690	1466	1704
Razgrad	26	-	42	1528	307	-	1	-	-	-	-
Ruse	255	868	135	162	1330	4152	2852	631	293	669	1613
Silistra	-	418	-	2536	-	-	-	-	-	-	134
Sliven	1227	719	-	-	62	1335	176	35	131	776	222
Smolyan	8092	8113	8030	6327	3406	9248	5154	1069	4068	2132	3870
Sofia-capital	224	-	-	-	-	-	-	-	-	-	-
Sofia	454	190006	800	409	5738	7040	-	345	1743	707	1
St. Zagora	258	-	842	-	7654	1686	-	-	-	83	-
Targovishte	53	2	-	-	-	-	-	581	251	-	-
Haskovo	273	432	4325	-	4240	225	169	-	-	1148	919
Shumen	11	10	222	53	2905	1476	-	-	-	-	-

Yambol	1210	-	-	-	278	-	-	-	-	-	-
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Table. 3. FUNDS, SPENT FOR FLOOD RECOVERY /thousand BGN/

Areas/years	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total for the country	16375	201136	9855	7338	51773	22665	5778	12227	216650	13523	17347
Blagoevgrad	1231	439	61	119	729	-	156	-	309	404	1129
Burgas	491	478	-	-	14006	11128	-	2450	264	744	947
Varna	1426	448	414	547	6618	2245	1115	1484	205207	317	1338
V. Tarnovo	32	305	1389	789	3081	448	131	3585	1685	3849	3612
Vidin	15	-	87	-	493	-	-	-	-	-	-
Vratsa	-	212	-	4	2896	985	1889	-	3000	-	-
Gabrovo	16	5	-	-	987	620	619	519	643	-	-
Dobrich	513	48	1	-	5381	60	-	-	-	-	-
Kardzhali	103	166	990	190	-	122	405	-	13	1	170
Kyustendil	453	423	453	301	-	884	11	632	11	254	317
Lovech	90	-	-	-	130	-	-	-	-	-	-
Montana	27	133	6	13	1826	-	-	-	-	500	-
Pazardzhik	56	232	-	-	968	76	-	700	-	-	-
Pernik	830	-	-	13	10	140	-	75	-	1594	1712
Pleven	971	739	-	-	631	110	-	22	-	-	630
Plovdiv	2020	-	-	195	5893	1481	223	321	190	948	380
Razgrad	-	-	-	149	412	-	-	-	-	-	-
Ruse	308	621	135	162	1235	473	-	303	1718	1073	1200
Silistra	-	1	-	11	928	-	-	-	-	-	-
Sliven	1227	1255	-	-	804	406	12	875	-	478	222
Smolyan	5222	4902	1878	4383	1389	2645	853	667	1733	1354	1841
Sofia-capital	177	-	-	-	-	-	-	-	-	-	-
Sofia	449	190295	768	409	3297	150	-	594	1877	761	2930
St. Zagora	206	-	537	-	6	-	195	-	-	83	-
Targovishte	36	2	-	-	-	-	-	-	-	-	-
Haskovo	271	432	2914	-	1575	692	169	-	-	1163	919
Shumen	-	-	222	53	-	-	-	-	-	-	-
Yambol	205	-	-	-	278	-	-	-	-	-	-

Table. 4. EXPENSES FOR RESCUE AND EMERGENCY WORKS FOLLOWING THE FLOODS 2010-2020 /thousand BGN/

[illegible]

Haskovo	-	-	-	346	34	253	159	-	-	906	1621
Shumen	-	-	-	-	-	-	-	-	-	-	-
Yambol	11	-	-	-	2	-	-	-	-	-	-

Climate change increases the frequency and intensity of floods, making it essential to analyze their causes, assess the consequences, and develop strategies to mitigate flood risks.

Under the "Water Act," floods in Bulgaria are classified into two main types: natural floods and anthropogenic floods. A more detailed classification can be made based on the source, mechanism, and characteristics of the floods.

- Floods are categorized by water source as riverine, pluvial, lacustrine, marine, oceanic, glacial melt, infrastructural, or underground.
- By formation mechanism, they can result from natural overflow, exceeding protective barriers, and cause damage to protective or infrastructural facilities, or obstruction or reduction of water conveyance capacity.
- By specific characteristics, floods are divided into gradual, flash, torrential, sediment-laden, snowmelt floods, high or low flow velocity, deep, or shallow floods.

Most often, floods are caused by intense or prolonged rainfall, leading to a quick rise in water levels in rivers, lakes, canals, and other water systems.



Photos 1-3. Consequences of the flood in the area of the cities of Tsar Kaloyan and Ruse /7-8.08.2007 - 8 people died/



Photos 4-6. Flood in Varna /19.06.2014 - 13 people died/



Photos 7-9 The floods in the area of the city of Shumen /01.02. 2015 and 28.09.2015/ and the city of Varna /2020/

STRATEGY AND PRELIMINARY FLOOD RISK ASSESSMENT

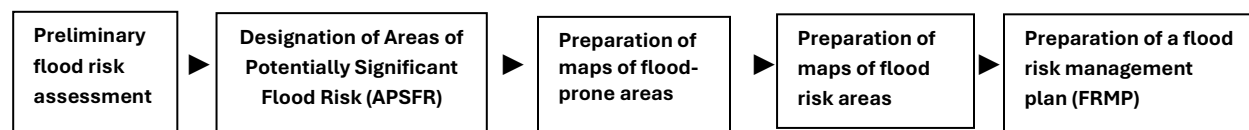
The lead authority for flood risk prevention and management is the Ministry of Environment and Water. This ministry is responsible for the state's overall environmental policy, including monitoring and responding to natural disasters such as floods.

The Ministry develops a "Strategy for Flood Prevention and Management" aimed at improving community and infrastructure resilience in flood-prone areas, reducing flood risks, and implementing various measures to mitigate potential damages.

The flood risk prevention and management strategy includes:

- Lowland management
 - emergency planning
 - floodplain zoning and land use planning
- Infrastructure development
 - infrastructure design
 - strategic land use planning
- Warning systems
- Emergency planning
- Public awareness and education
- Integrated approach - plan and strategy
- Risk assessment
- river basin flood risk assessment
- urban flood risk assessment

The assessment and management of flood risk is carried out in five steps according to the "Floods Directive" approved in Bulgaria:



The Preliminary Flood Risk Assessment (PFRA) is conducted under a unified national methodology approved by the Minister of Environment and Water, in accordance with Article 187, Paragraph 2, and Item 6 of the Water Act. An analysis of flood sources shows that around 60% of recorded floods in Bulgaria are caused by heavy rains, while fewer than 30% are due to rivers overflowing their banks.

The PFRA assesses potential future flood risks concerning human health, the economy, the environment, and cultural-historical heritage using accessible information. It identifies areas with significant potential flood risks (SPFRAs).

NATIONAL FLOOD RISK MANAGEMENT PLAN

The Ministry of Environment and Water, in collaboration with other competent institutions, develops a "Flood Risk Management Plan" (FRMP) and ensures its implementation. The current plan, covering 2022–2027, builds on the previous plan (2014–2021).

The FRMP outlines the content of the "Strategy for Flood Prevention and Management" and aligns with the European Union Floods Directive. It aims to identify, assess, and manage flood risks nationwide.

Key elements of the plan include:

- Risk assessment and mapping
- Early warning systems
- Structural and non-structural measures
- Flood extent and propagation
- Natural flood retention areas
- Soil and water management

- Land-use planning
- Environmental conservation
- Protection of navigation and port infrastructure

CONCLUSIONS AND RECOMMENDATIONS

Floods are a serious natural hazard for Bulgaria, with significant economic, social, and environmental consequences. Although some floods cannot be fully prevented, measures can reduce risks and improve flood management. These measures include:

- Awareness and education
- Funding and resource allocation
- Building protective infrastructure
- Early warning systems
- International and regional cooperation
- Sustainable agriculture and land-use planning
- Risk management and sustainable development

Effective flood management requires collaboration among government, scientific institutions, local communities, and civil society. Developing methodologies to assess flood risks, even in areas with no historical flood data, is crucial. Quantitative risk assessments are vital for identifying at-risk areas and prioritizing mitigation strategies.

In conclusion, addressing floods as a complex issue requires multifaceted, long-term efforts to reduce risks and protect people and property.

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