

B&H Country Profile concerning Soil and Water Issues

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1. Scope

Bosnia and Herzegovina (BIH) is situated in South Eastern Europe, in the central part of the Balkan Peninsula and has a total land area of 51.129 km². The total length of its borders is 1537 km of which 762.5 km are land borders, 751 km river borders and 23.5 km sea borders. Bosnia and Herzegovina has common frontiers with Republic of Croatia (931 km), Serbia (375 km) and Montenegro (249 km). To the north, BIH has access to the River Sava, and to the south to the Adriatic Sea, at Neum. The land is mainly hilly to mountainous with an average altitude of 500 meters. Of the total land area, 5% are lowlands, 24% hills, 42% mountains and 29% karst area. Forests and forestlands cover about 50% of the territory, while the total agricultural land covers 2.5 million hectares or 0.7 hectares per capita.

The bigger part of BIH has moderately continental climate, central part is characterized with mountainous climate, and south part of BIH has influence of Mediterranean climate. With its high average annual precipitation (1200 l/m² compared with the European average of 1000 l/m²). Besides that amount of precipitation, east and south part of the country are exposed by drought, during long period a year. Bosnia and Herzegovina possesses significant water resources. There are seven river basins (Una, Vrbas, Bosna, Drina, Sava, Neretva with Trebisnjica and Cetina) of which 75.7% belong to the Black Sea catchment and 24.3% to the Adriatic Sea catchment. There are also a large number of river lakes (on Pliva and Una) and mountain lakes (in the area of Dinaric mountains), as well as thermal and geothermal groundwater resources.

The state of Bosnia and Herzegovina is regulated by the Dayton Agreement and comprises three separate administrative units (two entities and one district): Republic of Srpska (RS), Federation of Bosnia and Herzegovina (FBiH, divided into 10 cantons) and Brcko District.



Figure 1. Map of Bosnia and Herzegovina

2. Climate

The country is situated between the continental and Mediterranean climatic zones, which creates three local climatic areas.

The northern land territory has a moderate continental climate with warm summers and cold, snowy winters. The mountain areas above 700 m have a mountain climate with short, cool summers and long, severe winters with snow. The annual precipitation in the inland and Alpine region is between 1,500 to 2,500 mm.

The south has an Adriatic-Mediterranean climate with sunny, warm summers and short, mild, rainy winters, and an average annual precipitation of 600 to 800 mm. The average temperature in Sarajevo, in the continental zone, is -1°C in January and 20°C in July. The varying climate conditions in B&H offer wide possibilities to the agricultural production, both in terms of crop choice and cultivation of land farming, fruit-growing, vine-growing, and vegetable-growing, as well as forage crops and livestock production.

Very important factor of erosion is hydrological regime. B&H is very diversified country in terms of precipitation, potential and real evapo-transpiration, water deficit and surplus (run-off and percolation). Starting from the beginning of October through the end of May, usually there is no drought in the great part of B&H. Erosion problems are present. The drought occurs normally from June to September, especially in the Mediterranean part of the Country.

Table 2. General situation is shown in the following agro hydrological balance (in mm):

Hydrological parameter	B&H average	South area	Central area	North area
Precipitation (P)	1200	2000	1000	800
Potential ET-PET	725	900	650	700
Real ET-RET	600	600	600	600
Water Deficit-D	125	300	50	100
Water Surplus-S	600	1400	400	200
Drought coefficient-P/PET	1.65	2.22	1.54	1.14
Outflow coefficient-S/P	0,50	0,70	0,40	0,20

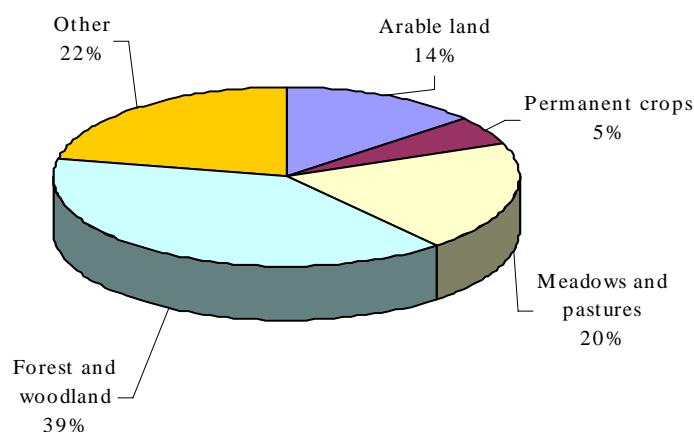
Besides, daily precipitations and heavy rains are very high. In some localities daily rains are going even to over 200 mm (Posusje, Jablanica). Daily rains over 30 mm are very dangerous from the erosion point of view.

3. Use of Land Resources

Bosnia and Herzegovina covers an area of 5,112,879 hectares of which the Federation BiH occupies 2,607,579 hectares and the Republic of Srpska 2,505,300 hectares. Around 52% (2,600,000 ha) of the total land area is suitable for agriculture with the remaining considered as forestland. Although the total agricultural land area in FBiH and RS is similar, when the population of each are considered - 2,250,000 for FBiH and 1,450,000 for RS - the division of agricultural land per capita in FBiH is at 0.56 ha whereas in RS it amounts to approx. 0.90 ha per capita. Furthermore, when the areas of fertile fields and gardens are considered, the situation in FBiH declines further and at 0.23 ha per capita is half that in RS. The various uses of the agricultural land is given in below Table 3.

Table 3. Land Use in Bosnia and Herzegovina

	FBiH (ha)	RS (ha)	FBiH (%)	RS (%)	BiH (ha)
Total area	2,607,579	2,505,300	51.0	49.0	5,112,879
Forest and bare land	1,500,179	1,209,590	55.3	44.7	2,709,769
Agricultural land	1,258,796	1,298,619	49.2	50.8	2,557,415
Fertile fields and gardens	508,062	671,599	43.1	56.9	1,179,661
Agricultural cultures	461,360	616,548	42.8	57.2	1,077,908
Orchards	41,395	54,358	43.2	56.8	95,753
Vineyards	5,307	693	88.5	11.5	6,000
Meadows	248,291	236,922	51.2	48.8	485,213
Pasture	502,443	358,734	58.3	41.7	861,177
Agricultural land per capita	0.56	0.90	-	-	1.46
Fields and gardens per capita	0.23	0.46	-	-	0.69



Source : USA Department of Defence 1993 est.

Figure 2. Land use in BIH

Analysis of the soil classes shows that the soil in BIH is very heterogeneous. Automorphic soils make up 86% of the total, while the remaining 14% are hydro morph soils. The content of humus in agricultural soils is approximately 50% lower than in soils covered with forest vegetation. Due to farming and treatment methods applied, the content of humus in agricultural soils shows a tendency to decline further.

Semberija, Posavina and Krajina in the North of BIH have somewhat better conditions for agricultural production with predominantly hydromorphic soils on flat and moderately undulating terrain in the valleys of the Sava River and its tributaries. The central part of BIH is a mainly hilly and mountainous region with a large portion of steep or sloping terrain. This area is covered mainly by district camisoles, calcocambisols on limestone and dolomites, and eluvia soil, as well as diluvialsoils that are mainly covered by forests and pastures. Only a small percentage of this area is suitable for farming and results in subdivisions into very small fields. Southern parts of Bosnia and Herzegovina are dominated by shallow layers of soil on lime/dolomite substrata and with sparse covering of vegetation and rock outcrops. Only narrow strips of land located along the courses of the Neretva and Trebisnjica rivers are used for agriculture (vegetables, fruits, vineyards, tobacco).

According to the land use and soil quality classification (from I to VIII), four basic zones have been identified in the table below.

Table 4. Soil quality classification in Bosnia and Herzegovina

Zone	ha	%
I - High quality soils of I, II and III class, which are appropriate for intensive agricultural production	774,907	15.16
II - Moderate quality soils of IVa and IVb, which can be used for other purposes	1,126,520	22.03
III - Low quality soils of V and VI class, which can be used for extensive agricultural farming and out of agriculture and forest sectors	1,654,616	32.36
IV - Very poor quality soils of VII and VIII class, which can be used for a few purposes with very strong restriction	1,556,857	30.45
TOTAL	5,112,900	100.00

Forest natural resources - the basic information on the state of the forest in BIH is given in Table 5.

Table 5. Forests in Bosnia and Herzegovina

State forests	RS (ha)	FBIH (ha)	BIH (ha)
High forests	553,763	645,081	1,198,844
Low forests	259,034	260,403	519,437
Uncovered & barren lands	166,919	301,132	468,051
Total	979,716	1,206,616	2,186,332
Private forests	RS (ha)	FBIH (ha)	BIH (ha)
Area [ha]	229,874	293,563	523,437
Total	1,209,590	1,500,179	2,709,769
Timber stocks (m³)			
High forests	132,717	141,776	274,493
Low forests	7,140	9,034	16,174
Total	139,857	150,810	290,667
Annual volume increase (m³)			
High forests	3,559,400	3,850,000	7,409,400
Low forests	252,960	279,840	532,800
Total	3,812,360	4,129,840	7,942,200
Annual volume of timber harvest (m³)			
High forests	3,336,500	3,614,000	6,005,000
Low forests	140,000	145,000	347,000
Total	3,476,500	3,759,000	7,235,500

Forest natural resources in Bosnia and Herzegovina are amongst the richest in Europe in terms of the extent and variety of stock relative to the size of the country. As about 50 percent of the territory of BIH is covered by forest, these resources represent an important asset. However, the recent war and subsequent unregulated development has resulted in heavy damage at all levels. In certain areas illegal logging operations occurred, along with forest clear-cuts and degradation, which have led to the occurrence of many diseases, forest fires, ice and wind breaks. It is also important to emphasize the fact that a large portion of the forested areas are under mines, which makes any forest protection and rehabilitation activities impossible to conduct. As an overall result, the sustainability of forest management and the stability of forest ecosystems are threatened.

Forestry in BIH is regulated differently in two entities. In RS the Law on Forests was adopted in 1994 (amendments and changes to the Law were adopted in May 2002). In FBIH the Law on Forests was adopted in 2002. FBIH has six protected forest areas (Trebevic, Prenj, Igman-jungle, Hutovo Blato, Blinsko lake), while RS has protected areas that includes two national parks ("Sutjeska" and "Kozara") and two old growth forests reserves ("Janj" and "Lom").



Figure 3. Map of forests in BiH

The major and key issues in forestry are given as follows:

Biotic and abiotic threats to forests. Bark beetle infestations started during the war and are still the major forest health problem in Norway spruce (*Picea abies*) stands, especially those stressed from war actions, drought and fires. Active control of insect population density is initiated, but of limited success. Major diseases do not normally occur in natural forests. Now, however, these are destabilized by war activities, and fires and insect attacks are causing pathological problems. There is not sufficient information on the total forest health situation. Forest fires have been frequent because of dry weather. No modern technology is available and fire fighting has to go on by hand. Grazing, and fires started on purpose to expand pastures, tends to lower the tree line in many mountainous areas. Protection of biodiversity is of concern.

Change in the primary function of forests. In the post-war period, illegal and irrational exploitation of minerals (quarries), construction of new settlements, production facilities, leisure homes, and through legal but inadequately planned construction of roads, industrial and other facilities, has permanently changed the primary function of the forests. As a result the "survival" and development of forests has faced permanent impacts.

Accessibility of forests. Due to a relatively low forest road density (about 7 meters/ha), over harvesting occurs in areas with good access with only limited harvesting taking place in areas with poor access. This has led to a significant decrease of standing volume and degradation of forest ecosystems in the most accessible areas. These areas are in addition more often prone to forest fires and insect infestations since over the last decade droughts have been more frequent.

Inadequate forest management systems. Long-term planning is important for development of the forestry sector, both in relation to forest management as well as value-added activities based on timber and non-timber resources. The forest management planning in BIH is active only at the level of Forest Management Plans and Annual Plans. A long-term program for forestry was developed for the period 1971 to 2005 but has not been revised for the past 3 decades. To meet changes in the basic criteria for planning it is necessary to revise the long-term plan, whenever changes are substantial.

Lack of culture-raising and protective measures. Insufficient capacity exists in the commercial forestry sector for seed and plant production, afforestation and silvicultural activities. In order to implement certain phases of crop improvement, it is necessary to obtain high quality planting material with known genetic background. Unfortunately, present practice, as in the past, relies upon the use of imported seeding material of unknown origin as opposed to using local stocks from the BIH genetically high quality forest stands.

Market. The lack of an economically sound forest industry capable of utilizing forest products and of providing raw materials for secondary processing is the most serious constraint in maintaining a sustainable forestry sector. The price currently being paid for poor quality logs is insufficient to maintain the forest and forest infrastructure over a long period of time.

3.1. Land Cover

Rough data on habitat category differentiation are being obtained according to the of Corinne Land Cover data base. This project has been performed by PHARE 2000. Ten main habitat categories have been identified on the basis of obtained data, as shown in Table 6.

Table 6. Land Cover of Bosnia and Herzegovina (according to the of Corinne Land Cover data base)

CLC code	Category	No. of polygons	area [ha]	% of total
111	Continuous urban fabric	3	187	0,004
112	Discontinuous urban fabric	454	49254	0,962
121	Industrial or commercial units	93	4680	0,091
122	Road and rail networks and associated land	5	166	0,003
124	Airports	6	964	0,019
131	Mineral extraction sites	106	9819	0,19
132	Dump sites	10	623	0,012
133	Construction sites	8	404	0,008
142	Sport and leisure facilities	8	442	0,009
211	Non-irrigated arable land	370	112740	2,202
212	Permanently irrigated land	2	912	0,018
221	Vineyards	23	1804	0,035
222	Fruit trees and berry plantations	81	6264	0,122
231	Pastures	2975	398001	7,772
242	Complex cultivation patterns	3034	790138	15,429
243	Land principally occupied by agriculture, with	5810	616456	12,038

	significant areas of natural vegetation			
311	Broad-leaved forest	3679	1627297	31,777
312	Coniferous forest	1114	243747	4,76
313	Mixed forest	1757	404122	7,892
321	Natural grassland	640	184943	3,611
322	Moors and heathland	392	103650	2,024
323	Sclerophyllous vegetation	303	71083	1,388
324	Transitional woodland-scrub	2606	405794	7,924
331	Beaches, dunes, sands	6	608	0,012
332	Bare rocks	76	4820	0,094
333	Sparsely vegetated areas	512	43286	0,845
334	Burnt areas	9	587	0,011
411	Inland marshes	30	5261	0,103
511	Water courses	118	13319	0,260
512	Water bodies	44	18150	0,354
523	Sea and ocean	1	1455	0,028
Total:		24275	5120976	100,000

3.2. Measures for the Rehabilitation of Degraded Lands and for Early Warning Systems for Mitigating the Effects of Drought

Most activities in the area of land protection, as well as prevention of land degradation, are implemented in the framework of national and sectoral programs coordinated by the Ministries.

Rehabilitation of land use and agricultural production in the karst field Popovo polje – Mediterranean part of the country is one of important ongoing projects, which has been financed by Spanish Government and implemented by MPDL in the area of about 2500 hectares.

In first phase of this project there have been established the farm cooperatives. Within this phase, it has performed the water supply system for irrigation and planting of orchards and vineyards.

Soil research and program of rational land use and protection was completed during last year.

In both Entities it has been made the program for forestation of the karst area in the south part of country. These projects are financed by Governments funds.

Establishment of the NCB for UNCCD in B&H will have a great importance for the future development of soil protection in Bosnia and Herzegovina. It is planned, with a great help and support of the UNCCD secretariat and potential donors, to prepare NAP as soon as possible. This will be the main National Action Plan and it should cover several specific topics that are important for the country:

- Assessment of potential and active soil erosion processes in the territory of B&H,
- Assessment of drought effect in different parts of B&H and its influence on erosion,
- Protection of hilly-mountainous areas (83.5% of the national territory) from water erosion by introduction of soil and water conservation measures with sustainable agricultural development,
- Sustainable use and management of lands,
- Revitalization of the karstic (lime-stone) area that covers more than one third of national territory which is drastically eroded and decertified,
- Flood controls and land drainage of flatland in the river valleys and karstic fields that covers totally about 400,000 ha,

- Protection of high quality soils from non-agricultural use and introduction of legal regulations governing the water and soil management,
- Creation and strengthening of scientific-research institutions in order to enable them to apply the modern technologies, information systems, transfer of knowledge and education,
- Implementation of representative and experimental watersheds according to European experience for monitoring erosion processes, sedimentation and contamination in relation to land use,

De-mining of BIH territory represents an extremely important and urgent task for social, economic and security reasons for many people.

4. Water

The substantial water resources of Bosnia and Herzegovina provide an important economic potential, but as with other sectors, insufficient attention has been paid in the past to the protection of water. This has been exacerbated by infrastructure damage caused by war activities and the lack of adequate maintenance. Flood control infrastructure throughout the country is damaged, outdated and deteriorated due to the war activities. The quality of potable water is still unsatisfactory in some parts of the country with pollution caused by out-dated and damaged pipelines and inadequate, poorly functioning chlorination systems. Therefore, there still remains a public health threat, especially in the rural areas where much of the potable water is supplied from individual wells. Few wastewater treatment plants exist with wastewater being discharged directly into rivers and streams.

The legislative framework for the manage and protection of water is running under provisions of new entity Law on water that has come in force in Republic Srpska and from the end of last year in Federation B&H too.

4.1 Water Resources

Catchment areas. Bosnia and Herzegovina is found within the Black Sea catchment (75.7%) and the Adriatic Sea catchment (24.3%). Within these two, there are seven other river catchment areas: Una, Vrbas, Bosna, Drina, Sava (indirect catchment), Neretva with Trebisnjica and Cetina. The rivers from the first four flow into the Sava River, a tributary of the Danube. Neretva, Trebisnjica and Cetina drain into the Adriatic Sea.

The annual precipitation of BIH (1250 l/m²) is high comparing to the European average (1000 l/m²) but this is unevenly distributed with a good proportion falling in the winter months. Although the rivers are characterized by relatively high runoff (22 l/s/km²) there is great variation in flow and much of this (57%) leaves the territory unused. In spite of the apparent wealth of water resources, this significant spatial and time variation results in areas that experience heavy flooding in winter months and having the drought season in the summer.

Table 7. Hydrologic Characteristics of Main River Basins in BIH

River basin	Area (km ²)	Population in 1991	Mean discharge (m ³ /s)	Minimum discharge (m ³ /s)	Average specific runoff (Q _{avg} /A) (l/s/km ²)
Sava (nearby basin)	5,506	635,353	63	1.5	11.44
Una (in BIH)	9,130	620,373	240	41.9	26.29
Vrbas	6,386	514,038	132	26.3	20.67
Bosna	10,457	1,820,080	163	24.2	15.59
Drina (in BIH)	7,420	422,422	124	24.1	17.13
Black Sea	38,719	4,012,266	722	118	18.65
Neretva and Trebišnjica	10,110	436,271	402	56.5	39.76

Cetina (in BIH)	2,300	79,089	31	1.8	13.48
Adriatic Sea	12,410	515,360	433	538	34.89
Total in BIH	51,129	4,527,626	1,155	176.3	22.59

Natural lakes in Bosnia and Herzegovina can be classified as constant and periodical. The constant lakes are classified as it follows:

- River lakes, mostly on Pliva and Una rivers. They are famous by their beauty, but are not significant from the aspect of water use;
- Mountain lakes, usually of glacial origin, can be found in the Dinaric region. They cover 0.4 to 25 ha (Boracko lake) and have the volume from 10,000 m³ to 3.5 million m³. Their importance is in their natural beauty, mountain tourism and cattle/breeding, whilst their importance for water use is less significant.

Periodical lakes formed by flooding of karst fields during some parts of the year, can be mostly found in or near the tributaries of Adriatic Sea, i.e. Cetina, Trebisnjica and Neretva. Their total volume is about 2.5x10⁹ m³ and in hydrological terms, they are very important in respect of the extreme flood discharges in the lower karst horizons.

Water (artificial) reservoirs. There are about 27 water reservoirs in Bosnia and Herzegovina, 13 of which are in the Neretva and Trebisnjica river basins and three on the river Drina. The total useful volume of these reservoirs recorded in 1991 was 3,000 million m³.

Ground water in Bosnia and Herzegovina can be found in three geographically separate areas each with special characteristics. In the northern parts, the ground water reserves are within alluvial sediments of unequal mechanical composition along the Sava River and its tributaries at a depth of about 50 m. Capacities in excess of 1 m³/s are found in Semberija and Lijevce Polje regions, with Artesian water found at depths of 100-200 m. In the central parts of BIH, groundwater accumulates in the caves and cavities of the limestone massifs and emerges on the surface as lime wells in the Una, Sana, Bosna, Drina and Neretva river basins. The southern parts of BIH belong to the Adriatic Sea catchment area and comprise large karst fields. The important wells are found in the Cetina, Neretva and Trebisnjica river basins.

4.2 Water use

Water supply. Drinking water supply services cover only 56% of FBiH and 48% of RS, compared with over 90% in Europe. Potable water in cities is supplied from: groundwater (47%), wells and springs (27%), surface sources (20%), whereas the remainder comes from infiltration. Some of the extracted water is of very good quality to meet the potable water requirements without treatment. Other sources require full treatment although they are sometimes only disinfected. Gross specific consumption in most urban water supply systems ranges from 200 to 600 liters/capita/day. Of this, about 100 to 200 liters/capita/day is used for the supply of the population with the pattern of use being made up of 32% for household use, 35% for business and other uses with 33% on average being lost.

Some water supply systems are unable to meet the needs of consumers during the dry season. Not only is the quantity insufficient, but also in many cases the quality requirements are not met. This is either due to inadequate seasonal water resources or the insufficient capacity of all or parts of the water supply systems. Additional problems arise from the lack of water protection for sources, facilities and springs.

Water resources are under potential threat from organic pollution resulting from the inadequate direct protection and also insufficient wastewater treatment plants. Other threats come from inadequate maintenance of sewage systems, intense exploitation of forests, uncontrolled use of pesticides, etc. In most cases water sources are not bacteriological safe.

Use of water for hydro power production (hydro energy). The total hydropower potential of Bosnia and Herzegovina is 6,100 MW mostly located within the Drina, Neretva and Trebisnjica river basins. Only about 38.75% of this is utilized and this meets approximately 40% of the total electricity production. Additional unused potential that has already been studied exists in these river basins and is greater than in all other river basins.

Irrigation. The total arable land of Bosnia and Herzegovina is about 1,123,000 ha of which only about 2% is irrigated. This is low, considering the world average of 15%, but is due to both the unfavorable topography and the spatial differences between demand and supply. In the karst areas of Herzegovina the percentage irrigated is higher with up to 6-7% of arable land being irrigated. The potential for irrigation has been examined and more than 154,500 ha have been identified as suitable for irrigation in Herzegovina, Semberija, downstream of Vrbas River, Dubicka Ravan and Srednja Posavina.

Internal river traffic. The Sava River forms the border with Croatia and Yugoslavia and water traffic is possible along the whole length of 332 km. On other rivers in Bosnia and Herzegovina, water traffic is only possible on the Una river for about 4.0 km. Water traffic is planned along river Neretva between Capljina (BIH) and Metkovic (Croatia).

Industrial water use. Industry in BIH uses water partially from the public water supply system and partially from its own sources. Both sources have been damaged by the war and are still in a very bad condition, especially the industries own water intakes, due to the downturn in the BIH economy and the decrease in industrial production.

Use of mineral and thermal water. Bosnia and Herzegovina has rich mineral water resources, but has only developed these to a limited extent. Mineral and thermal water has good economic potential especially in the areas of eco-tourism and health care. Some investments were made in this sector before the war (e.g. "Hotel Reumal" and "Medical rehabilitation center" - Fojnica, Banja Vrucica - Teslic) but little has been done to repair them after the war and no new investments have been forthcoming.

Fishing and fish farming. Around 3,570 ha of fishponds for carp, with a capacity of 1,000 to 1,100 kg/ha, exist in Republic of Srpska. The topography in the vicinity of the rivers would permit the construction of more fishponds and estimates have put the potential at about 4,450 ha. Some large and a number of smaller private fishponds are found in FBiH and these are used mostly for breeding of trout, carp and sheatfish. There is still considerable scope for expansion of fish farming in Bosnia and Herzegovina for breeding of trout, carp, sheatfish and some other breeds offish, in spite of numerous technical problems.

4.3 Water quality protection

Wastewater discharge. Most wastewater (almost 90%) is released directly without treatment into the nearest rivers, streams and underground channels. Around 56% of the urban population is connected to sewerage systems. For settlements with a population of more than 10,000, the extent of coverage rises to 72% whilst for smaller settlements this decreases to about 10%. In many cases the sewerage systems have not been completed, often only partially designed and constructed, and in some locations their capacity is insufficient to receive storm waters. Maintenance is mostly inadequate and there are still no regulations or legislation for these activities. Overflow from the systems occurs in the rainy season and affect around 65% of municipal centers. The problems lie not only with the failure to complete the systems as originally planned, but also to rectify war damage. Some parts of the systems thus require replacement of the damaged areas and about 850 km of the pipelines require cleaning.

Only seven cities with a population in excess of 5,000 inhabitants in Bosnia and Herzegovina had treatment systems before the war. These were Sarajevo, Trebinje, Trnovo, Ljubuski, Grude, Celinac and Gradacac and the total capacity of these wastewater treatment plants was 700,000 PE (Population Equivalent). Since the war a treatment plant has been constructed in Srebrenik. Out of the above treatment plants, only the plants in Sarajevo and Trnovo are still not functioning due to war damage. In addition to the above urban systems, there were also 122 plants for treatment of industrial wastewater. Forty percent of these worked successfully but none are in use due to the economic collapse and lack of equipment.

In 1991, the pollution load in BIH was approximately equivalent to a population of 9.5 million people although the population was only 4.5 million. Industrial wastewater load accounted for most of this and was equivalent to pollution generated by a population of 6.8 million. At the same time, the municipal wastewater load was equivalent to a population of 2.7 million. That is why the majority of rivers in Bosnia and Herzegovina were very polluted, some up to class IV of quality, with the Bosna and Vrbas rivers being the most polluted. At present the wastewater load is considerably lower as industry is not operating as before the war, but it is still disproportional high, as wastewaters are not treated.

Pollution of water by wild dumpsites. Water in Bosnia and Herzegovina is being polluted by direct disposal of waste into rivers and very close to watercourses. This has been identified as a significant problem in several locations in BIH. These include Samac, Sava river alluvium (where the spring sources for the city drinking water supply are located), Bijeljina, Modrica, Gorazde, and Visegrad. In addition, the drinking water springs for cities Ljubinje, Bileca and Trebinje and some others are being affected by the TPP Gacko tailings causing leachate from upper horizons to leach into the springs.

Uncontrolled deforestation and soil erosion. Uncontrolled deforestation, erosion of soil and mountain streams have special implications for the water sector, reflected through (I) lack of biologic potential and increased erosion of karst, (II) creation of alluvia and sludge that results in reduced capacity and increased risk of flood and pollution of water.

Introduction of pesticides and nutrients. There is no valid information on the degree of pollution of ground and surface water in Bosnia and Herzegovina by pesticides. Fortunately, pesticides are not in wide use. It is expected that their use will increase with development of agriculture and it will therefore be necessary to ensure that appropriate protection measures are introduced. Relatively speaking, lower nutrient concentrations are recorded in Una, Drina, Vrbas and Trebisnjica river basins. High concentrations of phosphorus and ammonium are found in Ukrina River and all profiles of river Bosna and its larger tributaries.

4.4. Water quality and monitoring

Systematic surface water quality testing and analysis in BIH were undertaken since 1965 at 58 locations. However, the complete monitoring system was destroyed during the war and establishment of new monitoring stations relies upon appropriate human and financial resources. With the available resources, the monitoring network is being gradually rehabilitated to cover both water quality and quantity monitoring.

Protection from flooding

Excessive river and flood flows endanger about 250,000 ha of land in Bosnia and Herzegovina, some 4% of the total territory or about 60% of lowlands. High groundwater tables are present in an additional 420,000 ha of river valley land and about 300,000 ha of moderately steep or high plains. By the beginning of the war in 1992, approximately 420 km of flood protection embankments, 220 km of boundary channels, 30 pumping stations of 120 m³/s capacity and 80 km of flood regulation channels existed. About 80,000 ha of land were

thus protected with flood protection facilities with most of them located along the Sava and Neretva rivers and their tributaries with only limited protection being provided in East Bosnia.

The existing facilities provide a good basis for further protection works, but there are insufficient pump stations and density of the canal and embankment network to protect all of the agricultural land. Repair of the existing systems is now needed and in addition, further expansion is also required. At present there are no reservoirs that are used to assist with flood protection and the transformation of flood flows. In addition, the level of protection and return periods used varies from area to area. For large rivers, return periods of 20 to 100 years are used.

Problem identification and analysis

Based on the above, the problems and their causes identified in the water sector in BIH are:

- Inadequate water supply to the population and industry;
- Inadequate protection of springs;
- Lack of treatment of municipal and industrial wastewaters;
- Numerous wild dumpsites are not remedied and are supplemented with new ones created often close to water sources and watercourses;
- Preventive measures are not applied;
- Frequent incidental pollution of water resources;
- Inadequate flood protection - unregulated river flows, floods, disasters;
- Erosion of surface soil and landslides.

The causes of such problems are:

- Lack of an integrated water management system;
- Lack of an integrated water management strategy;
- Lack of development plans and coordination on all decision-making levels;
- Non-harmonized legislation;
- Insufficient finances;
- Lack of information systems;
- Non-compliance with existing legislation;
- Lack of trained staff, equipment and institutions;
- Destroyed or damaged infrastructure (water supply and sewage);
- Large losses from the water supply systems;
- Insufficient wastewater treatment plants;
- Lack of monitoring systems;
- Deforestation and soil erosion;
- Irrational use of water on all levels;
- Inadequate water pricing and low collection rate, resulting in a weak financial base for water companies;
- Lack of research and training activities at all levels.

4.5. Water Conventions and international cooperation

Trans-boundary cooperation is very important segment for development of water sector of Bosnia and Herzegovina. In order of better functioning of water sector Bosnia and Herzegovina have already found effective ways to cooperate on water management issues through membership in several international and regional associations.

The International Sava River Basin Commission was established by the Framework Agreement on the Sava River Basin signed by the riparian countries (Republic of Slovenia, Republic of Croatia, Bosnia and Herzegovina and the Federal Republic of Yugoslavia) on December 03 2002, under the “umbrella” of the Stability Pact for Southeastern Europe with purpose of implementation of the Framework Agreement, and realization of the mutually agreed goals:

- establishment of the international navigation regime on the Sava River and its navigable tributaries;
- establishment of the sustainable water management;
- undertaking measures for prevention or restriction of danger, as well as elimination of the hazardous impacts of floods, ice, draught and accidents involving substances having negative impacts to waters.

The Agreement stipulates cooperation and exchange of data between the Parties in regard to the water regime of the Sava River, the navigation regime, regulations, organizational structures, and administrative and technical practice. It also envisages the necessary collaboration with international organizations (International Commission for protection of the Danube River – ICPDR, the Danube Commission, the United Nations Economic Commission for Europe UN/ECE, and institutions of the European Union). The Parties will apply the principle of reasonable and fair utilization and division of the Sava River basin water resources in all actions. They will regulate all issues on enforcement of measures for ensuring the unified water regime, and elimination or reduction of trans-boundary impacts to waters of other parties, whose cause could be the performance of economic or any other activity, by agreement.

The long-term benefit resulting from the work of the Sava Commission and implementation of the Framework Agreement on the Sava River Basin, as well as from the fact that the Sava River is part of the Danube Basin, will be establishment of the international legal regime by enforcement of instruments of international water law, international navigation law, international law on environmental protection, as well as the regulations of the European Union being applied to water resources of the Danube River that will be appropriately implemented in the Sava River Basin.

The Convention on Co-operation for the Protection and Sustainable Use of the River Danube (Danube River Protection Convention) forms the overall legal instrument for co-operation and transboundary water management in the Danube River Basin.

The Convention was signed on June 29 1994, **and duly** came into force in October 1998, when it was ratified by the ninth signatory. Since 2004, B&H has become party of this Convention.

The main objective of the Danube River Protection Convention (DRPC) is to ensure that surface waters and groundwater within the Danube River Basin are managed and used sustainably and equitably.

This involves:

- the conservation, improvement and rational use of surface waters and groundwater;
- preventive measures to control hazards originating from accidents involving floods, ice or hazardous substances;
- measures to reduce the pollution loads entering the Black Sea from sources in the Danube River Basin

The Mediterranean Action Plan (MAP) is a regional cooperative effort involving 22 countries bordering the Mediterranean Sea, as well as the European Union. Through the MAP, these Contracting Parties to the Barcelona Convention and its Protocols are determined to meet the challenges of protecting the marine and coastal environment while boosting regional and national plans to achieve sustainable development. B&H is party of this Convention and 4 of 9 Protocols.

The main objectives of Action Plan for the Protection of the Marine Environment and the Sustainable Development of the Coastal Areas of the Mediterranean are:

- to ensure sustainable management of natural marine and land resources and to integrate the environment in social and economic development, and land-use policies;
- to protect the marine environment and coastal zones through prevention of pollution, and by reduction and, as far as possible, elimination of pollutant inputs, whether chronic or accidental;
- to protect nature, and protect and enhance sites and landscapes of ecological or cultural value;
- to strengthen solidarity among Mediterranean coastal States in managing their common heritage and resources for the benefit of present and future generations; and
- to contribute to improvement of the quality of life

5. Legislative Framework and policy or strategy papers per entities (Federation B&H and Republic Srpska)

Federation Bosnia and Herzegovina

Government and Parliament of Federation BiH

- Adoption and Implementation Water and Environmental Protection Strategy.

Federal Ministry for Environment and Tourism

- Federal Environmental Strategy:
 - Federal Strategy for Environmental Protection
 - Federal Strategy for Nature Protection
 - Federal Strategy for Waste Management
 - Federal Strategy for Air Protection

Federal Ministry for Agriculture, Water Management and Forestry

- Strategy of Water Management and Water Protection
- Water Management Plans for Watershed Area for Sava River and Adriatic Sea
- Strategy for Agricultural Development for 2005 - 2010

River Basin District Body

- Protection Plans for River Basin Districts

Cantons in Federation B&H:

- Cantonal Environmental Plans
- Cantonal Nature Protection Plans
- Cantonal Air Quality Action Plans
- Cantonal Waste Management Plans

Municipalities

- Municipal Waste Management Plans

Republic of Srpska/ RS

Ministry for Physical Planning, Civil Engineering and Ecology of RS

- Environmental Protection Strategy
- Strategy on Nature Protection in RS

Ministry for Agriculture, Forestry and Water Management of RS

- Strategy of Water Management
- Water Management Plans for the Watershed Areas of the Sava River and the Adriatic Sea
- Strategy for Agricultural Development, for period: 2005 – 2015.

National Assembly of RS

- Water and Environment Protection Strategy

Municipalities and towns

- Local Plans of Waste Management
- Local Program for Air Protection

Brcko District

- Strategy of Environment Protection
- Strategic Plan for Environment Protection

The definitions of environmental information, restrictions on its access and provisions for public participation and access to justice of the entities laws correspond generally to those established in the Aarhus Convention. The laws interpret the definition of public authority rather narrowly, however, by obliging mainly only the Environment Ministries to provide environmental information to the public and to create participation mechanisms for the public.

Sources of the data - main documents used:

1. **First National Report to the United Nations Convention to Combat Desertification, February 2007**
2. **"National Environmental Action Plan (NEAP) of Bosnia and Herzegovina ", March 2003.**
3. **"Environmental Performance Reviews of Bosnia and Herzegovina (EPR)", Economic Commission for Europe, Committee on Environmental Policy, United Nations, New York and Geneva (2004).**
4. **"Poverty Reduction Strategy Paper for BIH (PRSP) - (2004-2007).**