STATE OF THE ENVIRONMENT IN THE FEDERATION OF BOSNIA AND HERZEGOVINA - 2010 Report

Publisher
Federal Ministry of Environment and Tourism

Editor-in-Chief
Prof.dr.sc. Nevenko Herceg

Deputy Editor-in-Chief
Mr.sc. Mehmed Cero

Editorial Board:
Academician Sulejman Redžić, prof.dr.sc. Tarik Kupusović, prof.dr.sc. Nevenko Herceg, prof.dr.sc. Aleksandar Knežević, mr.sc. Mehmed Cero, Fethi Silajdžić, Tomislav Lukić and Martin Tais

Language editing, proofreading and layout
Bosna-S Consulting, Sarajevo

Print
FRAM ZIRAL, Mostar

Printing run
1.000 copies

CIP - Katalogizacija u publikaciji
Nacionalna i univerzitetska biblioteka Bosne i Hercegovine, Sarajevo
502.1(497.6)(047)


Prijevod djela: Stanje okoliša Federacije Bosne i Hercegovine. - Tekst na engl. jeziku.
1. Stanje okoliša Federacije Bosne i Hercegovine
COBISS.BH-ID 17866246
STATE OF THE ENVIRONMENT
IN THE FEDERATION OF BOSNIA AND HERZEGOVINA
Table of Contents

PREFACE .................................................................................................................................................... 7

1 INTRODUCTION ...................................................................................................................................... 9
   1.1 Purpose of a Report on state of the environment ........................................................................... 11
   1.2 Methodology applied and data available .................................................................................... 11
   1.3 Indicator-based approach ............................................................................................................ 11
   1.4 Stakeholders in the process of monitoring ad evaluating the condition of environment ............ 12
   1.5 Report development process ........................................................................................................ 12
   1.6 Action plan ................................................................................................................................ 13

2 INSTITUTIONAL AND LEGISLATIVE FRAMEWORK OF ENVIRONMENT SECTOR IN FBiH ...... 17
   2.1 Institutional aspect .......................................................................................................................... 19
   2.2 Legal aspect .................................................................................................................................. 20

3 INDICATORS ............................................................................................................................................. 23
   3.1 Environmental indicators in the area of nature .............................................................................. 25
   3.2 Environmental indicators in the area of water ............................................................................. 35
      3.2.1 Water quality .......................................................................................................................... 36
      3.2.2 Water protection ..................................................................................................................... 37
      3.2.3 Protection against water ......................................................................................................... 38
   3.3 Environmental indicators in the area of land .............................................................................. 38
      3.3.1 Land structure ........................................................................................................................ 39
      3.3.2 Land use .................................................................................................................................. 42
      3.3.3 Soil protection ........................................................................................................................ 42
   3.4 Environmental indicators in the field of energy .......................................................................... 47
   3.5 Environmental indicators in air protection field .......................................................................... 52
      3.5.1 Emissions into air ..................................................................................................................... 52
      3.5.2 Air quality ................................................................................................................................ 54
      3.5.3 Monitoring ............................................................................................................................. 56
   3.6 Environmental indicators in waste management .......................................................................... 58
      3.6.1 Waste generators ..................................................................................................................... 58
      3.6.2 Municipal waste ....................................................................................................................... 62
      3.6.3 Industrial waste ....................................................................................................................... 63
      3.6.4 Medical waste .......................................................................................................................... 66
      3.6.5 Waste from Agriculture and Forestry .................................................................................... 67

4 ENVIRONMENTAL SITUATION IN THE FBiH ................................................................................. 73
   4.1 Nature ............................................................................................................................................ 76
   4.2 Waters ........................................................................................................................................... 76
### CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.3 Land</td>
<td>76</td>
</tr>
<tr>
<td>4.4 Ambient Air</td>
<td>78</td>
</tr>
<tr>
<td>4.5 Waste Management</td>
<td>79</td>
</tr>
<tr>
<td>5. ENVIRONMENTAL PROTECTION ACTION PLAN</td>
<td>83</td>
</tr>
<tr>
<td>5.1 Federation Strategy of Environmental Protection – general</td>
<td>85</td>
</tr>
<tr>
<td>5.1.1 Review of Activities from the Action Plan which were Commenced</td>
<td>85</td>
</tr>
<tr>
<td>5.1.2 Proposal of the Priority Activities from the Action Plan for the next Three Years</td>
<td>85</td>
</tr>
<tr>
<td>5.2 Protection of Nature</td>
<td>85</td>
</tr>
<tr>
<td>5.2.1 Review of activities from the Action Plan which were completed</td>
<td>85</td>
</tr>
<tr>
<td>5.2.2 Review of Activities from the Action Plan which were Commenced</td>
<td>85</td>
</tr>
<tr>
<td>5.2.3 Proposal of the Priority Activities from the Action Plan for the next Three Years</td>
<td>85</td>
</tr>
<tr>
<td>5.3 Air Protection</td>
<td>86</td>
</tr>
<tr>
<td>5.3.1 Review of Activities from the Action Plan from the Strategy which are Ongoing</td>
<td>86</td>
</tr>
<tr>
<td>5.3.2 Activities Planned for the next Three Years</td>
<td>86</td>
</tr>
<tr>
<td>5.4 Waste Management</td>
<td>86</td>
</tr>
<tr>
<td>5.4.1 Review of Activities from the Action Plan which were Completed</td>
<td>86</td>
</tr>
<tr>
<td>5.4.2 Review of Activities from the Action Plan which were Commenced</td>
<td>86</td>
</tr>
<tr>
<td>5.4.3 Proposal of the Priority Activities from the Action Plan for the next Three Years</td>
<td>87</td>
</tr>
</tbody>
</table>
Global environmental crisis sends a clear message – current development of civilization is practically unsustainable, unless human behavior is radically changed. Large number of undesired environmental changes is result of an accumulated pressure of a large number of processes that pass by undetected and soon become an accepted part of everyday life. During 2009, positive environmental legislation and an increasing level of institutional awareness about the need for a systematic approach to environmental problems resulted in development of a Proposal of the Federal Environmental Strategy and an Action Plan, which were ultimately passed in the House of Peoples of the Federation Parliament, thereby meeting the formal and legal conditions for implementation thereof.

Since development of an environmental policy depends on environmental data available, which serve as foundation for setting the priorities in environmental sector, development of a Report on state of the environment in the Federation of Bosnia and Herzegovina was the next logical step in the process. Having in mind that the report was based on an indicator-approach, it describes “a zero state” based on which the Federal Ministry of Environment and Tourism created preconditions for future monitoring of environmental protection policy effectiveness. Accordingly, the Report on state of the environment offers itself not only as an important tool in planning the environmental protection policy but also as an indicator that shows the necessity of making environmental protection element an integral part of all policies and strategic documents of other sectors. Integration of environment protection into sector policies, apart from being one of the instruments, is, at the same time, one of the basic principles and goals of a contemporary environmental protection practice and sustainable development. In that sense, this document is only an initial material, which will, through a dialogue and participation of relevant stakeholders, clearly define the principles of future development and priority measures that must be taken to protect all pertaining elements of environment.

With this Report we want to present the data on evaluation of state of the environment in the Federation of BiH with an aim to ensure greater participation and involvement of scientific, professional and general public in environmental processes, that is, to shift the environmental responsibilities and tasks to all those who make an impact on environment – starting with from legislative and executive power at all levels and all way down to companies and individuals. Raising awareness about environment is undoubtedly a long-term goal and environmental protection measure. Intention of this report is to additionally raise sensibility for environmental issues and to inform the public about state of the environment and importance of taking appropriate environmental protection measures.

Editor-in-Chief
1. INTRODUCTION
Law on environmental protection of the Federation of BiH ("Official Gazette of FBiH" no. 33/03 and 38/09) is the main piece of legislation that regulates environmental issues and sets the goals, principles, measures, responsibilities, documents, funding and supervision of environmental protection within the territory of the Federation of BiH. Article 22 of this Law stipulates that the Federation Ministry of Environment and Tourism shall be responsible for establishing an environmental information system and enabling appropriate monitoring of the state of environment. On the other hand, an increased institutional awareness about the need for a systematic approach to the issue of environment and the fact environment will become one of the priorities as we get closer to accession to EU accelerated the activities aimed at developing a document that will deal with several sectors and topics – triggers, pressures and impacts on environment, in order to facilitate analysis of the state of environmental elements and assessment of environment policy implementation. Report on state of the environment is one such document, for it offers an assessment of the overall state of environment as well as assessment of effectiveness of environmental protection measures applied. Along with the Federal Environmental Protection Strategy and Action Plan, this Report is one of the fundamental environmental protection documents in the Federation of BiH. Also, it is only the first in the series of reports on state of the environment that the Federal Ministry of Environment and Tourism is ought to prepare periodically in the scope of its mandate to establish an environmental information system and facilitate international exchange of environmental data.

1.1 PURPOSE OF A REPORT ON STATE OF THE ENVIRONMENT

Purpose of preparing a Report on state of the environment is twofold. On one hand, the Report consolidates, analyzes and presents environmental data in a structured way and evaluates present condition of environment. On the other hand, it serves as a logical starting point for future planning and implementation of environmental protection measures in the territory of the Federation of BiH. This Report on state of environment in the FBiH offers an overview of conditions of certain environmental components as well as an overview of institutional and legislative framework for environmental protection in FBiH. Using the results of analyses, evaluations and calculations of environmental indicators observed in the past period, this Report gives an overview of state in 2010.

1.2 METHODOLOGY APPLIED AND DATA AVAILABLE

Methodology applied in preparation of this Report was primarily determined by the nature of the issues covered in the Report (environmental protection), the level to which the environmental protection system was established and its twofold function (consolidation, analysis and structured presentation of environmental data on one hand and provision of a logical starting point for future planning and implementation of environmental protection measures in FBiH). The contents of the Report was structured according to so-called DPSIR model, the concept of which is very simple: driving forces cause pressures that reflect on state of the environment, which makes a direct impact on ecosystem and a whole chain of indirect impact. All these negative impacts provoke a series of responses on the part of public, which then launches a series of appropriate measures targeted to all the links in the chain. The Report was structured in a way to give an overview of causes, pollutants and consequences thereof, on one hand, and an analysis of environmental protection measures and instruments available on the other. Quality of this Report is directly tied to the quality of data and information available. In some areas, measurements are systematically conducted and historical data are available. Historically, data concerning sector pressures were not recognized as relevant for environmental issues and therefore such data were not at all collected and processed. Fragmentation of data by different sources, lack of systematic measurements and lack of all data necessary were one of the main problems in collecting and validating the data used in this Report.
INTRODUCTION

1.3 INDICATOR-BASED APPROACH

Report on state of the environment in FBiH introduces an indicator-based approach in determining the current condition of environment with an aim to facilitate more simple exchange and use of information in the process of planning, developing and improving the condition of environment in the Federation of BiH. Indicators are representative values of a case and in a way they quantify the information about environment. Thus, the goal of an indicator-based approach is quantification of physical indicators of state of the environment and an efficient comparison of indicator values from different cycles of the environmental sector development process. Since this is an indicator-based Report, it offers “a zero-state”, based on which the progress of environmental protection is to be monitored and evaluated against in the future. Environmental indicators in FBiH refer only to physical components of the environment and they do not include the indicators of current state of institutional, legislative and economic frameworks in the environmental sector, which in this Report are treated as a separate unity. For this Report, the indicators were selected based on their availability and overall importance for evaluation of state and their presence in the EEA¹ core list². A part of indicators was taken from CSI list of indicators defined by EEA for the purpose of harmonizing the data format with the requirements of international data exchange, while the other indicators were defined to show the specific environmental parameters in FBiH.

For the purpose of determining the condition of environment in the first cycle of environmental sector development in FBiH, a list of 80 environmental indicators was defined according to the following physical components of environment:

- Nature, fourteen (14) indicators;
- Waters, nine (9) indicators;
- Soil, sixteen (16) indicators;
- Energy, nine (9) indicators;
- Air, ten (10) indicators; and
- Waste management, twenty two (22) indicators.

Selected indicators are the currently available indicators relevant for fundamental environmental issues – biodiversity, water quality, air pollution and ozone depletion, waste, etc.

1.4 STAKEHOLDERS IN MONITORING AND EVALUATION OF STATE OF THE ENVIRONMENT

Permanent and efficient communication, cooperation and coordination among different stakeholders, segments and processes of environmental protection are fundamental activities necessary for establishing a good quality environmental protection system. Content of this Report required that all relevant stakeholders in the segment of environmental protection take part, to the maximum extent possible, in the process of preparing of the Report. This approach increased the likelihood that the Report will show a realistic picture of environment, based on which the most appropriate environmental protection measures could be defined for FBiH. Accordingly, the Government of the Federation of BiH adopted a Conclusion (932/2009) on November 30, 2009, mandating the Federal Ministry of Environment and Tourism to prepare and publish an integrated report on state of the environment in the Federation of BiH. The Conclusion reiterates the need for more intensive activities in terms of environmental data and information management, sector indicators processing and periodic reporting on state of the environment in the Federation of BiH. According to the Conclusion, the Federal Ministry of Environment and Tourism is mandated to manage these activities and take appropriate actions in order to establish a Federal Nature Protection Institute and an Environment Protection Agency. The Conclusion also stipulates that until these institutions are established, environmental data will be managed by the Federal Ministry of Environment and Tourism and all reference institutions in charge of individual environmental components (Federal Hydrometeorological Institute, Federal Agropedology Institute, Agency for Adriatic Sea Watershed, Federal Geology Institute, Federal Statistics Bureau and federal Administration for Geodetic and Property Relations), are obliged, according to Environmental protection Law, to deliver reliable, timely and accurate data and information under their respective jurisdictions to this Ministry.

1.5 REPORT DEVELOPMENT PROCESS

Report on state¹ of the environment in FBiH was prepared by the Federal Ministry of Environment and Tourism in the course of drafting a Federal Environmental Protection Strategy, which required that the current state of the environment in the Federation of BiH be determined. By final

---

¹ European Environment Agency
² CSI - Core set indicators
³ Strategy on EU integration of BiH
approval of the Federal Environmental Protection Strategy on the 26th session of the House of Peoples in the Federation Parliament held on October 26, 2009, all formal conditions were met to implement the Strategy. Integral parts of the Federal Environmental Protection Strategy (hereinafter referred to as Federal Strategy) are:

- Federal Environmental Protection Strategy;
- Federal Air Protection Strategy;
- Federal Waste Management Strategy;
- Federal Water Management Strategy, which shall be done separately.

Having in mind the fact that this strategic document was prepared with support of all relevant stakeholders at both, federal and cantonal levels, the integration thereof into other sector strategies and its subsequent implementation should be significantly facilitated. The guidelines relative to the strategy are the following:

- How to reduce the utilisation, prevent environmental overload and pollution, prevent disruptions, and stimulate the recovery of degraded environment;
- How to protect human health and improve the environmental conditions for a better life quality;
- How to preserve and protect natural resources, how to use them rationally, and apply management techniques to ensure its renewability;
- How to harmonize other interests with the environmental protection requirements;
- How to cooperate on an international level for the environmental protection;
- How to ensure public initiative and stimulate public participation in the environmental protection efforts;
- How to coordinate the economic sectors and integrate social and economic demands into environmental protection requirements;
- How to establish and expand the institutions for protection and conservation of the environment.

The Report on state of the environment in FBiH was prepared based on a detailed analysis, using the methodology recommended by EEA, which applies a DPSIR approach in the environment sector planning and thoroughly elabo-

rates the relevant issues. DPSIR approach ensures an efficient planning process in environment sector. Namely, according to this approach the sector development is planned on a cyclic base, where each new cycle begins with much better parameters of state of the environment than the earlier ones. Report on state of the environment is prepared for each cycle with an aim to determine the state in that respective cycle, but at the same time, the results of that cycle will be used as reference values for the next cycle, which is supposed to improve the quality of the current reference indicators. Also, this approach was selected because of compatibility of information intended for international data exchange, which primarily goes through EEA. The process of the preparation of report has been carried out in accordance with the principles of participation and inclusion of all stakeholders for the environment sector.

The applied cross-sectoral approach and participation of relevant institutions dealing with all aspects of the environment has ensured the usage of most up-to-date information and data on environment available. Due to lack of uniform cross-sectoral database, which would timely provide the required information, the data had to be acquired through different evaluations, assumptions and analyses. Certainly, the most precise data can be obtained by processing the results obtained through continuous monitoring of all environmental aspects. However, establishing of such a comprehensive environmental monitoring system is a very demanding task. This task will be among the priorities in the coming years. Due to encountered difficulties during the Report preparation in terms of obtaining necessary data and information on the state of the environment in FBiH, one of the primary tasks of the future uniform environmental information system is to define the tasks and responsibilities concerning delivery of environmental data among the relevant federal bodies in charge of individual environmental components.

### 1.6 ACTION PLAN

Federal environmental protection strategy and pertaining Action plan make a functional connection with appropriate national institutions of BiH through the measures that the State should take in terms of developing environment policy and making faster progress towards full membership in EU. These measures include:
INTRODUCTION

- Establishing appropriate national capacities (especially, those necessary for implementation of international environment treaties) and adopting necessary laws at the State level;
- Acceding to and implementing the Kyoto Protocol and UN Framework Conventions on climate changes in order to enable foreign investments into increase of energy efficiency, i.e. use of renewable energy sources;
- Strengthening the environment capacities in the Entity ministries, especially in inspection services;
- Implementing the standards and criteria of environment based on strategy of «voluntary semi-membership» in the first phase, and later as a candidate for membership and finally as a full member of EU, which would be an optimal foundation for development of institutional relations and not only in the sector of environment;
- Making preliminary legal and economic analyses concerning the conventions and protocols not yet acceded by BiH and regulating the implementation of these documents at different levels – State – Entity – Canton;
- Forming an environmentally responsible market in BiH (sending a message to relevant stakeholders about environmentally acceptable behavior, introducing national environmental programs and economic incentives);
- In implementing these steps, one should have in mind that these activities cannot be implemented exclusively within environment sector, but in coordination with all other sectors.

Action plan of the Federal Strategy is designed as a tabular overview of all environmental components treated by the Federal Strategy (air, soil, nature and waste), observed through legislative and institutional frameworks, economic instruments for environmental protection, systematic measures and planned deadlines for execution thereof. It also lists the institutions responsible for execution of these measures as well as an estimate of funds required and potential funding sources from which individual projects and activities should be funded. Given the lengthy procedure of adoption of the Federal Strategy, certain activities from the Action plan had to be launched and some were even completed before formal adoption of the Strategy. Report on state of the environment gives an overview of progress in implementation of individual components of Action plan and lists the priorities for implementation over the next three years (2010-2012), depending on the funding and institutional capacities available. Apart from funding planned in the Budget of the Federation of BiH, the implementation of activities from the Action plan would require that a Federation BiH Fund for Environmental Protection be put in function and that its economic instruments be appropriately upgraded in accordance with the Law on Federation BiH Fund for Environmental Protection (“Official Gazette of FBiH”, no. 33/03).
2. INSTITUTIONAL AND LEGISLATIVE FRAMEWORK OF ENVIRONMENT SECTOR IN FBiH
2.1 INSTITUTIONAL ASPECT

Environmental administration in FBiH has extremely fragmented and complex institutional structure (three levels – Federation, cantons and municipalities). In this situation, lack of a strong vertical and horizontal coordination led to a very poor, inefficient and costly environment management in FBiH, despite the fact that competences and functions in the Federation of BiH are adequately defined. Namely, environmental administrations at all levels (federal, cantonal and municipal) have mandates defined by law, which regulates their competences and functions. However, main reason behind the gaps, overlapping and duplication of competences and functions among these levels of environmental administration is the lack of institutionalized channels of vertical consultations and coordination mechanisms. Such complex administrations require a high precision from the aspect of legislation, implementation and control. Vertical coordination in FBiH is anticipated in the 2003 Law on Environmental Protection in the sense of evaluating the strategic environmental assessments, taking positions and making opinions. In October 2006 the Government of FBiH passed a Decision on appointment of members to an Advisory Board for Environment, which was tasked with providing scientific and professional support to the Federal Ministry of Environment and Tourism and FBiH Government in the environment sector. Advisory Board consists of 13 members, of which 10 are proposed by competent cantonal ministries for environmental protection (selected from scientific circles, organizations and institutions that represent professional and economic interests), while the other three are proposed by FMET, ANU BiH and RECBiH. Apart from line ministries, at the Federation level there are also public professional institutions that deal with the environmental issues either as a part of line ministries or under direct authority of the FBiH Government and their competences and functions are also defined by Law. It is noted that professional institution that deals with the issues of nature has not yet been set up.

- Conduct professional tasks in different segments of the environment (Federal Agropegeology Institute, Federal Geology Institute, Federal Administration for Geodetic and Property Relations, Agency for the Sava River Watershed, Agency for Adriatic Sea Watershed, Federal Hydrometeorological Institute, Federal Statistics Bureau);
- Supervise and control the activities that make impact on state of the environment (Federal Administration for Inspection Affairs);
- Initiate, plan and execute the activities aimed at protecting people, goods and environment from natural disasters, urgent/accidental situations and large-scale disasters (Federal Civil Protection Administration).

However, mechanisms that ensure data and information exchange, mutual coordination and consultations between these institutions and FMET, i.e. between these institutions and other line ministries are not adequate. Due to this situation, the efficiency is significantly reduced as well as possibility for obtaining good quality results on environmental management in FBiH. There are no formal forms of institutional cooperation among the sectors that deal with environmental issues, which often leads to conflict of interest among the sectors that have an impact on natural resources.

- Although there are no institutional elements of adequate environmental administration in place, it was concluded that environmental protection and management as a task is relatively new to FBiH and that there is no sufficient number of adequately trained staff for environmental management. This situation creates a significant gap between legally defined functions (administrative tasks that should be implemented) and those that are actually implemented.

Problem of human resources in the sector of environment can be summarized in a few key aspects:

- Small number of experts in relevant environment fields (waste, air emissions, noise, nuclear emissions, etc.);
- Lack of qualified staff and scope of work at all administrative levels exceeds the existing capacities;
- Experts work on several different tasks;
- Gap in the sense of planned and filled job positions.

According to figures listed in «Functional overview of the environment sector in Bosnia and Herzegovina» (2005),
INSTITUTIONAL AND LEGISLATIVE FRAMEWORK OF ENVIRONMENT SECTOR IN FBiH

BiH has 0.08 officers/100,000 population in the environment sector. Comparison with some of the European countries has shown the following results:

Number of staff in the environment sector at the State level

<table>
<thead>
<tr>
<th>State</th>
<th>Number of staff / 100,000 population</th>
</tr>
</thead>
<tbody>
<tr>
<td>BiH</td>
<td>0.08</td>
</tr>
<tr>
<td>Germany</td>
<td>2.39</td>
</tr>
<tr>
<td>Finland</td>
<td>17.98</td>
</tr>
<tr>
<td>Switzerland</td>
<td>4.90</td>
</tr>
</tbody>
</table>

Table 1: Number of staff in environment sector at the State level

Number of staff in the environment sector at the Entity level

<table>
<thead>
<tr>
<th>Entity level</th>
<th>Number of staff / 100,000 population</th>
</tr>
</thead>
<tbody>
<tr>
<td>FBiH</td>
<td>1.75</td>
</tr>
<tr>
<td>RS</td>
<td>1.69</td>
</tr>
<tr>
<td>Germany (Saxsonia)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Number of staff in environment sector at the Entity level

Number of staff in the environment sector at cantonal level

<table>
<thead>
<tr>
<th>Cantonal level</th>
<th>Number of staff / 100,000 population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sarajevo</td>
<td>2</td>
</tr>
<tr>
<td>Tuzla</td>
<td>1.76</td>
</tr>
<tr>
<td>Zenica - Doboj</td>
<td>1.75</td>
</tr>
<tr>
<td>RP Chemnitz - Germany</td>
<td>18.75</td>
</tr>
<tr>
<td>Vogtlandkreis - Germany</td>
<td>15.38</td>
</tr>
<tr>
<td>Appentzell Auss. - Switzerland</td>
<td>26.42</td>
</tr>
<tr>
<td>Luzern - Switzerland</td>
<td>20</td>
</tr>
</tbody>
</table>

Table 3: Number of staff in environment sector at cantonal level

Based on data above, one can conclude that some European countries (Germany, Finland and Switzerland), when compared to BiH, have:

- 25 – 200 times more staff in the environment sector at the State level,
- cca. 12 times more staff in the environment sector at the Entity level,
- cca. 8 – 18 times more staff in the environment sector at cantonal level.

By establishment of an Inter-entity environmental body, the Federation of BiH and Republika Srpska have established cooperation and coordination on environmental matters. This body consists of eight members, of which four are appointed by the FBiH Government and four by RS Government. The Inter-entity body deals with all environmental issues that require a coordinated approach of the Entities. In the project planning process, this body should ensure that interests of both entities are taken into consideration, in particular when it comes to the issue of utilization of natural resources and cross-entity border areas. This body also deals with matters delegated to it by the Entities: international treaties and environmental programs, cooperation with international organizations and other countries, coordinating the adoption and implementation of laws and other regulations, coordinating the monitoring over the implementation of standards and procedures concerning the environment, giving recommendations for establishment of environmental quality standards at the Entity level, coordinating the action plans and other programs related to the environment, conducting the monitoring and maintaining the information system, collecting and exchanging data.

2.2 LEGAL ASPECT

Analysis of legislation in the area of environment revealed that a large number of documents are missing. For example, according to the FBiH Law on environmental protection, it is anticipated that 23 bylaws be adopted. Of this number, only 6 were adopted so far, despite the fact that deadlines for adoption of these document have long passed. Apart from missing bylaws, the problem is also that the those documents that were adopted are neither harmonized with the standards and regulations of EU nor among themselves. Although the general principle is that the laws on lower levels of government have to be harmonized with those on higher levels, there are still many differences in cantonal legislations because some of them were adopted before the FBiH Law on Environmental Protection came into force, which often creates certain conflicts in the implementation of these laws.

Lack of Spatial plan of the Federation of BiH is an additional problem. This plan is supposed to be an umbrella strategic document based on which the use of space will be defined and development plans will be prepared. This document should also define the objects and areas of natural heritage, spatial development goals, protection, use and purpose of land. Along with the Federal Spatial Plan, it is necessary to adopt cantonal and municipal spatial plans, which must be harmonized with the Federal Plan. The activities aimed at preparing the Federal Plan are ongoing.
There are some problems in the area of concessions as well. In 2002 the Parliament of the Federation passed a Law on concessions (“Official Gazette of FBiH” no. 40/02 and 61/06). Apart from this Law, there are also cantonal laws that regulate the issue of awarding concessions for objects that are not under jurisdiction of FBiH. In reality, it often happens that a concession is awarded, but later on, in the phase of issuing construction permits, it turns out that the construction is not possible. The analysis showed that existing regulations/laws on concessions do not impose any obligation to an awarding authority to check whether or not the construction is possible prior to commencement of a concession award procedure. Besides, a provision should be built in a law to ensure that the Commission in deciding on economic feasibility study, consider not only whether the project meets all formal requirements but also whether it fits into the spatial plan. In this way, one could avoid the possibility of awarding concession in the area where construction is not allowed. There is also a problem with the environmental policy not being integrated into other sectors. There is obvious lack of cross sector cooperation in the process of drafting regulations.

As for the international obligations, the standards have to be met in terms of reporting, appointment of national focal points and monitoring. During implementation of the project „Functional overview of public administration in the sector of water and environment“ it became apparent that the administration lacks the capacities for monitoring and managing multilateral environment agreements.
3.

INDICATORS
Indicators for monitoring the environment in the Federation of BiH are developed based on DPSIR analysis. DPSIR is a general framework for organization of environmental data in individual components – nature, water, soil, air and waste management. Initially, the idea for this framework was derived from social studies, and then it became broadly applied, in particular for organizing the indicators in the context of environmental protection and sustainable development.

DPSIR framework illustrates the “cause-effect” relation between mutually correlated components of social, economic and environmental systems:

- **(Drivers)** - Driving force of environmental changes – economic sector and human activities
- **(Pressures)** - Pressure on the environment in the form of emissions and waste
- **(State of the environment)** - physical, chemical and biological
- **(Impacts)** - Impact on population, economy and ecosystems
- **(Response)** – Response of society, priorities, targeted settings, indicators

In assessment of environment condition these indicators play an important role. Indicator values are obtained from a certain sample that describes state of the environment, influence thereof on human beings, ecosystem, pressure that the sample makes on environment, basic driving mechanisms behind negative impacts (e.g. in agriculture, waste management, water management), and social responses to the negative impacts of the cause. The indicators offer an efficient way to monitor changes, fulfilment of policy and strategy goals of the sector. They contribute to a better understanding of complex environmental problems and provide quantified information in a simple and clear manner.

European Environment Agency (EEA), which developed so-called CORE set indicators, used DPSIR framework in developing its standard indicator typology. Main purpose of CORE set indicators is to ensure a practical and stable basis for reporting to EEA and improving the quality and geographical coverage of data flow.

Where these indicators failed to provide the full picture of the situation, the indicators adjusted to specific circumstances of the environment in FBiH were used. In Report on state of the environment in FBiH, the document that stands for the first phase of the Waste Management Strategy, the following indicators were taken into consideration in the context of DPSIR analysis:

- Indicator D – driving forces
- Indicator P – pressures
- Indicator S – state of environment
- Indicator I – impacts
- Indicator R – response

State of the environment in FBiH was determined based upon a list of environmental indicators and analysis of indicator values. The list of indicators used in the area of waste management is shown by components.
3.1 ENVIRONMENTAL INDICATORS IN THE AREA OF NATURE PROTECTION

<table>
<thead>
<tr>
<th>NATURE</th>
<th>[Indicator type]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural habitat</td>
<td></td>
</tr>
<tr>
<td>Biodiversity</td>
<td></td>
</tr>
<tr>
<td>Geological diversity</td>
<td></td>
</tr>
<tr>
<td>Natural heritage</td>
<td></td>
</tr>
<tr>
<td>Conversion of habitat</td>
<td></td>
</tr>
<tr>
<td>Conversion of primary ecosystems</td>
<td>[P]</td>
</tr>
<tr>
<td>Conversion of secondary habitats</td>
<td>[P]</td>
</tr>
<tr>
<td>Excessive exploitation of resources</td>
<td></td>
</tr>
<tr>
<td>Pollution</td>
<td></td>
</tr>
<tr>
<td>Impact of climate changes on nature</td>
<td></td>
</tr>
<tr>
<td>Invasive species</td>
<td></td>
</tr>
<tr>
<td>Public awareness</td>
<td></td>
</tr>
<tr>
<td>Identification (ranking) of ecosystems with high quality biodiversity</td>
<td></td>
</tr>
<tr>
<td>Description of high quality areas</td>
<td></td>
</tr>
</tbody>
</table>

Table 4: List of environmental indicators of state of nature in FBiH

Federation of Bosnia and Herzegovina spreads on the surface of 26,110 km². It is a unique spatio-temporal entity with a high level of biological, geological and hydro-ecological diversity not only in the territory of Western Balkans, but also in Europe. Spread and existence of a large number of phytocenoses, zoocenoses and anthropocenoses, which are in a permanent interaction with abiotic components (climate, geological substrate), resulted in development of an extremely rich biosphere in this area. Regarding the level of diversity of species, reflected in diversity of plants, animals, mushrooms, lichen and certain groups of prokaryotes, the Federation of BiH is among the top countries in Europe.

Biodiversity

Bearing in mind the existence of interaction of all factors of biotope and biocenoses of this area, we can certainly say that this part of Bosnia and Herzegovina accommodates over 90% of the overall number of species identified.

<table>
<thead>
<tr>
<th>Group of organisms</th>
<th>Number of species</th>
</tr>
</thead>
<tbody>
<tr>
<td>algae</td>
<td>1,100</td>
</tr>
<tr>
<td>mosses</td>
<td>500</td>
</tr>
<tr>
<td>ferns</td>
<td>70</td>
</tr>
<tr>
<td>spermatophyte</td>
<td>4,100</td>
</tr>
<tr>
<td>fish</td>
<td>Više od 100</td>
</tr>
<tr>
<td>amphibian</td>
<td>20</td>
</tr>
<tr>
<td>reptiles</td>
<td>35</td>
</tr>
<tr>
<td>birds</td>
<td>320</td>
</tr>
<tr>
<td>mammals</td>
<td>80</td>
</tr>
<tr>
<td>invertebrate</td>
<td>Oko 10,000</td>
</tr>
<tr>
<td>mushrooms</td>
<td>Oko 1,400</td>
</tr>
<tr>
<td>lichen</td>
<td>Oko 300</td>
</tr>
<tr>
<td>prokaryote</td>
<td>several thousands of insufficiently examined</td>
</tr>
</tbody>
</table>

Table 5: An overview of evaluated biodiversity in FBiH

Basic diversity indicators in Bosnia and Herzegovina are:

- Diversity of terrestrial habitats: rocks of different geological age, diversity of core substrate, type of soil, unique and diverse forms of relief, and diversity of climate conditions;
- Diversity of water habitats: a rich and diverse hydrological network (mountain lakes, springs, mountain creeks, rivulets, rivers, sinking rivers, marshes, swamps, underground waters, thermal springs, brackish waters and sea);
- Long-term processes of anthropogenesis;
- Diverse processes of ethnocogenesis.

Ecological heterogeneity of the Federation of Bosnia and Herzegovina (geomorphologic and hydrological diversity, specific geological past and diversity of eco-climate), resulted in a high level of endemic species in this area. These include over 450 species and sub-species of vascular plants, hundreds of invertebrates (particularly insects), 12 species of fish, 2 species of amphibians, 4 species of reptiles and a few species of birds and mammals.

In a small geographical area there are several developing endemic centers, still producing new species. Development centers of glacial flora and fauna are a proof of the processes that took place after the ice age at the Balkans Peninsula. Diversity of insects, ichtyofauna and mammals makes
the Federation of BiH recognizable in Europe, and because some species (cave organisms and fish in Karst sinking rivers and underground objects) it is unique in the world.

**Geological diversity**

Apart from species diversity, the Federation of BiH also has very rich landscape diversity, consisting of all forms of geological and biological diversity in the broadest sense possible. Starting from the coastal area and all way up to the highest mountains, one can identify:

- Mediterranean landscapes,
- Sub-Mediterranean landscapes,
- Mediterranean-mountain landscapes,
- Oro-Mediterranean landscapes.

Going from the lowest levels of Bosanska Posavina (altitude 100 m) to the highest mountain peaks (Cvrsnica, Vranica, Bjelasnica), as a result of specific conditions, the following landscapes evolved:

- Peripanonian landscapes,
- Panonian landscapes,
- Highland landscapes,
- Hilly landscapes,
- Mountain landscapes.

Each landscape can be divided into several ecosystems (forests, meadows, rocky ground, osier-bed and ecosystems of arable and inhabited land). Unique quality of the FBiH area is recognized in specific landscapes typical for overall diversity of the Federation like:

- High mountain landscapes, dominantly covered by mountain meadows, alluvial fans, cracks, basophilous peat bogs, pre-mountain ecosystems of pine trees, beech, white bark-pine, spruce and fir tree.
- Diverse and poly-dominant landscapes in refugiums of BiH:
  - Landscapes of relict pine forests in dolomites and ophiolitic zone with ecosystems of Illyrian pine and white bark pine;
  - Landscapes of relict and refugical ecosystems in canyons and cliffs of Una, Sana, Neretva, Bosna and Drina rivers, (which contain the largest diversity of ecosystems, communities, habitats and geological forms).
- Marshy landscapes (Hutovo Blato, Busko Blato, mountain lakes of Kupres, Bjelasnica, Prenj, Cvrsnica, Sator, and island-shaped marshy areas (Vranica, Zvijezda).
- Complex ecosystem of Karst valleys (Grahovsko, Livanjsko, Glamocko, Kupresko, Suicko, Grudsko, Posusko, Dugo polje, Mostarsko Blato, Ljubusko, Stolacko and western part of Popovo polje with hydro geological and morphological phenomenon – the Cave of Vjetrenica).

Based on evaluation of situation, one can conclude that the features of landscape and biological diversity of FBiH are the following:

- High level of genetic, species and ecosystem diversity;
- High level preservation of landscape diversity of both European and global importance;
- Significant level of changes in relation to distribution and content of climate-susceptible ecosystems;
- Strong loss trend of biological and landscape diversity conditioned by a wide spectrum of anthropogenous factors.

**Natural heritage**

Natural heritage includes parts of natural environment in the Federation, distinguished and protected by separate laws as valuable goods of a high bio- and geo-diversity. The total area of protected nature is not exactly corresponding to the natural potentials and identified natural values. The protected area is generally very small. Majority of protected areas in the FBiH is still regulated under the 1985 Law on protection of natural, cultural and historical heritage of SR BiH. It is important to mention that protected areas treated by this Law currently do not require appropriate level of protection or care. These areas are often invaded by inappropriate «development» actions such as opening of quarries (particularly in relict refugial landscapes), cutting (in nature reserve), building various energy facilities (large and mini hydroelectric plants), communication facilities (roads and communication networks), economic and other infrastructure objects.
### INDICATORS

| **Strict Nature reserve** | Rainforest Žuća Ribnica  
Rainforest Pješivica |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Controlled nature reserve</strong></td>
<td>Forest area of Masna Luka at Čvrsnica</td>
</tr>
</tbody>
</table>
| **Special reserve** | Cave Vjetrenica in Zavala  
Bijambarska Cave |
| **geological** | Cave Hrustovača near Sanski Most |
| **botanical** | Rainforest Žuća Ribnica  
Rainforest plješivica |
| **ornithological** | Peatland in Zvijezda near Vareš  
Mediterranetum na Kleku |
| **Reserve of natural regions** | Neretva Canyon from Jablanice to Drežnice  
Spring of Buna River in Blagaj |
| **geological** | Canyon of Rakitnica  
Region of Bašjakovac near Livno |
| **botanical** | Canyon of Vrbas near Jajce  
Region of Kruščica near Vitez |
| **ornithological** | Cliff Uča near Kladanj  
Region of Tisivac near Busovača |
| **geological** | Cave Bijambarska near Čapljina  
Cave Vjetrenica in Zavala |
| **botanical** | Peatland Đilda at Zvijezda |
| **ornithological** | Hutovo Blato near Čapljina |
| **Reserve of natural regions** | Neretva Canyon from Jablanice to Drežnice  
Spring of Buna River in Blagaj |
| **geological** | Cave Hrustovača near Sanski Most  
Cave Vjetrenica in Zavala |
| **botanical** | Peatland Đilda at Zvijezda  
Mediterranetum na Kleku |
| **ornithological** | Hutovo Blato near Čapljina  
Cave Vjetrenica in Zavala |
| **Natural monuments** | Neretva Canyon from Jablanice to Drežnice  
Spring of Buna River in Blagaj |
| **geological** | Calc. sinter area near waterfall Kravice  
Calc. sinter area in Martin Brod |
| **botanical** | Calc. sinter area near waterfall in Jajce  
Calc. sinter area in Martin Brod |
| **ornithological** | Cave Vjetrenica in Zavala  
Bijambarska Cave |
| **Reserve of natural regions** | Neretva Canyon from Jablanice to Drežnice  
Spring of Buna River in Blagaj |
| **geological** | Calc. sinter area near waterfall Kravice  
Calc. sinter area in Martin Brod |
| **botanical** | Calc. sinter area near waterfall in Jajce  
Calc. sinter area in Martin Brod |
| **ornithological** | Hutovo Blato near Čapljina |
| **Natural monuments** | Neretva Canyon from Jablanice to Drežnice  
Spring of Buna River in Blagaj |
| **geological** | Calc. sinter area near waterfall Kravice  
Calc. sinter area in Martin Brod |
| **botanical** | Calc. sinter area near waterfall in Jajce  
Calc. sinter area in Martin Brod |
| **ornithological** | Hutovo Blato near Čapljina |

**Table 6:** List of protected areas under the Law on natural and cultural heritage of SR BiH
Current social trends, which often ignorant to detrimental sides of transition processes, significantly contribute to deterioration of natural heritage in the Federation of B&H. Post-war Law on environmental protection, based on principles of EU HABITATS DIRECTIVE (92/43/EEC) and Council Directive 79/409/EEC, stipulates the following categories of protection (harmonized with categorization of protected areas according to IUCN):

- Protected nature reserve (Ia, Ib and IV categories of IUCN);
- National park (II category of IUCN);
- Natural monument (III category of IUCN);
- Protected landscape (V category of IUCN)

However, since authority for establishment of protected areas is shared between the federal and cantonal levels (depending on the category), implementation of relevant legislation is significantly weakened. It is important to mention that economic instruments in place or mobilized financial flows used to enable an efficient protection and preservation of high value natural areas, are not established in FB&H. On the other hand, there is no enough awareness about the possibility of using natural resource management as an efficient and sustainable profit source.

At the same time, biological and landscape diversity is greatly endangered:

- Critically endangered species/habitats/ecosystems/landscapes of local, regional and global importance;
- Habitats and ecosystems with a large number of endangered endemic and relict species or species with a high rate of biological diversity;
- Ecosystems of a significant economic and environmental value;
- Landscapes with a significant biological and cultural diversity.

According to IUCN (International Union for Conservation of Nature) criteria, there are over 600 plant taxaexposed to different levels of threat, 250 species (vertebrates, amphibians, reptiles, birds and mammals), dozens of invertebrates and over 50 types of mushrooms and lichens. In biodiversity management of FBiH, a special attention should be paid to priorities of long-term protection:

- Diversity of endemic relict species, i.e. species endangered at national, European and global levels; economically important species and autochthonous genetic resources;
- Wealth of canyons and cliffs as development centers of flora, fauna and vegetation; biodiversity refugia of tertiary age;
- Habitat diversity outside of common area of distribution and rare habitats (peat-bogs, saline soil, mountain springs, sea reefs, small marshes, small caves, etc.);
- Diversity of Karst ecosystem as major natural phenomenon (Karst valleys, sinking rivers, caves, rugged land);
- Diversity of high-mountain ecosystems–islands of preserved glacial flora and fauna;
- Diversity of ecosystems of relict pine forests in different geological substrates (limestone, dolomites, ophiolite, sinter, etc).

**Conversion**

Conversion is a process of habitat degradation, in which a higher level of organization and integration of habitat is converted to lower forms of organization. This can happen as a result of one or more environmental factors, which can be of anthropogenic nature or result of natural disaster (fires, floods and landslides), or result of a long-lasting regressive biocenosis succession process. As a rule, conversion is unfavorable process for autochthonous biodiversity.

State of bio- and geo-diversity in FBiH, occurring as a result of conversion of habitat, is reflected through the scale of changes in the structure of biocenosis and ecosystems to a complete loss of certain ecosystems in a given area and in a given time. Particularly unfavorable situation is detected within forest ecosystems, sensitive Karst areas, Karst valleys and marshy ecosystems, especially canyons and cliffs that serve as development centers of endemic and relict-refugial communities. Particular threat to the future of nature in FBiH comes from arbitrary and professionally unfounded endeavors in creating new patterns of energy system, urban development and use of mineral and fossil resources. This problem is particularly evident in the Mediterranean belt of BiH, the area that is today exposed to a huge pressure of unplanned construction, exploitation of marine resources and infrastructural building which may permanently degrade the natural values of this part of the Federation.
Impacts of the existing state of bio- and geo-diversity of FBiH are reflecting in physical reduction of surface covered by primary and secondary terrestrial ecosystems, i.e. homogeneity of biodiversity in water ecosystems.

As mentioned in the planning document, there is a set of federal environmental legislative, which serve as a basis for development of a positive attitude and response of society to certain negative pressures and impacts. However, further instrumentalization of the social response has to be focused on the development of an appropriate monitoring (I) and protection system (II) of bio- and geo-diversity.

In Federation, conversion of primary forest habitats is conditioned by the following activities: intensive, excessive and non-selective lumbering, particularly on a sensitive geological ground (dolomites, peridotite, amphibolite, etc.); unbalanced construction of road infrastructure, forest roads, energy plants («small» hydroelectric plants), tourist infrastructure, exploitation of mineral resources, etc.

Conversion of high-mountain habitats is conditioned by the following factors: excessive and intensive exploitation of primary minerals, eolic and hydro-erosion of mountain habitats, snow melting, tapping of mountain springs, unplanned construction of infrastructure, unbalanced tourism.

Conversion of fresh water habitats is conditioned by the following factors: building of dams and creating artificial hydro-accumulations, unplanned construction building in the coastal area, unbalanced construction of road infrastructure, quarries, exploitation of gravel, unplanned and ecologically unacceptable construction of mini-hydroelectric plants, degradation and devastation of protected forest belt in the coastal area, spring tapping, directing streams to other watersheds, cutting the streams, excessive use of water for irrigation and recreation purposes.
Conversion of marine habitats is conditioned by the following factors: degradation, devastation and destruction of coastal belt due to unplanned construction, exploitation of mineral resources and construction of road communication; unplanned and excessive aqua-culture; unplanned infrastructure construction.

Conversion of marshy non-forest ecosystems is conditioned by the following factors: drainage, excessive exploitation of fertile soil (humus, peat), intentional fires in basophilous peat bogs.

Conversion of secondary forest ecosystems is conditioned by the following factors: unbalanced and uncontrolled lumbering, drying due to unprofessional introduction of cultivars, unprofessional planting.

Conversion of meadow ecosystems in conditioned by following factors: excessive pasture, ploughing, mining and other similar agricultural interventions, natural progradation due to lack of maintenance (in absence of mowing).

Conversion of refugial-relict habitats is conditioned by the following factors: dams and hydro-accumulations, planning of new hydro-accumulations (Neretva, Sana, Bosna), excessive opening of new quarries, excessive exploitation of gravel.

Resources exploitation

Excessive exploitation of natural resources implies human use of these resources to the extent which prevents the natural recovery (renewable non-biological resources) and impair important phases during the period of their reproduction (renewable biological resources). When it comes to non-renewable resources, excessive exploitation implies the use of such resources to the extent which causes very significant environmental changes.

Factors of excessive exploitation are:

- Opening of quarries with high frequency of excavation in unique areas that contain very valuable habitats (saharoid dolomite, ophiolitic rocks, canyons, calc. sinter layers, high-value areas, thermal and mineral zones, etc.);
- Excessive exploitation of water resources (including all types of water habitats) for energy purposes, irrigation and water supply purposes, in particular from underground sources;
- Uncontrolled and intensive use of medicinal and edible herbs;
- Uncontrolled and illegal fishing and hunting i.e. collection of wild animals (snails, reptiles, amphibians, fish, birds, etc.);
- Illegal trade in rare, protected and unique geno-fund and geological diversity (stalactites, stalagmites, boulder, sand).

Figure 5: Map of quarries in FBiH
Pressures that occur due to excessive exploitation of biological and geological resources are manifested in:

- Reduced surface covered in valuable forest resources;
- Reduced biomass of medicinal, aromatic and vitamin species;
- Reduced population of reptiles, amphibians, fish and birds;
- Increased number of mines and quarries;
- Reduced quality of natural heritage.

State of biological and geological diversity conditioned by excessive exploitation of resources is manifested, primarily, in a changed structure of ecosystems and change in overall state of ecosystem, resulting by lose of some of the ecosystem services (air quality regulation, water quality regulation, climate, etc.). Excessive exploitation of biological resources led to fragmentation of habitats with multiple consequences to the resources used and also all organisms inhabiting the given habitat. Excessive and unplanned exploitation of mineral resources, apart from affecting biological diversity and causing irreversible damages to lithosphere, has a very strong impact on ambience and landscape values of the area and it diminishes the possibility of development of other economic branches of society. The Federation of BiH has basic legislation that regulates the use of natural resources. However, this legislation is not in accordance with the Law on nature protection and Environmental Protection Law.

Pollution implies a state that causes significant changes in spatial and temporal organization of an environmental ecosystem. Depending on the nature and intensity, and place of origin, pollution causes significant changes in the structure of biodiversity and natural heritage. Also, certain forms of atmospheric pollution lead to destruction of surface of geological diversity, affecting the quality and service values of air and reducing the adaptive values of many representatives of biodiversity with a lower ecological valence. Pollution of pedosphere leads to significant changes in the content of life in soil, and through destruction of risosphere causes significant changes, even disappearance of plants and animals. In water ecosystems, pollution affects the change in pH values and raises the eutrophication rate, which significantly alters the quality of habitat, content of organisms in ecological forms of bentos, plankton and nekton. Pollution in the area of ecumene causes negative impact on the quality of life and ecological productivity of population, livestock and plant resources, the rate of which can drop for 30-50%. Pollution also leads to weakening of immune systems in plants, animals and humans, opening the doors to a wide spectrum of different diseases such as mycosis, bacteriosis and virosis.

Pollution of environmental components results in change of the habitat condition, what causes complete loss of certain types of habitat. Pollution is one of the major driving forces causing changes at the level of species diversity. Given the fact that all species have defined ecological valence in relation to the spectrum of ecological conditions (all species are adjusted to live in certain conditions), the change of conditions prevents their survival and leads to their extinction. Furthermore, absence of certain species in some of the habitats significantly changes the content of biocenosis, resulting in degradation and changed type of ecosystem. Endemic and rate plants, animals, mushrooms and lichen, which are tolerant to very limited deviations in terms of ecological conditions are particularly endangered. Impacts of pollution to biological diversity can be direct (certain species and ecosystems) and indirect (chain pollution of certain spheres or through interaction of species in ecosystems). As already mentioned, in the set of environmental laws in the Federation of BiH, exist laws that regulate the issue of environment pollution. Just as with other change driving forces, we have to emphasize a very poor coordination in implementation of legislations in the set of environmental laws.

Influence of climate changes on nature

One of the important abiotic components of ecosystems is climate, whose change at the local level is a result of substantial change of basic parameters of climate at the global level. These changes are conditioned by various influences of the planet Earth and certain influences from the universe. They are followed by temperature and precipitations drop extremes and its unequal distribution. Global warming represents the main indicator of these changes and is reflected on the state of biodiversity in FBiH. These changes can be particularly noticed in the areas of mountain ecosystems populated by so-called criofil organisms (alongside glaciers). Additionally, the process will lead to change in borders of the existing forest ecosystems at the vertical profile, which will affect the current forest ecosystems of
spuca, fir tree, pine tree, and all frigorific species and community types. Significant changes will also occur in terms of reduced sources of fresh water and significant loses of biodiversity.

The pressures created by climate changes are reflected through changes of habitat conditions, which lead towards a loss of diversity of species and ecosystems typical for given habitats. The influence of climate changes in this region (South-Eastern Europe) as well as in BiH/FBiH is still in an early stage. The trends in the increase of temperature, increase of pressure on water resources, increase of frequencies of poor weather conditions and floods, increase of erosion and wood fires, will continue. The state of bio and geodiversity in the aspect of climate change in the Federation of Bosnia and Herzegovina is already characterised by an increased number of endangered populations, species and ecosystems. The influence on biodiversity has been confirmed by analyses conducted by scientists and experts from the region. This particularly relates to species and ecosystems on high mountain areas. One of the responses of the society to global climate changes is the adoption of the Climate Change Framework Action Plan for Adaptation to the climate changes for South East Europe. This Action Plan has been adopted by five state Ministries for environment (Albania, Bosnia and Herzegovina, Former Yugoslav Republic of Macedonia, Serbia and Montenegro).

At the conference held on 14.11.2008 in Sarajevo, the participants expressed interest in regional cooperation regarding the climate changes. Considering the global character of the climate changes issues, such regional cooperation is necessary. In addition, Bosnia and Herzegovina is obliged to implement the Framework Convention on Climate Change (Rio de Janeiro, 1992), which also obliges the Federation of BiH to follow the principles and implement the goals set within the Convention.

Invasive species

Invasive species are organisms that have the capability to distribute and spread their habitats and area on other territories, due to the high physiological and especially ecological reproductivity. Since they can achieve high production rate within a very short period of time, they quickly conquer new habitats and press and hinder growth and development as well as reproduction of organisms from other areas, that is autochthonous genofund. Due to various modern communication ways, different species can move for a short period of time to very distant areas (America, Asia, Africa). Nowadays some of these species represent a big danger for biodiversity of both, land and water ecosystems. The main reasons for the spread of invasive species, in addition to climate changes (that are often favourable to them), lie in insufficient control of seeding, herbal and animal living materials, various products, more increased openness of the land and its relatively small surface. To this should be added also genetically modified organisms and genetically modified food, which will certainly have very serious and enormous consequences, especially on the world of sensitive autochthonous biodiversity.

Pressures created by spread of invasive species. Spread of invasive species causes physical decrease of the size of habitat of autochthonous kind of plants, animals and fungus.

The state of bio and geodiversity during the spread of invasive species. Spread of invasive species endangers habitats and populations, species and entire ecosystems. Spread of invasive species in urban and agrosystems is of a particular importance it lowers the quality of life and endangers the autochthonous agrobiodiversity.

Influence of invasive species on autochthonous flora, fauna and fungus has not been sufficiently researched apart form the generally recognized reduction of habitat. Nevertheless, certain invasive species, such as Ambrosia spp. have proven allergic effect, and thus significantly influence the quality of life.

Existing responses of the society. So far there is no defined social framework of responses to the existence and spread of invasive species in the Federation of BiH.

Public awareness

Public awareness is result of interactive relations of a series of factors: political, economic, social, cultural and many other. Result of this reaction is development of a certain attitude towards environment and manifestations within. Public awareness strongly depends on public information, knowledge and a group of psychosomatic determinants. Current public awareness in FBiH is not at a satisfactory level. This state is responsibility not only of media (radio, TV and electronic media), but also of government structures working on raising public awareness. More attention should be paid to the work of NGO sector, particularly the
work of organizations and societies that, directly or indirectly, deal with environmental protection and strengthening of public awareness. Currently, in the Federation of BiH doesn’t exist framework for raising public awareness about environment.

**Identification (ranking) of ecosystems with high level of biodiversity**

Specific landscapes in overall diversity of the Federation of BiH, make a special contribution to unique character of FBiH:

- High-mountain landscapes, dominated by ecosystems of mountain meadows, mountain slides, cracks, basophilous peat, and pre-mountain ecosystems of juniper, beech, white bark-pine, spruce and fir tree.
- Diverse and poly-dominant landscapes in refugials of BiH:
  - Landscapes of relict pine forests in dolomites and ophiolitic zone with ecosystems of Illyrian pine and white bark pine;
  - Landscapes of relict and refugial ecosystems in canyons and cliffs of Una, Sana, Neretva, Bosna and Drina rivers, (which contain the largest diversity of ecosystems, communities, habitats and geological forms).
- Marshy landscapes (Hutovo Blato, Buško Blato, mountain lakes of Kupres, Bjelasnica, Preč, Cvrsnica, Sator, and island-shaped marshy areas (Vranica, Zvižeda).
- Complex ecosystem of Karst valleys (Grahovsko, Livanjisko, Glamocko, Kupresko, Suicking, Grudsko, Posusko, Dugo polje, Mostarsko Blato, Ljubusko, Stolacko and western part of Popovo polje with hydro geological and morphological phenomenon – the Cave of Vjetrenica).

**Description of particularly valuable areas**

**High mountain areas.** Federation of BiH is characterized by ecosystems of mountain landscapes having the significant diversity of biological forms and types of habitats. These landscapes, in FBiH, are located at the pre-mountainous and mountain belt of high massifs. Relief of the habitat is very dynamic. Very diverse and biologically relevant ecosystems are located at steep slopes, sinkholes, depressions, on cliffs with carbonate and siliceous geological base and shallow humus-based accumulation soil. The climate implies large snow precipitation, strong mountain winds and very expressed temperature extremes. Mountain depressions, where snow stays throughout the year, have volatile nivale ecoclimate. Despite very similar eco-conditions, most of the massifs in FBiH have very specific and unique life. Each massif emerged during its own development and shaping process and thereby was inhabited by different species. Diversity in development process resulted in a high level of endemic species in each massif in the territory of FBiH.

**Areas of relict and refugial ecosystems.** Particularly valuable parts of environment in FBiH are refugial and relict habitats that emerged after a long processes of shaping of earth crust, geogenesis, climate development and life. These are the habitats that suffered the least changes in the period from pre-glacial to post-glacial period. As a result of that, these habitats preserved old species of flora and fauna and specific types of ecosystems. Namely, within these habitats are many tertiary species of plants and animals, which managed to survive the drastic climate changes during the last glacial period. These habitats, which accommodate many types of relict plants and animals, are crucial for biodiversity of BiH, and thereby for global diversity. The position of tertiary relict ecosystems in FBiH is primarily linked to canyons, cliffs and steep mountain slopes and watersheds of the Una, Bosna, Drina and Neretva rivers.

**Marshes.** Marshes and swamps are nowadays most endangered ecosystems in FBiH. Marshy areas are habitats of many rare plants and different species of birds, reptiles, amphibians and fishes. Within worlds and European conservation actions these habitats and pertaining groups of organisms are considered as a priority. Due to shortage of hydromorphous soil in FBiH, and because of constant drainage and drying, the marshy habitats and whole ecosystems are limited to relatively small areas. In the area of FBiH, marshy habitats often have a local character, which is conditioned by specific orographic and edaphic circumstances. Marshy habitats are located in water-bearing geological grounds with different sediments and deep hydromorphous soils. Marshy landscapes include a large number of ecosystems with high landscape values, which attribute very specific ecological and biogeographical features to plain areas. These ecosystems include the areas along the major watersheds (Una, Bosna, Drina, Neretva) with developed communities of forests
Karst valleys. Karst forms in the area of FBiH are specific phenomena that refer to the patterns in development of earth crust, as well as in development of hydro-network, biological and ecological diversity. Karst in the broader sense implies a rocky desert, but in the narrow sense it implies a relief with predominant underground circulation in melting rocks (limestone, dolomite, calc. sinter). Karst develops through melting of a limestone by water that contains CO₂. In this process CaCO₃ transforms into Ca(CO₃)₂. Due to erosion, the cracks in limestone are expanding and build a network of underground channels and holes, which can go far below the sea level. Along major cracks bays emerged. Valleys, flats with irrigated base, usually emerge in places of contact between limestone and impermeable rocks. Sinking rivers are water streams that sink from the surface to Karst cracks or abysses, wherefrom they continue their underground flow. Ecologically and biologically most interesting Karst phenomenon are Karst valleys. They are formed through a very specific paths of orogenesis, geogenesis and hydrogenesis in variable climate conditions. Karst valleys create ecological diversity of FBiH very specific. Given the eco-climate features, Karst valleys of BiH are divided into following groups:

- Karst valleys of Western Bosnia (Glamocko, Livanjsko, Kupresko, Duvanjsko and Suicko polje);
- Karst valleys of Western Herzegovina (Posusko, Grudsko);
- Karst valleys of lower Western Herzegovina (Listicko, Ljubusko and Mostarsko Blato);
- Lower Karst valleys of Eastern Herzegovina (Busko Blato and Popovo polje).

It is necessary to emphasise the fact that all types of particularly valuable areas in the Federation of BiH are currently exposed to extremely strong anthropogenic pressures.

### 3.2 ENVIRONMENTAL INDICATORS IN THE AREA OF WATER

<table>
<thead>
<tr>
<th>WATER</th>
<th>[Indicator type]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of waters</td>
<td></td>
</tr>
<tr>
<td>Use of water for water supply</td>
<td>[P]</td>
</tr>
<tr>
<td>Use of water for irrigation</td>
<td>[P]</td>
</tr>
<tr>
<td>Use of water in industry</td>
<td>[P]</td>
</tr>
<tr>
<td>Water protection</td>
<td></td>
</tr>
<tr>
<td>Drainage and treatment of household and industrial wastewaters</td>
<td>[R]</td>
</tr>
<tr>
<td>Organic substance emissions</td>
<td>[P]</td>
</tr>
<tr>
<td>Quality of surface waters</td>
<td>[S]</td>
</tr>
<tr>
<td>Quality of underground waters</td>
<td>[S]</td>
</tr>
<tr>
<td>Quality of drinking water</td>
<td>[S]</td>
</tr>
<tr>
<td>Protection against water</td>
<td></td>
</tr>
<tr>
<td>Area under flood risk</td>
<td>[S]</td>
</tr>
</tbody>
</table>

**Table 7:** List of environmental indicators regarding state of waters in FBiH

FBiH Law on waters (“Official Gazette of the Federation of BiH”, no. 70/06) stipulates that the Water Management Strategy is an integral part of the Federal Environmental Protection Strategy. Drafting of the Water Management Strategy is a task of the Federal Ministry of agriculture, water supply and forestry. Accordingly, the Federal Ministry of agriculture, water supply and forestry and the Federal Ministry of environment and tourism, by coordinating their work plans for 2006 and anticipating development of strategies in their respective fields, approached to the preparation of individual components of the Strategy. For the purpose of a Federal Environmental Protection Strategy, certain indicators of the state of water were considered in a way to enable an overview of the overall situation of environment and interaction between individual components. The Federal Water Management Strategy from 2009 deals with this subject matter more detail.
3.2.1 Water quality

Use of water for water supply

Currently, there is no record on the water use that could offer a clearer picture about the real volume of water tapped for different purposes and users. In the network of water springs used for water supply, underground waters have a dominant role (over 50%). Statistical year books of FB&H contain data about volume of water tapped through public water supply systems. Based on data available, about 270 l/per capita is tapped every day, including the losses, which are about 50%. Thus, an average consumption, i.e. quantity of water delivered per day to consumers is about 135 l/per capita. About 70% of the overall water delivered through these systems goes to households.

Main reasons for the functioning difficulties of water supply companies are tied to large physical losses in the systems, which in some cases go up to 80%, low payment rate (below 50%), low prices and organizational fragmentation at the municipal level. All these elements determine very poor financial indicators. Current state of companies dealing with water supply management system discourages foreign investors to invest, since the investment risks are too high, in particular from the aspect of regulations. There is no systematic monitoring of drinking water quality and standard compliance, except in a few major municipal water supply systems.

Use of water for irrigation

There are no precise figures on surfaces irrigated. According to some estimates, in the coastal area of Adriatic Sea there are currently about 7,000 ha being irrigated. Assuming that an average water consumption is about 3,000 m$^3$/ha/yr, the daily consumption is then about 146 l/per capita.

4 Reports delivered to the Federal Statistics Bureau are partly based on records and documentation and partly on estimates.
**Water use in industry**

According to Statistical year book of FBiH quantity of water delivered through public water supply systems for other activities is about 30% of overall water delivered. Since major industrial facilities are supplied from their own springs, these figures cannot be considered relevant for assessment of the quantity of water used in industry.

3.2.2 Water protection

**Drainage and treatment of households and industry waste waters**

There are no precise data about percentage of households covered by a sewage system. Even in some bigger municipal centers there are peripheral settlements, which often are not connected to a sewage system. So far, there are 5 wastewater treatment plants, while wastewaters from other settlements are directly released into open water streams. Aforementioned wastewater treatment plants are located in Gradacac, Srebrenik, Ljubuski, Grude and Neum.

According to document “National Diagnostic Analysis BiH” (NDA BiH) from 2003, estimated quantity of wastewaters from households is cca. 0.65 m³/per capita. FBiH Statistics Annual claims that this figure for the entire FBiH is 1.7 m³/per capita, but this figure is not considered as representative.

**Organic substance emissions**

Having in mind the situation regarding the waste water treatment in FBiH, it is not realistic to expect reduction in terms of discharge of organic substances and nutrients into waters, in the near future. In order to assess the organic substance emissions in water, we used a theoretical model offered in the IMPRESS guide of Water Framework Directive, which was then compared to data collected by NDA BiH for the Adriatic Sea watershed. The assessment made can be considered representative. In the Sava River, the annual production is about 40,000 BOD (t/year), 15,000 N (t/yr) and 2,000 P (t/yr) from population, cattle and agriculture, respectively. As for the Adriatic Sea, the values are 8,000 BOD(t/yr), 4,000 N(t/yr) and 450 P(t/yr).

This pressure corresponds to indicators of CSI 020 (concentration of nutrients), CSI 019 (oxygen-consuming river substances) and other calculated indicators not being in the CSI list.

**Quality of surface waters**

Quality of surface waters – those that are registered and classified in accordance to regulations of the former SFRY (“Official Gazette” no. 6/78 and 8/78), mainly corresponds to the limiting values. The worst situation is noted for the Bosna River particularly in the Spreca River, according to data obtained from the station near Doboj. Over the past few years some of the old stations for quality and quantity monitoring have been repaired and some new are installed. Apart from the agencies in charge for water streams of the Sava River and watershed of Adriatic Sea, monitoring of surface waters is also conducted by the Federal Hydrometeorological Institute and public electric-power companies. In order to set up monitoring as required by Law on waters, it is necessary to adopt regulations on common content and methodology for development of a database on water protection in the river confluences, especially regulation on frequency of monitoring locations, sampling frequency and

![Figure 7: Emission of organic substances into water](image-url)
methodology, list of mandatory parameters, analysis methodology and assessment algorithms, list of plants that are to conduct the monitoring on their own or otherwise ensure data relevant for water protection.

**Quality of underground waters**

In the Federation of Bosnia and Herzegovina, there is neither systematic monitoring of underground water quality nor any data on quality. The Law anticipates development of a monitoring program and introduction of a monitoring station for tracking the state of underground waters, i.e. chemical content and quantity thereof.

**Quality of drinking water**

Water quality is not subject to systematic tests. Internal controls of drinking water quality are conducted only in major water supply systems. FBiH Law on waters stipulates an obligation for authorized laboratories regarding usage of regular and systematic water tests. Drinking water quality conditions are determined by the Federal Ministry of Health.

### 3.2.3 Protection against water

#### Protection facilities

Technical part of anti-flooding system, which was in place and functioning before the war in BiH, consists of a large number of protection facilities and dykes installed along the Sava and Neretva Rivers and their tributaries (along 350 km). The system consisted of: (i) 170 km of peripheral channels; (ii) 25 pump stations of 120 m³/s capacity for protection against underground waters; (iii) 76 km of controlled water streams; (iv) 55 km of built banks; (v) 3.8 km of tunnels with two-tower drainage systems for waters from flooded Karst valleys; (vi) 28 water accumulations - capacity of 3.6 billion m³; and (vii) a series of other protection installations such as controlled streams, small accumulations, etc.

Present state of these establishments is very poor, partly due to war damages and partly due to poor maintenance caused by a lack of funding and fact that some facilities are mined. This is particularly the case with the settlements along the Sava River. In case of rare large-scale floods in this area, the consequences would be immeasurable. Certain measures have been taken to improve the state of these establishments, but their condition is still beyond satisfactory. Situation in other parts of country is not much better, as one could see after the 2001 floods in Tuzla Canton. The 2001 floods caused enormous material damage to crops, housing facilities and infrastructure. The wave of floods in Tuzla Canton also triggered erosion of arable land and landslides.

#### Area at risk of flooding

According to some estimates, currently there are about 21,500 ha of land in the watershed of the Sava River at risk of major flooding (occurring once in 100 years). Also, in the area of the Adriatic Sea there is cca. 20,600 ha at risk of flooding.

### 3.3 ENVIRONMENTAL INDICATORS IN THE AREA OF LAND

<table>
<thead>
<tr>
<th>LAND</th>
<th>[Indicator Type]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure of overall land</td>
<td>[S]</td>
</tr>
<tr>
<td>Structure of urbanized land</td>
<td>[S]</td>
</tr>
<tr>
<td>Land use</td>
<td></td>
</tr>
<tr>
<td>Conversion</td>
<td>[P]</td>
</tr>
<tr>
<td>Annual average of agricultural land conversion</td>
<td>[S]</td>
</tr>
<tr>
<td>Development of land use monitoring system</td>
<td>[R]</td>
</tr>
<tr>
<td>Land protection</td>
<td></td>
</tr>
<tr>
<td>Land emissions</td>
<td>[P]</td>
</tr>
<tr>
<td>Anthropogenous and special degradation of land</td>
<td>[P]</td>
</tr>
<tr>
<td>Land sensitivity</td>
<td>[P]</td>
</tr>
<tr>
<td>Land acidity</td>
<td>[S]</td>
</tr>
<tr>
<td>Contamination with heavy metals and other chemical agents</td>
<td>[S]</td>
</tr>
<tr>
<td>Health condition of land</td>
<td>[S]</td>
</tr>
<tr>
<td>Physical loss of land</td>
<td>[S]</td>
</tr>
<tr>
<td>Land density</td>
<td>[S]</td>
</tr>
<tr>
<td>Structure by quality classes</td>
<td>[S]</td>
</tr>
<tr>
<td>Development of land quality</td>
<td>[R]</td>
</tr>
<tr>
<td>Certified forests – FSC</td>
<td>[R]</td>
</tr>
</tbody>
</table>

Table 8: List of environmental indicators of state of land in FBiH

#### 3.3.1 Land structure

Structure of overall land

Data on current use of land are very important for a sustainable land resource management. According to statistics
of the Federal Statistics Bureau\textsuperscript{5}, FBiH has 1,140,000 ha of agricultural land. Of that, 719,000 ha (63 %) in arable land, 419,000 ha (36.8 %) in pasture land, and 2,000 ha (0.2 %) in marshy and other land.

In 719,000 ha of arable land, about 411,000 ha (57.2 %) are in ploughed fields, cca. 42,000 ha (5.8 %) in orchards, 4,000 ha (0.6 %) in vineyards, and 262,000 ha (36.4 %) in meadows. In the Federation of BiH there is about 0.40 ha of overall agricultural land per capita, while share of arable land is significantly smaller (0.25 ha/capita).

According to International Standard 0.17 ha of arable land per capita is a critical limit required for feeding the population. As the population grows, the ratio will continuously drop. This situation will impose the need for a very rational and targeted use of agricultural land in accordance to the relevant legislation.

\textsuperscript{5} 2006 Statistics Annual for FBiH

Structure of land use should be monitored in accordance to the international standards, so that obtained data can be compared. Accordingly, there shall be data on structure of land by type of cover in line with the Corine Land Cover classification. For the time being, such data are not fully available in the Federation of BiH and one can obtain just a rough estimate for only four types of covers. These rough estimates are available for whole BiH.

Obvious discrepancies in data from different sources suggest that there is a lack of reliable data collected in appropriate manner and in accordance with internationally recognized tracking methodology.
Structure of urbanized land

According to spatial planning data available, 7% of overall land is intended to be used for urban and rural development. Only 2% of overall land are reserved for exploitation fields and construction zones, roads and energy infrastructure.

<table>
<thead>
<tr>
<th>Category</th>
<th>km²</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total FBiH</td>
<td>26,110.5</td>
<td>100.0</td>
</tr>
<tr>
<td>Urban and rural development</td>
<td>1,830</td>
<td>7.0</td>
</tr>
<tr>
<td>Exploitation fields and construction zones</td>
<td>520</td>
<td>2.0</td>
</tr>
<tr>
<td>Roads and energy infrastructure</td>
<td>520</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Table 9: Structure of urbanized land in FBiH

3.3.2 Land use

Conversion (transformation)

Figure 12: Structure of land use in BiH (Source: FAO (GCP/BIH/002/ITA), March 2002)

Figure 13: Share of certain activities in anticipated 10-year land use conversion
The most significant pressure, when it comes to use of land and its structure, is conditioned by requirements of socio-economic development. Due to growth of population, change in lifestyle of population, increase of purchasing power and economic development, the needs for land use transformation become greater. Accordingly, the land structure changes, to certain extent, in line with aforementioned categories to detriment of agricultural and forest land, i.e. to detriment of high-quality categories that enable vital ecological functions of soil.

Tracking the land use transformation gives and preliminary insight in detection of potential danger to the quality of environment, biodiversity and health of people. Therefore, the EEA list of key environmental indicators includes the "CSI 014 Land take", which tracks the categories of land that are disappearing and land surface in hectares taken for other purposes (industry, mines, urban development, etc.). This indicator also determines the activities that have the highest requirements in terms of land. In Europe, the need for land is usually satisfied from the category of arable land, so 48.4% of the overall land converted is arable land. In FBiH there are no data about converted land since there is no integrated record or data obtained from lower levels of government available. Sarajevo Canton is an excellent example – the spatial plan of Sarajevo Canton (2003-2023) anticipates that a share of construction land will increase from 14.6% to 20.28%, primarily to the cost of agricultural land whose share will drop from 36.9% to 28.7%.

Data offered in the BiH Spatial Plan for period 1981-2000 can serve as a fair estimate. Based on these data a general assessment about the land surface needed for certain activities in the period of 10 years can be made (see next Chart). Accordingly, the infrastructure appears as "the major land user". Having in mind the war and post-war events, one can assume that the share of housing in industrial zones is percentagewise somewhat higher than the share of infrastructure.

In order to plan and protect the land it is necessary to identify the most endangered areas, that is, the land that suffered the most significant changes. The most adequate methodology for tracking these changes is through satellite images. However, currently it is not possible to make these images for Bosnia and Herzegovina. The most endangered zones in the Federation of BiH are urban industrial centers presented in Figure 15. Broader area of Mostar and Neum are the zones that suffer significant changes in terms of land use transformation. It is important to mention that significant changes also occurred in the lower density zones, i.e. rural areas in which there is an increased trend of building sport and recreational centers, for example in Vlasic, Igman, Bjelasnica, Kupres, etc.

Annual average of land use conversion

As noted earlier, agricultural land, especially arable land, is a very precious resource in the Federation of BiH and it is getting very close to the arable land limit required under the international population standard. Therefore, it is extremely important to track the level of agricultural land loss on annual basis. Based on expert evaluations, in the Federation of BiH some 0.101% of agricultural land is lost/converted per year. Although the FBiH Law on agricultural land imposes an obligation to competent cantonal ministries to keep record on change/conversion of agricultural land, such data is not available. Some cantons do not have such records at all, while some refuse to disclose information on agricultural land conversion.

Development of land use monitoring system

In order to manage a valuable and limited resource such as land in a sustainable manner, in the Federation an integrated and efficient system should be established to moni-
According to some experts, devaluation of land due to inadequate functioning of real estate market/land created a perception in the minds of people that land is unlimited resource, which resulted in a completely irresponsible attitude towards land. Therefore, the obstacles to establishment of an efficient land market need to be removed. Major problem in this segment is inadequate cadastre and land registers, which make the title verification process very lengthy and in some municipalities very complicated. Law on land registers (“Official Gazette of FBiH” no. 58/02) imposes an obligation of introducing electronic data entry and processing. The problem remaining in the municipalities is lack of sufficient budgetary funds and/or other resources which would comply with these legal provisions. Problems concerning land use monitoring can be summarized as follows:

- There is no precise and credible categorization and inventory of land followed by a set of appropriate technical maps for FBiH,
- Incomplete data on land use transformation,
- No record on all spatial changes,
- No satellite images to enable efficient identification of changes,
- Cadastre and land registers are not updated, while pasture land cadastre is kept in only four cantons: Posavski (590 ha), Bosansko-podrinjski (25 ha), Srednjobosanski (21.38 ha) and Herceg-bosanski (68 ha)\(^8\)
- Only a few cantons keep record on uncultivated agricultural land.

### 3.3.3 Soil protection

Regarding soil protection, the most significant threat to the quality of soil, that is, its ability to provide physical and ecological functions necessary for sustainable development, lies in various emissions that directly or indirectly reach the soil, in various types of antropogenous degradations, and land sensitivity being result of natural characteristics of the FBiH territory. In order to plan the appropriate protection of soil, it is necessary to have the data – indicators, showing potential problems that can endanger quality of human life and natural habitats of the large number of sensitive plants and animals.

#### Emission into soil

Everything said about pollution of water, air and disposal of waste should be repeated in this section. All these emissions directly or indirectly, fully or partially, end up in the soil, creating the risk for human health and survival of plants and animals. Currently, there is lack of available data regarding all present emissions, hence it is hard to estimate the exact pressure on the soil. However, it is a known fact that the emission of lead is 15 t a year (10 % coming from furnaces). These emissions from air will be more and more important factor of pressure as the industry and roads network develop. However, waste disposal is currently the most important pressure and risk factor. Every year, 1.5 million tonnes of waste is produced, and that is 15 % of annual production, while 10 % of the waste is toxic. It is worrying that only 40 % of waste is collected in an organised manner and sent to 56 sanitary landfills, as well as the fact that there is no public awareness that the waste should be sorted in households. Besides, 90 % of industrial waste is inadequately disposed as well as 77 % of medical waste. Additional problem lays in the lack of data on petrol and petrol derivatives storage facilities and reports on their status. In other words, it can be said that there is a general lack of information that could precisely define risk areas and levels of risk for natural habitats and human health.

\(^6\) Bublin (2004): Inventory of post-war situation of land resources in BiH, FAO office in Sarajevo, Project GCP/BiH/002/ITA.

\(^7\) Price of land does not reflect real value of the land.

\(^8\) FMPVŠ (2007): Study on state of the agricultural land, draft version.
Antropogenous and special degradation of soil

Areas that are already degraded, contaminated in a certain way, represent a significant risk to human health, natural resources, and natural habitats. According to EEA indicators (CSI 015 Progres in management of contaminated sites), monitoring covers only the progress of a certain sites in terms of removal and/or reduction of risk imposed by such areas. This obliges all member states to identify such areas and conduct an assessment of the risk to environment and human health, and to make a plan for controlling of such risk and/or complete removal of the risk. This plan then monitored. The Law on Spatial Planning and Land Use (“Official Gazette of FBiH”, issue no 4/06) foresees keeping records on all spatial changes, including these, but does not foresee keeping of registry (cadastre) for such areas. Generally speaking, there is no reliable and documented source of data that would enable identification of such degraded areas and assessment of the environmental. However, according to pre-war data on the level of BiH, there were 20,000 ha of technogenous desert (0.5 % of BiH territory). It should be pointed out that the disposal of bulk waste is evident in rural areas, which significantly endangers the possibility to generate income, especially in non-agricultural activities such as tourism. Also, minefields that account for 4 % of territory of FBiH represent a constant threat to environment quality and possibility to generate income. The presence of landmines will stand as a real threat for humans and development in some areas for years to come.

Soil sensibility

It is natural characteristics of the soil of entire territory of B&H, that defines this resource as extremely sensitive medium which needs to be handled with extreme caution, in line with appropriate plans and systematic care principles. The facts that 84.2 % of the territory has the slope over 13 %, and that 40 % of the land is lower than 30 cm above the sea level, while 17 % of the land is very shallow, indicate that the largest part of the territory can be categorised as sensitive soils that need extra care, special handling methods, and use of specialised production practices. Therefore it is worrying fact that there is no map of highly sensitive areas, as well as no agro-environmental policy (programmes) dealing with this issue. Currently, only a small portion of the budget for support of agriculture is allocated for stimulation of sustainable agricultural production; within the area of rural development – there is no focus on the soil issue.

9 For further details visit http://themes.eea.europa.eu/IMS/CSI
Acidic reaction of soil can be natural and anthropogenously induced characteristic of the soil. In BiH, about 43% of all soils have an acidic reaction. In general, the main cause of anthropogenously acidification of soil and occurrence of “acid rain” is in contaminated water flows. However, it should be noted that there are not data that could be used for precise identification of affected areas. There are only some pre-war data indicating the influence of inadequate agricultural practices. According to data from Federal Agropedology Institute, acidification of agricultural land due to intensive use of fertilisers in the last 30 years of pre-war period (1956-1991) was somewhere between 0.5 and 1.5 pH units, which means that in certain areas in BiH, on state owned farms, due to use of N:P:K fertiliser, average pH value used to drop from 6.0 to 5.5 pH in H$_2$O. These processes affected almost 65,000 ha of mainly plain and hilly terrain. There are no data on private farms which account for most of the territory. Apart from inadequate agricultural practice, acidification of soil is also a result of inadequate forest and forest land management. There are no official data indicating the extent of the problem, but the very fact that one of the main problems of BiH forestry is illegal felling indicates that the forests are not managed properly. Correct answer would be to propagate sustainable practices of forestry in agriculture. So far, FBiH does not have clearly defined agro-environmental programmes as a part of overall policies for agricultural support. However, the situation has somewhat improved since as of this year, there is support for whole-grain and organic agricultural production.

Contamination with heavy metals and other chemical agents

It is hard to talk about the level of contamination with heavy metals and other chemical agents. Researches of soil contamination were conducted sporadically, so we have access to data from researches conducted by Federal Agropedology Institute in 1998, 1999, 2000 and 2005.
it is possible to present these data which can be used as indication on the level of soil contamination with heavy metals. Share of soil with medium and high content of heavy metals, where Co and Cd are not shown as important polluters (the second percentage represents share of land with high contamination level):

- Sarajevo Canton – Pb (37 %, 13 %), Cu (88 %, 2 %), Zn (90 %, 0), Mn (72 %, 1 %),
- Una-Sana Canton – Pb (22 %, 2 %), Cu (62 %, 0 %), Zn (68 %, 0 %), Mn (83 %, 5 %),
- Tuzla Canton– Pb (11 %, 0 %), Cu (60 %, 1 %), Zn (54%, 0 %), Mn (67 %, 3 %),
- Central Bosnia Canton – Pb (0 %), Cu (88 %, 2 %), Zn (78 %, 0 %), Mn (56 %, 44 %).

There are also some other pre-war data that can be used as indicators (Kubat 1987), overview map of aureole of natural and artificial contamination – Field Velika Kladusa (Ba and Pb), field Otoka B. Krupa (Pb and Cu and Ag), three fields Bihać (Al, Fe, Ti and Ga), Cemernica (Al and Fe, Si, Mn), Bugojno-Prozor (Ba, Hg, Sb, Pb, As), Kreševo- Fojnica (Pb, Sb, Hg, Ba, F, As and U), Borovnica-Vares-Cevljanovići-Srednje (Pb, Sb, Hg, Ba, Zn, Cd), Olovo (Pb), Tuzla (Cl and Na), Goražde – Čajniče (Sb, Hg, Pb and Ba).

In absence of systematic research and monitoring, there are no data on contamination of soil with radionucleoids, organic pollutants and NO\textsubscript{x} compounds. There are only data from Federal Agropedology Institute who have monitored pollution along regional roads M5, M16, M17, M18 during the period 2004 – 2006, and there are no records on increased contents of pollutants.

So, due to the lack of data, it is not possible to give an estimate of the actual soil contamination status in BiH for both these bases, but it can be said that large urban and industrial centres, as well as areas under air currents carrying pollutants from huge facilities such as TP Ugljevik, are in fact areas under risk.

Health status of land

There are no data on the health status of the soil, however, all areas with occurrence of sheep diseases such as brucellosis and footrot are considered risky. This primarily includes areas around Travnik (Vranica and Vlasic), areas around Konjic and Sarajevo. Risky areas also exist in large urban centres, mainly in large unprotected playgrounds, since there is no adequate regulation related to keeping of domestic animals and pets.

Physical loss of land

According to available data from Federal Agropedology Institute, it is estimated that average annual loss of land in BiH is 3,000 ha. The following graph shows causes of loss of land in BiH. It should be pointed out that systematic monitoring of physical loss of land does not exist and therefore there are no relevant data. The existing estimate is worrying enough, and calls for as many activities as needed to protect this precious resource.

Density of land

There are no available data that could enable us to make an evaluation of situation regarding density of land. Inadequate agricultural practice results in increased density of land which has negative effects on land fertility and endangers survival of species present on such land; therefore, it has negative effects to quality of life of humans and biodiversity in general.
**Structure per yield classes**

Quality value of land is defined by its yield class (quality of land), with the most valuable land of the highest quality in category I, and the poorest in category VIII. Yield class in BiH is mainly defined by the slope, depth, structure, texture, contents of humus, reaction, water permeability, contents of rocks, number of vegetation days, altitude, etc. Data on the structure of land are from the pre-war period and they include entire territory of BiH since after the war no systematic monitoring of land quality in FBiH was established.

![Diagram showing land structure in FBiH according to land quality categories](image)

As shown in the previous image, there is just about 14% of high quality land in BiH, and the majority of land is of medium quality – 67% of category IV to VI land. Therefore the law on agricultural land requires that the land of I-III cadastre class may be used as agricultural land; it can be used for other purposes only if it is absolutely necessary. The spatial plan defines the ways of use of all land surfaces. However, since there are no mechanisms that would ensure execution of this obligation, the regulation is not applied and it can be expected that after the war the quantity of agricultural land will decrease; anyhow, it is not possible to tell to what extent.

**Level of development of land quality monitoring**

Although there are two laws (Law on Agricultural Land and Law on Spatial Plan and Land Use in FBiH) offering legal grounds for establishment of integrated system of land monitoring (which includes land quality monitoring and any spatial change), no institutions responsible for such establishing have been put in place so far. Federal Agropedology Institute obtained the appropriate authorisations, but they were not sufficient for forming of such complex land information system. So it may be said that the development of monitoring system is at the very beginning and that the main obstacle for its further development is hidden in the lack of institutional solutions on the level of FBiH. It is important to point out that there are no:

- Utility value of land plans with all accompanying analytical documents and thematic maps. Cantons are obliged (by Article 6 of the Law on Agricultural Land) to create and finance such plans, and that has not been done in all cantons (Una-Sana, Tuzla, Sarajevo, Central Bosnia, Bosnia-Podrinje and Posavina Canton fulfilled this obligation);
- Certain thematic maps that are used for all land protection plans and programmes;
- Registry of contaminated areas and inventory;
- Classification of contaminated areas according to risk levels;
- Data on actual land contamination;
- Monitoring of legal obligations (recultivation, etc.).

**Forest certification – FSC**

Forest management and use significantly affect the quality of land. Therefore it is very important to manage forest resources in a sustainable manner. Forest certification is one of the ways to ensure sustainable forest management.

### 3.4 ENVIRONMENTAL INDICATORS IN THE FIELD OF ENERGY

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total (domestic) production of energy in FBiH</td>
<td>[S]</td>
</tr>
<tr>
<td>Final consumption of energy per sectors</td>
<td>CSI 027 [S]</td>
</tr>
<tr>
<td>Total energy intensity in BiH</td>
<td>CSI 028 [R]</td>
</tr>
<tr>
<td>Total consumption of primary energy per types of energy-generating products in BiH</td>
<td>CSI 029 [S]</td>
</tr>
<tr>
<td>Consumption of renewable energy in BiH</td>
<td>CSI 030 [R]</td>
</tr>
<tr>
<td>Electric energy from renewable sources in BiH</td>
<td>CSI 031 [R]</td>
</tr>
<tr>
<td>Large furnaces</td>
<td>[P]</td>
</tr>
<tr>
<td>Small furnaces</td>
<td>[P]</td>
</tr>
</tbody>
</table>

**Table 10**: List of environmental indicators of status of energy sectors in FBiH
Total (domestic) production of energy in FBiH

In energy balance of FBiH, production mainly includes domestic energy resources – coal and hydro energy. Coal is mainly transformed into electric energy and compared to water power in total production of energy in FBiH, its participation is somewhere near 2:1 (thermal plants: hydropower plants).

Coal (brown coal and lignite) is produced in ten mines on the territory of FBiH (Kakanj, Zenica, Breza, Bila, Gracanica, Kreka, Djurdjevik, Banovici, Tusnica and Kamengrad) for the purposes of production of electric energy and heat, industry and general consumption.

Electric energy is produced from domestic coal in two thermal plants (Kakanj and Tuzla), and from water in eight hydropower plants (Rama, Jablanica, Grabovica, Salakovac, Mostar, Capljina, Jajce 1 and 2), and some low-power hydropower plants. In thermal plants, by use of co-generative systems, there is simultaneous production of heating energy and technological steam.

Liquid fuels and gas have been imported. Liquid fuels are mainly used in traffic.

Energy from renewable sources, except for hydro energy, is still not present in energy balance of FBiH, since it is not significantly present in energy industry of FBiH. Regarding firewood, there are no reliable data so even if it is believed that its share in total production of primary energy in FBiH is significant (probably 5 to 8 %), this segment remains outside energy balance.

Final consumption of energy per sectors CSI 027 - BiH

Final consumption of energy includes energy delivered to consumers of all types of need for energy and all sectors, except for energy sector.
Total energy intensity in BiH CSI 028 [R]

Total energy intensity is defined as a relation between total consumption of primary energy and GDP for that calendar year.

Figure 19: Consumption of primary energy, GDP, energy intensity for BiH for the period 1998 – 2004 (source: CETEOR d.o.o. Sarajevo)

Total consumption of primary energy per types of energy-generating products CSI 029 - BiH

Total consumption of energy is calculated as a sum of total consumption of energy produced from solid, liquid and gas fuels as well as from renewable sources of energy. This data is provided for entire Bosnia and Herzegovina. Relative share of certain type of fuel is determined as a relation between total consumption of specific energy-generating product and total consumption of energy in a certain year. Data on total consumption of energy per types of energy-generating products for the period 1998 to 2004 are shown at the following image.

Figure 20: Total consumption of primary energy in BiH (Source: CETEOR d.o.o. Sarajevo)
Consumption of renewable energy in BiH - CSI 030 [R]

Consumption of renewable energy represents a relation between consumption of energy produced from renewable sources and total consumption of energy for a certain year, representing a share of renewable energy sources in total consumption. This is shown at the image below.

Electric energy from renewable sources in BiH CSI 031 [R]

The “renewable electric energy” indicator is a relation between electric energy produced from renewable energy sources and total consumption of electric energy.

![Figure 21: Consumption of renewable energy in BiH for the period 1998-2004 (Source: CETEOR doo Sarajevo)](image1)

![Figure 22: Share of electric energy from renewable sources compared to total production of energy in BiH in the period 1998-2004 (Source: CETEOR doo Sarajevo)](image2)
Large furnaces

There are two thermal power plants using coal on the territory of FBiH:

TPP Tuzla, with total installed power of 715 MW and average annual production of about 3,100 GWh, consumes around 3 million tonnes of coal per year. Basic activity of TPP Tuzla is production of electric energy for the needs of electric energy system (EES). As a part of its basic business activity, it also produces and delivers thermal energy as its primary product, produces and delivers heating energy for the system of remote heating of cities of Tuzla and Lukavac and technological steam for industrial purposes. Also, as additional activity, it delivers industrial water for the surrounding area. TPP Tuzla burns lignite and brown coal from mines “Kreka” (Dubrave, Sikulje, Mramor and Bukinje) and “Banovici” on furnaces 4-6, and on the furnace 7 – brown coal from mines “Djurdjevik” and “Banovici”. This TPP also burns 100,000 t/yr of coal from Stanari mine.

TPP Kakanj, with total installed power of 450 MW and average annual production of about 2,300 GWh, consumes about 1.5 million tonnes of coal per year. Apart from primary product in form of electric energy, TPP “Kakanj” also produces and delivers heating energy for remote heating of Kakanj and delivers slag and ash to cement factory Kakanj. TPP “Kakanj” burns mixture of brown coals from mines Kakanj, Breza and Zenica, and to a smaller extent, from mines Gracanica, Bila and Livno.

Small furnaces

When it comes to small furnaces, situation in FBiH is characterised by inadequate furnace constructions (small furnaces for home use and low power boilers are mainly produced according to Western-European licences, built for different types of coal and do not ensure efficient and low-pollution burning of domestic coals). Having in mind that the majority of cities in BiH is placed in valleys with poor ventilation conditions (natural self-cleaning of atmosphere), and that large losses of energy in buildings contribute to pollution, situation in BiH is not satisfactory.
The coal is mainly excluded from use in Sarajevo (natural gas is used instead), but in many other cities, it is partially replaced by expensive electric energy. In rural areas, wood is used as an energy-generating product. Since the buildings are built without necessary heat insulation, furnaces with low level of effectiveness are used and they are handled carelessly; consumption of wood in countryside is extremely high. Many cities in BiH offer central heating for central urban areas. Central heating has numerous advantages: households do not need to purchase firewood and maintain burners, and it is possible to achieve quality burning, that is, higher level of effectiveness and lower air pollution, emission of gases from one (tall) chimney. It is a fact that these systems in BiH are quite old and poorly maintained, and current standard of living does not allow following of organisational and technological innovations in this field. At the same time, decreased standard of living in BiH for a huge number of households, as well as an increase in price of energy-generating products, resulted in lower rate of billing services for heating and operational difficulties of companies supplying energy. Solution for this problem lays in increasement of the effectiveness level both in conversion of fuels into heat and fuel usage.

A large number of small companies have their own industrial power plants. Occasional measurements have shown that they operate with low level of effectiveness (poor maintenance, lack of instruments for monitoring of burning efficiency). This results in higher consumption of fuel than necessary and therefore higher emission of sulphur dioxide, except for Sarajevo, where the efficiency of combustion is controlled every year, since 1972. In other cities, control is not present, although experiences from Sarajevo show that costs of control (including inspectors’ salaries) account for not more than 3% of achieved savings in fuel. Central heating issue is present throughout BiH. Economic situation prevents citizens from paying for central heating services and they tend to switch to individual heating, which could cause increase in air pollution.

**Number of registered motor vehicles**

Road traffic has the biggest influence on environment, and especially transportation by passenger cars (due to low efficiency). Traffic, except in narrow city centres, does not stand as an important air pollutant in FBiH. Roads network is quite undeveloped, and transit traffic through FBiH is almost non-existent. Speed on roads is relatively low, so traffic does not cause significantly high emissions of nitrogen oxides, while the emissions of CO are significant only in centres of larger cities, as well as in zones with highways passing through settlements.

Based on the amendments to the Law on Traffic, age limit for import of passenger cars is abolished. Although it was said that all imported vehicles should meet environmental criteria, this will not result in lower influence on air quality. Image below shows the number of registered motor and passenger cars for the period 1999 – 2004 as well as the number of passenger cars per population of 1,000. Number of passenger cars per population of 1,000 in Croatia in 1998 was 198.

![Figure 25: Number of registered motor and passenger vehicles in FBiH (Source: Federal Institute of Statistics)](image)

Consumption of oil derivatives in road traffic in FBiH in 2008 was 615,028.08 tonnes.

Analysing and comparing data on registered motor vehicles in 2008 in BiH (data provided by Agency for Identification Documents, Records and Data Exchange) with data acquired in the period 2000 – 2008 (data provided by relevant ministries of internal affairs) was noted significant increase in the number of registered motor vehicles in 2008, which is by 17 % when compared to 2004.

During the period 1999 – 2004, volume of railway transport increased. So the number of transported passengers increased from 182,000 in 1999 to 208,000 in 2004, which represents an increase of about 15 %. Volume of cargo railway transport also increased during this period – from 115 to 445 million t/km, which represents an increase of 287%.
3.5 ENVIRONMENTAL INDICATORS IN AIR PROTECTION FIELD

<table>
<thead>
<tr>
<th>AIR</th>
<th>[Indicator Type]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emissions into air</td>
<td></td>
</tr>
<tr>
<td>Emission of acid gases (acidifying substances) in FBiH</td>
<td>CSI 001 [P]</td>
</tr>
<tr>
<td>Emission of ozone precursors CH₄, CO, NOₓ and NMVOC in BiH</td>
<td>CSI 002 [P]</td>
</tr>
<tr>
<td>Emission of primary particles and secondary precursors of particles PM₁₀, SO₂, NOₓ and NH₃⁻</td>
<td>CSI 003 [P]</td>
</tr>
<tr>
<td>Emission of GHG</td>
<td>CSI 010 [P]</td>
</tr>
</tbody>
</table>

| Air quality | |
| Production and consumption of compounds that damage ozone layer | [P] |
| Acidity of (pH) precipitations | [S] |
| Exposure of ecosystem to acidification of atmosphere, eutrofication and ozone | [S] |
| Overstepping of limit values of air quality parameters in urban areas | [S] |
| Contents of heavy metals in total airborne particles | [S] |

| Monitoring | |
| Overview of status of air quality monitoring | [S] |

Table 11: List of environmental indicators of air status in FBiH

3.5.1 Emissions into air

Emission of acid gases (acidifying substances) in FBiH – CSI 001 [P]

Main human activities that cause acidification and eutrophication of the environment are burning of fossil fuels and agricultural activities that result in emissions of sulphur dioxide (SO₂), nitrogen oxide (NOₓ) and ammonium (NH₃⁻). Indicator that has been following trends of anthropogenic emissions of acidifying gases (CSI 001) since 1990, ranks each contaminating substance according to its acidification potential. The appropriate potentials are NOₓ 0.02174, SO₂ 0.03125 and NH₃⁻ 0.05882. CSI 001 and emissions of certain acidifying gases for FBiH are shown in Image 26. Emissions for 2004 were estimated based on data on production, consumption and composition of fuels, and measuring of emissions of pollutants, acquired from individual emission sources in FBiH as well as based on energy balance for 2004. Emissions for 1990 were estimated based on appropriate emissions calculated for BiH.

![ CSI 001 indicator trend from 1990 to 2004](image26.png)

Figure 26: Emissions of pollutants

Image above shows that CSI 001 indicator went down by 31% in 2004 when compared to 1990. Reduction in emission of certain pollutants is almost proportional. Main cause for such situation is decrease in industrial production when compared to 1990. Energy production is the largest source of emission of acidifying gases.

Emission of ozone precursors CH₄, CO, NOₓ and NMVOC in BiH – CSI 002 [P]

Indicator that characterises emissions of ozone precursor (CSI 002) takes into account anthropogenic emissions of nitrogen oxides, carbon monoxide, methane and non-methane volatile organic compounds, each ranked according to its potential for creation of tropospheric ozone. It is expressed in tonnes of equivalent NMVOC. Factors of potential to create tropospheric ozone are: NOₓ 1.22, NMVOCs 1, CO 0.11 and CH₄ 0.014. Since there are no data for FBiH this indicator is for BiH. Image below shows indicator of ozone precursors in BiH for 1990 and 2004.

![ Emissions of tropospheric ozone precursors in BiH (t equiv. NMVOC)](image27.png)

Figure 27: Emissions of tropospheric ozone precursors in BiH (t equiv. NMVOC) (Source: Federal Hydrometeorological Institute)
that the emission of ozone precursors is reduced in 2004 when compared to 1990 and is 63% of the emission in 1990. Share of traffic in emissions increased from 24% (1990) to 40% (2004). It is a result of increased intensity of road traffic, but also of decrease in industrial production.

**Emissions of primary particles and secondary precursors of particles PM10, SO2, NOx and NH3 - CSI 003 [P]**

Indicator that characterises emissions of ozone precursors (CSI 003) takes into account anthropogenous emissions of solid particles smaller than 10 micrometers (PM$_{10}$), SO$_2$, NO$_x$ and NH$_3$. Calculation of emissions of certain pollutants is done by multiplying with the factor of potential for creation of particles: PM$_{10}$ 1, NO$_x$ 0.88, SO$_2$ 0.54 and NH$_3$ 0.64. Indicator is expressed in tonnes equiv. PM$_{10}$.

Emissions of other pollutants necessary for calculating this indicator are also shown. Emissions for 2004 are estimated based on data on production, consumption and composition of fuel, and measuring of emission of pollutants, acquired from individual emission sources in FBiH.

It is evident that the emission of solid particles in 2004 is by 32% lower than in 1990. It is a result of increased efficiency of particle filter at individual sources that represent main source of emission of solid particles, as well as of reduced industrial production.

**Emission of GHG - CSI 010 [P]**

Indicator of emission of GHG (CSI 010) shows emission trends for anthropogenous GHG and their sinks. Emissions are represented according to the type of pollutants and their potentials for global warming. The indicator also provides information on emissions from the sector of: energy supply and use (including energy production, fugitive emissions, use of energy in industry and other sectors), transport, industry (processes), agriculture, waste and other (non-energy), that are expressed in millions of tonnes of equivalent CO2. Potentials of certain GHG according to creation of greenhouse effect are provided in the table below.

**Table 12: Potential for creating greenhouse effect**
Emission of CO₂ in BiH in 1990 was 24 million tonnes, while the estimations for 2004 are about 14 million. Emission of CO₂ for FBiH in 2004 is calculated based on energy balance of FBiH, that is, based on consumption of coal, liquid fuels and natural gas. Results of calculations and consumption of fuels are provided in the table below.

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Consumption</th>
<th>Emission CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>t/a 5,337,429</td>
<td>7,828</td>
</tr>
<tr>
<td>Liquid fuels</td>
<td>660,791</td>
<td>2,180</td>
</tr>
<tr>
<td>Natural gas</td>
<td>180,578</td>
<td>318</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10,326</strong></td>
<td></td>
</tr>
</tbody>
</table>

Since BiH, as a developing country, accepted Kyoto Protocol, during the first Kyoto period (from 2008 to 2012) it is not obliged to determine emission ceiling for GHGs compared to the base year, but may enable parties of Annex 1 of Convention to achieve part of their obligations of reduction of emission through investments in BiH.

Based on available data, it is not possible to estimate emission of other GHGs listed in the table.

### 3.5.2 Air quality

#### Production and consumption of compounds that damage ozone layer [P]

Indicator - production and consumption of compounds that damage the ozone layer qualifies the production and consumption of ozone depleting substances (ODS) in Europe. ODS are stable chemicals that contain chlorine and/or bromine and damage stratospheric ozone layer. It is expressed in millions of kg of ODS according to the potential of ozone depleting substances – Consumption (ODS tonne) = Consumption (metric tonnes) x ozone depletion potential factor. Data are given for entire Bosnia and Herzegovina sine production and consumption of ODS is monitored on the state level only.
Acidity (pH) of precipitation [S]

Acidity of precipitation is monitored at the automatic station for air quality monitoring in Bjelave, Sarajevo. Gradual increase in acidity of precipitation was detected.

Acidic precipitation occurs throughout the year; during the summer, 5 % and 6 % of acidic precipitation was recorded, and months with the most frequent occurrence of acidic precipitation are December and February with 13 %. High occurrence of acidic precipitation could be explained by already known fact of remote transport.

Exposure of the ecosystem to acidification of atmosphere, eutrophication and ozone [S]

Data on emissions of \( \text{SO}_3 \) and \( \text{NO}_x \) and ambient concentrations of \( \text{O}_3 \) measured at the back-station– Ivan Sedlo between 8 and 20 hours, are delivered annually to UNECE/EMEP and EU. EMEP/MSC-W uses these data for calculating transport of compounds of nitrogen and sulphur in the atmosphere. Data on ozone are interpolated in the appropriate manner.

Overstepping limit values of air quality parameters in urban zones [S]

This indicator shows part of urban population that is potentially exposed to concentrations of pollutants in ambient air outside limits set for protection of human health. Urban population taken into consideration is total number of people living in cities with at least one monitoring station.
### Table 14: Overstepping of limit values of air quality parameters in urban zones. Data for 2005. (Source: Eionet - European Environment Information and Observation Network – Reporting in BiH (http://eionet.europa.eu/))

<table>
<thead>
<tr>
<th>Location</th>
<th>SO$_2$</th>
<th>NO$_2$</th>
<th>PM$_{10}$</th>
<th>Ozone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sarajevo-back station Bjelave</td>
<td>7 days</td>
<td>26 µg/m$^3$</td>
<td>No data</td>
<td>No data</td>
</tr>
<tr>
<td>Tuzla Square – traffic</td>
<td>52 days</td>
<td>35.5 µg/m$^3$</td>
<td>No data</td>
<td>No data</td>
</tr>
<tr>
<td>Zenica – Kemal Kapetanović Institute</td>
<td>25 days</td>
<td>No data</td>
<td>No data</td>
<td>No data</td>
</tr>
</tbody>
</table>

Contents of heavy metals in total airborne particles [S]

In FBiH, there are only data on contents of heavy metals in total airborne particles on three locations in Zenica. This parameter needs to be monitored in industrial cities (Zenica, Tuzla, Lukavac, Maglaj).

#### 3.5.3 Monitoring

According to Federal rulebook for air quality monitoring (Official gazette of FBiH 12/05), monitoring is established and conducted in order to:

- Acquire indicators of air quality with respect to its effect on humans, ecosystems and their elements, and constructed economies, for the purpose of evaluation of status and effects of measures for limiting or reducing of air pollution.
- Acquire data in order to meet obligations set in international agreements accepted by Bosnia and Herzegovina that demand exchange of data on air quality and related indirect indicators, as well as on cross-border transport of pollutants.

According to the Rulebook, institution authorised to manage monitoring system in FBiH is Federal Hydrometeorological Institute. Tasks and duties of Federal Hydrometeorological Institute are:

- Establishment, organisation and managing of the air quality monitoring system in Federation of Bosnia and Herzegovina, as a part of monitoring in Bosnia and Herzegovina.
- Establishment of air quality informational system for the purpose of reporting on results of monitoring in prescribed formats.

Air quality monitoring network, according to this rulebook, can be:

- Federal – entity (as a part of the state network),
- Cantonal,
- City / municipal,
- At the level of facility operator (source of pollution) and
- At the level of special zones.

Monitoring of federal importance is managed by Federal Hydrometeorological Institute.

#### Overview of air quality monitoring status

Air quality in FBiH is monitored in a spotty pattern – in certain cities (five) and using different methods. In some cases, data are published, but in some not. Use of results of monitoring in planning of air quality is underdeveloped. Change in air quality caused by emission of stationary facilities is monitored, but there is no monitoring of change in air quality caused by mobile sources. Until 2007, there were no allocated responsibilities for air quality monitoring network. There is one station for phon measuring (Ivan Sedlo), while cross-border transport (import and export) are not monitored.

Monitoring of federal importance is managed by Federal Hydrometeorological Institute which conducts consolidation and analysis of gathered data related to air pollution – emissions and status of air pollution – emissions, with data being collected directly from stations Ivan Sedlo and Sarajevo. Federal Hydrometeorological Institute has joined international exchange of information on air quality with European Environment Agency. This activity is based more on personal enthusiasm than on the established system, since the appropriate system needs to be set up. At the end of 2005, automatic station for air quality monitoring was set up at the meteorological station Ivan Sedlo (for phon measuring), according to EMEP programme. This programme includes monitoring and evaluation of cross-border transport of airborne pollutants to remote destinations in Europe.
a) Phon measuring

Automatic station Ivan Sedlo (hourly samples) - Federal Hydrometeorological Institute monitors SO₂, NO₂, O₃ and PM10.

b) Air quality in urban-industrial zones

Air quality monitoring is conducted in two types of monitoring stations that function on two different principles. For measuring of SO₂ and grime, it is based on WHO guidelines (based on standard British method), and the other automatic station offers half-an-hour samples.

<table>
<thead>
<tr>
<th>Method</th>
<th>WHO –standard British method (24-hours samples)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sarajevo 4 x</td>
</tr>
<tr>
<td></td>
<td>Tuzla 1 x</td>
</tr>
<tr>
<td></td>
<td>Zenica 1 x</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Automatic stations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sarajevo</td>
</tr>
<tr>
<td>Tuzla</td>
</tr>
</tbody>
</table>

Table 15: Overview of stations for air quality monitoring in urban-industrial zones

Sarajevo- Sarajevo Canton network includes five stations (standard British method) and is managed by institution authorised by Cantonal Ministry of Spatial Planning and Environment. Network management is based on long-term contract with the Cantonal Public Health Institute. For the purpose of air quality monitoring, Sarajevo Canton uses data from Federal Hydrometeorological Institute (meteorological station Bjelave) for SO₂ and grime, and meteorological parameters.

Tuzla- Monitoring of concentration of SO₂ and grime in air of city of Tuzla at its meteorological station was recovered in 2002 after a period of inactivity caused by the war. In March 2003, air quality monitoring system for Tuzla Canton territory was established, and it conducts automatic monitoring of air quality at five stationary stations and one mobile station. Network of monitoring stations is managed by Cantonal Ministry for Spatial Planning and Environment. Information is published on regularly updated website of this Ministry. All six stations also monitor meteorological parameters.

Zenica – Air quality monitoring is conducted on a single location for SO₂ and grime (WHO method), and for total dust and residual dust, and it is managed by Metallurgy Institute “Kemal Kapetanovic”. This monitoring station within the institute network is mainly functional, but the information are not available to public and other institutions. It may be concluded that effective air quality monitoring in Zenica does not exist.

The table below shows parameters monitored, and equipment used in cantons and municipalities.

<table>
<thead>
<tr>
<th>Method</th>
<th>Sarajevo</th>
<th>Tuzla</th>
<th>Zenica</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHO</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Automatic stations

|Sarajevo | x  x  x  x  x  x  x  x |
|Tuzla   | x  x  x  x  x  x  x|

Table 16: Monitoring equipment used in cantons

Kakanj- there is one monitoring station in Kakanj, at the city centre, and it is owned by TPP Kakanj. It also measures meteorological parameters and is linked to another meteorological station. The table below shows parameters monitored in this automatic station.

<table>
<thead>
<tr>
<th>Automatic stations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kakanj</td>
</tr>
</tbody>
</table>

Table 17: Parameters monitored in Kakanj station

Regarding monitoring of biological air pollution, so far there has been monitoring of biological pollution of air with pollen at the Faculty of Science in Sarajevo, but due to current problems with financing and maintaining of this station, data are not systematically processed.

Goals and measures that need to be undertaken

According to analyses of the existing situation, it is necessary to make improvements to the existing monitoring system on current locations, but also expand the monitoring network to other cities. Having in mind current social
and economic situation, it can be said that it is necessary to implement air quality monitoring system in areas that are of significant industrial activity and/or of population over 50,000. According to this classification, air quality monitoring should be established in 11 cities in FBiH. There is an issue of station/equipment type: whether to use stations with half-hour sampling and automatic chemical analysis (EU instructions) or stations with 24-hour sampling and analysis in laboratories (WHO recommendation).

Air quality monitoring systems require establishing of centres with staff capable of management. These centres need to take care of:

- Collecting and processing of data;
- Publishing of data;
- Publishing of periodical reports;
- Issuing of proposals for improvement of air quality;
- Network maintenance.

The task for Federal Hydrometeorological Institute is to establish, organise and manage the air quality monitoring system in Federation of Bosnia and Herzegovina. Therefore it is necessary to establish connections between all centres with FMI, forming a monitoring centre that would receive the data, and establish an informational centre for air quality that would provide reports on monitoring results in prescribed formats. The task of Federal Hydrometeorological Institute is to implement QA/QC (Quality Assurance and Quality Control).

### 3.6 ENVIRONMENTAL INDICATORS IN WASTE MANAGEMENT

#### Table 18: List of environmental indicators of situation in waste management sector in FBiH

<table>
<thead>
<tr>
<th>WASTE</th>
<th>[Indicator type]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipal waste</td>
<td></td>
</tr>
<tr>
<td>Built regional landfills (specially defined indicator)</td>
<td>[R]</td>
</tr>
<tr>
<td>Generation and recycling of packaging waste</td>
<td>CSI 017 [P]</td>
</tr>
<tr>
<td>Industrial waste</td>
<td></td>
</tr>
<tr>
<td>Production of industrial waste</td>
<td>[P]</td>
</tr>
<tr>
<td>Hazardous industrial waste</td>
<td>[P]</td>
</tr>
<tr>
<td>Non-hazardous industrial waste</td>
<td>[P]</td>
</tr>
<tr>
<td>Environment condition and consequences</td>
<td>[S] i [I]</td>
</tr>
<tr>
<td>Industrial waste management</td>
<td>[R]</td>
</tr>
<tr>
<td>Wasted oils (from industry and transport in general)</td>
<td></td>
</tr>
<tr>
<td>Old vehicle tires (from industry and transport in general)</td>
<td></td>
</tr>
<tr>
<td>Old car batteries (from industry and transport in general)</td>
<td></td>
</tr>
<tr>
<td>Useless old vehicles</td>
<td></td>
</tr>
<tr>
<td>Electronic waste</td>
<td></td>
</tr>
<tr>
<td>Medical waste</td>
<td></td>
</tr>
<tr>
<td>Total quantity of waste from medical institutions</td>
<td>[P]</td>
</tr>
<tr>
<td>Production of hazardous medical waste</td>
<td>[P]</td>
</tr>
<tr>
<td>Production of waste in veterinary institutions</td>
<td>[P]</td>
</tr>
<tr>
<td>Application of individual methods of adequate management of waste from medical and veterinary institutions</td>
<td>[R]</td>
</tr>
<tr>
<td>Agriculture and forestry waste</td>
<td></td>
</tr>
<tr>
<td>Production of waste in agriculture – crop production</td>
<td>[P]</td>
</tr>
<tr>
<td>Production of waste in agriculture – cattle breeding</td>
<td>[P]</td>
</tr>
<tr>
<td>Production of waste in forestry</td>
<td>[P]</td>
</tr>
<tr>
<td>Area under organic production</td>
<td>[R]</td>
</tr>
<tr>
<td>Area under integral production</td>
<td>[R]</td>
</tr>
</tbody>
</table>

#### 3.6.1 Waste generators

**Population**

FBiH has a population of 2,327,466 with average density of 89.1 inhabitants/km². This number occasionally increases since 520,747 citizens of FBiH lives abroad. Canton with the highest number of citizens is Tuzla Canton with population of 496,280 inhabitants on 2,649 km².
Increase in population in FBiH has been stagnant lately; that is evidence of change in natural increase of population which is constantly decreasing since 1991. Annual increase in 1991 was 24,367 and today, this number is around 3,000 citizens per year. This results in quite the same present population in FBiH for many years now.

**Industry**

Level of industrial activity expressed in production capacity is used as an indicator of circumstances (driving force) which results in waste production. Under current conditions in Bosnia and Herzegovina, certain industry fields achieve more than 50% of production in 1989, while larger number of industrial facilities operates with 15-30% of installed capacities or pre-war production. In FBiH, there is currently an exploitation of ores in volume of more than 6 million tonnes per year, which is mainly related to exploitation of coal. Capacity of exploitation of table salt for food and industrial uses is about 90,000 t/yr. Annual production of construction materials is: brick 220,000 m³, asphalt mass 350,000 t, and concrete 250,000 t. Production capacity for steel and gray cast iron is around 25,000 t/yr.

The only significant industrial activity in the sector of non-ferrous metal production is production of aluminium and alloys in Mostar, with a capacity of around 130,000 t/yr. Annual production of construction materials is: brick 220,000 m³, asphalt mass 350,000 t, and concrete 250,000 t. Total annual production of cement is 1.2 million t, rock 1.5 million t and plaster 50,000 tonnes. Base chemical industry facilities are mainly located in Tuzla region, primarily for production of soda (180,000 t/yr) and coke (700,000 t/yr). Regarding other significant chemical and similar industry production, there is a production of detergents and medicines (capacities: around 10,500 tonnes of soap and detergent and 180 tonnes of drugs). Annual production of paper under current conditions of “non-integral” produc-

---

10 “Production of important industrial products”, 1989.
11 “Environmental Protection Assessment Report for Industrial, Medical and Other Hazardous Wastes in Bosnia and Herzegovina”, Bosna-S Oil Services Company, 2002.
13 Reports that are sent to the Federal Institute of Statistics are partially based on records and documents, and partly on estimates.
14 Data received from the Recycling Association.
15 Data received from the Recycling Association.
In food industry sector, main activities are production of bread and bakery products (total volume of production is 140,000 t), production of milk (total volume of production is 620,000 hl) and meat products (total volume of production is around 10,000 t), and processing of fruits and vegetables (total capacity: 10,000 t and 50,000 hl). Slaughter houses currently process around 102,000 t of raw meat.

The term ‘industrial waste’ here includes technological waste that results from industrial production process. Industry branches and facilities that, according to the amount and characteristics of produced waste represent relatively the most important producers of industrial waste are:

1. JP Elektroprivreda BiH and Elektroprivreda HZHB, (hydro power plants and thermal power plants: Mostar, Tuzla, Kakanj, Capljina, Jajce, etc.) – mainly waste slag and ash, turbine and electro-installation oils;
2. Mines, mainly coal mines in Tuzla and Central Bosnia basin – waste-rock, and waste machine oils;
3. Ferrous metallurgy, mainly Mittal Zenica – waste slag/ash/metals, cinder, dust, clay, dirt, oils and emulsions;
4. Non-ferrous metallurgy, mainly Alumij Mostar – waste slag, coke dust, iron, clay, anode waste, oils;
5. Cast factories, mainly in Tuzla, Ilijas, Vares and Visoko – waste sand;
6. Other metal-processing industry in Sarajevo, Hrasnica, Gradacac, Travnik, Siroki Brijeg, Konjic and Jajce – waste metal, oils and emulsions for metal processing;
7. Cement factories in Kakanj and Lukavac – waste oils;
8. Production of paper in Maglaj – this facility is currently not one of large waste generators, but once it goes back to integral production, significant volumes of cellulose waste may be expected;
9. Chemical industry – coke factory in Lukavac and Soda factory Lukavac – waste CaCl2 and NaCl;
10. Leather industry, mainly in Visoko – waste animal tissues soaked with tanning chemicals based on chrome salts;
11. Slaughter houses – waste animal tissues;
12. Primary wood processing – waste wood18;

Agriculture and forestry

Agriculture, as human activity, takes an important place in overall development of the society. A series of activities in agriculture and forestry result in various forms of effects to the environment. Production of plants and cattle-breeding represent key activities in agriculture that produces effects that need to be taken care of in order to reduce damages to the environment.

Cattle breeding is an agricultural branch with good natural conditions for development in FBiH. This particularly refers to North-West BiH with estimated share of 35 % in pre-war cattle fund.

In forestry, exploitation of forests results in generation of waste. In FBiH, 858,263.1 ha of land is under forest. In 2006, total amount of gross wood mass in FBiH19 was 2,593,736 m3, and achieved production of forest wood types was 2,217,333 m3.

Healthcare

Environmentally inadequate implementation of activities on protection of human health and health of animals represents a very important obstacle on the way of reduction of influence on the environment. It is necessary to establish monitoring of production of such waste, and introduce mechanisms for its adequate management.

According to data from Statistics Department of the Public Health Institute of Federation of BiH for 2005, there are total of 253 healthcare institutions for suppression, treatment and prevention, and diagnostics for human diseases on the territory of FBiH; 85 medical care centres, 23 hospitals, 125 pharmacies and 20 institutes.

---

18 Although waste wood from primary processing, as the main type of construction waste, does not represent a hazardous waste, significantly large area is needed for its disposal. In case of disposal of large quantities of such waste on relatively small areas, regardless of biodegradation or inertness of waste material, purely physical burden to the location and its surrounding is still important.

19 Data for 2006 acquired from Federal Forestry Administration
3.6.2 Municipal waste

Municipal solid waste includes household waste and other similar types of waste produced in industry and service activities. Municipal waste is usually left at depots. In majority of areas covered with waste collection services, waste is not separated since separation and recycling capacities in FBiH are still insufficient.

Level of service coverage (MCSD-109-R)/P - indicator of waste collection service coverage was defined by Mediterranean Commission for Sustainable Development (MCSD). Due to significant problem of illegal waste disposal in developing countries, as well as in underdeveloped regions of Europe, monitoring of this indicator has been introduced since it is believed that the service collection coverage and waste disposal represent basic feature of civilisation, just as water supply and sewage systems. According to researches, until Strategy, coverage with such services in FBiH varied significantly. Average coverage is 70%.
Number of unregulated and illegal dumpsites (specifically defined indicator -S) – low level of coverage with services of waste collection results in large number of illegal dumpsites. On the territory of Federation, there are 1,893 illegal dumpsites in various sizes, covering total area of 974,221 m². According to data from Federal Administration for Civil Protection, there are 21 organised and 33 partially organised or disorganised municipal dumpsites.

![Figure 42: Number of registered illegal dumpsites per cantons in FBiH](image)

Municipal dumpsites are mainly of open-type, located in areas unprepared for such purpose, with no protection systems for preservation of soil, water and air. There is no control of leachate and gases on almost all municipal dumpsites. Occasionally, waste is covered with inert material using small dredges.

Dumpsites in Tesanj, Krupa (Krivodol) and Mostar (Uborač) are partially organised. These dumpsites partly use multi-barrier isolation system, system for collecting and drainage of leachate; dumpsites are fenced, and have a management. Only Sarajevo Canton and Zenica-Doboj Canton have constructed sanitary landfills. On sanitary landfill Smiljevici (Sarajevo Canton), a device for wastewater treatment is under preparation for use.

Majority of existing dumpsites receive all sorts of hazardous and non-hazardous waste from households, including bulky waste, waste from medical facilities, waste from industrial plants, etc. Animal origin waste is left at municipal dumpsites, but at illegal dumpsites as well. It is urgent to start building sanitary regional landfill in order to initiate restoration and closing of municipal dumpsites – this is the key conclusion for this indicator.

Municipal waste generation (EEA-CSI 016-P) – There are no reliable data on municipal waste generation in FBiH. Estimate of municipal waste generation is based on production per capita in rural and urban areas and according to it, average production of municipal waste in FBiH is 269 kg per capita per year, ranging from 211 kg in West-Herzegovina Canton to 386 in Sarajevo Canton.

These data put FBiH in rank of Eastern European countries with average of 336 kg per capita per year for 2005. Poland reports on production of 260 kg/capita/year, Czech Republic 280 kg/capita/year, Slovakia 319 kg/capita/year, and Slovenia 458 kg/capita/year. This is significantly lower than production in Western European countries which is 580 kg/capita/year. Low level of waste production is linked to the standard of life and low level of consumption. For predicting the worst case scenario for the period up to 2018, data on Sarajevo Canton were taken as a basis. With the same growth trend as in 1990 taken as a presumption, it is estimated that by 2017, waste production will be 1.2 kg/capita/day.

Construction of regional landfills (specifically defined indicator-R) – Waste management strategy, EU PHARE, not formally adopted by FBiH, proposes a concept for regional management of municipal waste that foresees construction of regional landfills as a form of final waste management. This concept was supported by the loan from the World Bank provided for construction of regional landfills. However, the practice so far shows that the concept of regional waste management is primarily focused on construction of landfills instead of broad-concept of waste management.

Researches on achievements in application of regional waste disposal concept have shown that five locations for regional landfills (Sarajevo, Zenica, Grude, Tuzla, Bihac) were suggested, and they are to be used by 41 municipalities, that is 51.25%. Locations in Grude, Tuzla and Bihac were not accepted with evident NIMBY syndrome, which means a significant resistance from local population and administration in close vicinity of these locations. Four municipalities expressed willingness to join inter-municipal association and disposal at landfills located on the territory of RS (Doboj and Bijeljina). Municipalities of Bosnia-Podrinje Canton have signed an inter-municipal agreement with municipalities from RS for disposal at regional landfill in Gorazde (total of ten...
After evaluation of potential locations, location Tresnjica near Gorazde was selected for a future landfill, so activities on preparation of necessary documentation have begun. Initiative to resolve this issue has also started in municipalities Grahovo, Livno and Glamoc. Other municipalities of Federation, 32 municipalities or 40%, remain with unresolved status.

**Generation and recycling of packaging waste (EEA-CSI 017)** – There are no reliable statistical data on generation of packaging waste in FBiH. According to data on ex-Yugoslavia (period before 1990), in cities with more than 150,000 inhabitants, 100 kg of waste per capita per year was generated. Information stating that urban areas produce 34 % of packaging waste results in 135 kg per capita per year in urban zones of Sarajevo, which represents a reasonable increase compared to 1990, if we take into account changes in consumer habits. Main source of glass packaging are households, bars and restaurants, offices and supermarkets. It is estimated that BiH generates 35,000 - 40,000 t of which around 30 % is reusable. If we analyse only the territory of FBiH, then we estimate that this number is 60 % of total production, or 24,000 t/year. This information is based on data received from the Recycling Association of FBiH from 1991, when the production of glass packaging in BiH was 38,000 t/yr.

The system of separate collection and processing of packaging waste in FBiH has not been established. There is experience, but it is based on projects of limited territorial scope. In development of this concept, the best results were achieved in Sarajevo, Zenica, Bosanska Krupa, and Posusje.

Out of total volume of produced packaging waste, system of separate collection results in a very small quantity. Evaluation of the level of recycling in FBiH is based on the estimates of the Recycling Association of FBiH, and data of the Foreign Trade Chamber on import-export of these raw materials according to which the percentage of collected paper is 20-25 %, of plastic less than 1 %, aluminium over 60 %, and glass less than 1.5 %.

### 3.6.3 Industrial waste

**Production of industrial waste [P]** – Annual production (generation) of industrial waste from thermal power plants, steel and soda production process, as main generators of waste, is more than 1.85 million tonnes (slug, ash, CaCl₂ and NaCl from soda production). Estimates vary between 1.85 and 2.35 million tonnes, mainly due to changing share of non-combustible substances in coal burned in thermal power plants. Although these types of waste are not considered hazardous in the Rulebook on categories with lists, due to their pH value and changing contents of heavy metals, they may represent a significant burden to local area in case of disposal on the unprotected soil. Also, coal mines (the biggest mines in the region) generate around 250,000 to 300,000 t of waste-rock each year, which due to its content represents less threat to the environment.

Regarding spatial allocation, the largest volumes of industrial waste are produced in wide region of Tuzla and Zenica.

**Hazardous industrial waste [P]** – Except for wasted oils, old car batteries and electronic waste from industrial use (estimated total quantity of 3,000-4,000 tonnes/year), it is estimated that industry generates from 2,000 to 3,000 tonnes of specific hazardous waste per year, with 1,000 t/year of industrial sludge, and the rest of it accounts for significantly smaller quantities of waste such as: waste acidic and alkaline solutions, additives, metals contaminated with emulsions for metal processing. Although the quantity of this waste is small (> 0.5 %), it is this type of waste that can cause the most negative effects to the environment if not disposed properly.

**Non-hazardous industrial waste [P]** – Due to such a large share of slag and ash from large industrial furnaces and boilers, waste-rocks, technological waste from soda industry, but also many other materials such as waste sand from
casting factories, waste metal, etc., that are, according to the Rulebook on categories with lists of FBiH, categorised as non-hazardous waste, the largest share (over 99%) in total industrial waste in current conditions represents non-hazardous waste.

State of environment and impacts [Indicators S and I] – According to information gathered so far, at least 170 ha (1,700,000 m²)\textsuperscript{20} of land of FBiH territory is covered with accumulated inadequately disposed industrial waste from large industrial plants, mainly slag and ash from large industrial furnaces.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{image}
\caption{Surface covered with industrial waste (ha)}
\end{figure}

However, areas covered with inadequately disposed industrial waste can be taken as an indicator of state of environment (indicator S) under certain conditions, since it represents spatial component only. Also, it is not possible to establish solid indicators of resulting impacts on the environment (indicator I), since certain impacts cannot be quantified in terms of cause and consequence.

Industrial waste management [R] – Actual growth of annual quantities of total industrial waste cannot be reliably foreseen. It is possible to presume that use of prevention principle (harmonisation with BATs, “green” procurement) may prevent increase in waste quantities from being proportional to increase in volume of industrial production (currently, we can roughly conclude that the value of this indicator of waste generation prevention - R1 is practically zero).

Due to the above mentioned, at this moment, focus should be put on adequate handling of produced waste, since that represents main indicator of society response. Also, rehabilitation of existing inadequate dumpsites for industrial waste, expressed in percentage of recovered area under inadequately disposed waste compared to the current state, will be used as the second indicator of society response.

According to available information on disposal of industrial waste from different sources, just about 10% or less of total volume of industrial waste is adequately handled, i.e. it is mainly used as secondary raw material (use of part of slag and ash from TPP – approximately between 150,000 and 200,000\textsuperscript{21} tonnes), while around 90\%\textsuperscript{22} or more is inadequately disposed on unprotected soil or burned under inadequate or uncontrolled conditions.

Data provided by industrial subjects to Federal Ministry of Environment and Tourism, as well as cantonal ministries of environment, as a part of procedure for issuing of environmental permits for certain facilities, will be used as a basis for establishing of the first quality database (Registry of Polluters).

Waste oils (from industry and transport) – BiH consumes around 22,000-23,000 t of lubricants per year. This data includes summary consumption in all types of industrial applications and applications in the transport sector, and it can be considered as an indicator D. Out of this quantity, around 50% or 11,000-11,500 t/yr can be collected after use, while the rest of it is released into environment due to vapourisation of light fractions, leaks, dripping, etc. Based on relative relationship between population, number of vehicles and industri-

\textsuperscript{20} Environmental Protection Assessment Report for Industrial, Medical and Other Hazardous Wastes in Bosnia and Herzegovina”, Bosna-S Oil Services Company, 2002.

\textsuperscript{21} Based on TPP data on volumes of coal burned, average contents of non-burnable residue in coal, and data on actual use of slag and ash in cement industry.
trial activity, it is estimated that around 6,600-7,500 tonnes of waste lubricants can be collected on the territory of FBiH. Waste lubricants collected in this way are mainly burned in an inadequate manner as cheap “alternative fuel” in various heating systems. A small portion of industry exports such collected lubricants for the purpose of adequate disposal abroad, which is less than 2% of total quantity of collectable lubricants, having in mind that BiH does not offer any environmentally acceptable solutions for final disposal.

Old vehicle tires (from industry and transport) – Quantity of old tires generated in FBiH is around 4,500 t, with majority disposed in an inadequate manner by burning or long-term storing. Old tires are treated as non-hazardous waste. Some of them are recycled by so called protecting; according to rough estimates, only up to 5% of total quantity of old tires.

Old car batteries (from industry and transport) – Every year, FBiH generates around 3,900 t of old car batteries. According to data acquired directly from main collectors of old car batteries, at least 3000 t of old batteries are collected every year. In recent years, due to lack of adequate local capacities, collected batteries were mainly exported for recycling abroad, primarily to Slovenia. Car batteries contain heavy metals (led) and electrolytes (acid) and are therefore treated as hazardous waste.

Unusable old vehicles – On the territory of FBiH, currently there are at least 225,000 old cars or 337,500 old car batteries, at least 3000 t of old batteries are collected every year. In recent years, due to lack of adequate local capacities, collected batteries were mainly exported for recycling abroad, primarily to Slovenia. Car batteries contain heavy metals (led) and electrolytes (acid) and are therefore treated as hazardous waste.

Electronic waste - Production of this type of waste is about 4 kg/person per year, that is, around 16,000 t/year on the state level, with:
- 4,000 tonnes of home and office devices (TV, computers, office devices, mobile phones, etc.),
- 12,000 tonnes of home appliances.

Every year, FBiH produces around 5,800 t of electronic waste from households only, not including this type of waste from administrative and other premises. Having in mind this category as well, it is estimated that the amount of around 8,000 t/year would be appropriate for the territory of FBiH. It is presumed that handling of this waste is reduced to rare individual initiatives that include less than 5% of produced waste. Electronic waste containing PCB, HCF, HFC, free asbestos or other hazardous substances is considered hazardous.

3.6.4 Medical waste

Total amount of waste from medical institutions [P] - FBiH does not have a registry of waste amounts generated in the process of healthcare for humans and animals. According to estimates, average production of total waste from medical institutions in FBiH is around 2 kg/person/year, which is around 5,000 tonnes of waste per year.

Out of total amounts of medical waste, 39% of waste is generated in medical institutions in Sarajevo Canton only (sharp objects, 327 t/yr) and 0.5% of waste generated in FBiH (pharmaceutical waste, 250 t/yr) is handled properly – this means that 88% if this type of waste is handled improperly in FBiH.

Figure 45: Other waste streams (t/yr)
Production of hazardous medical waste [P] – Share of hazardous medical waste in total amount of medical waste is around 50%. Average production of hazardous medical waste in FBiH is around 1.1 kg/person/yr. Using this reference value, it can be concluded that medical institutions in FBiH produce around 2,500 tonnes of hazardous medical waste every year. Out of total amounts of medical waste, only 39% of total medical waste produced in Sarajevo Canton (sharp objects, 327 t/yr) and 0.5% of waste produced in FBiH (pharmaceutical waste, 250 t/yr) is properly handled. When projected to the level of FBiH, it can be concluded that 77% of hazardous medical waste is improperly managed.

Production of waste from veterinary institutions [P] – In FBiH, veterinary institutions produce 191.5 m³ of waste every year. According to data found in literature, lab waste has specific weight of 0.1 t/m³, which means that FBiH produces around 20 t/y of veterinary waste.

Application of individual methods of adequate medical and veterinary waste management [R] – Almost all large medical institutions in FBiH have one-chamber furnaces for burning of (municipal) waste that some of them use for destroying of pathological waste in an uncontrolled manner. There is no monitoring of emissions into air, and furnaces are often handled by unqualified staff. Majority of those furnaces do not meet technical requirements, and many are put out of order.

General Hospital Sarajevo and University Clinic Centre in Sarajevo own devices for sterilisation and grinding of sharp objects. This requires separate collection of waste that is, upon completed procedure, put back together with municipal waste. There same situation is evident in veterinary institutions in Bihac and Zenica.

In FBiH, there is two-chamber incinerator for medical waste with capacity of 300 kg/day located at city depot Ub-orak in Mostar, and it out of order.

Currently, 39% of waste produced in healthcare institutions in Sarajevo Canton, or around 180 t/year that includes sharp objects, is grinded and sterilised prior to mixing with municipal waste; that accounts for 4% of total medical waste in FBiH.

Final disposal of medical and veterinary waste in FBiH is done by method of non-sanitary disposal on city dumpsites, together with municipal waste. Only in Sarajevo Canton, pathological waste (placentas, amputated body parts, etc.) are collected separately and left at city cemetery, while the rest of the waste from healthcare and veterinary institutions, together with municipal waste, is transported to the only, fully sanitary landfill in FBiH. This means that 18% of waste produced in medical institutions and 12% of veterinary waste in FBiH is left at sanitary landfill. Exception to this rule is collecting of pharmaceutical waste which is collected separately in FBiH, placed in metal barrels and covered with cement or exported for safe destruction.

Based on the number of veterinary institutions in Sarajevo Canton, and estimate on the amount of waste they produce which is disposed of on sanitary landfill, it can be concluded that 88% of veterinary waste is disposed of in unsanitary manner on city dumpsites, together with municipal waste.

3.6.5 Waste from Agriculture and Forestry

Production of waste in agriculture – plant production [P] - Waste created directly from plant agricultural production can be classified in several types, considering the generated amounts. There are significant possibilities for an adequate disposal of the following types of waste, which were identified as most important in plant agricultural production, and these are: waste from harvest residues; waste from musty silage and hay; waste plan tissues created by removing plant mass from boundaries, canals, along the roads, uncultivated land, economic yards,
etc. (ambrosia and other types of weed), waste packaging from pesticides, containing hazardous substances and other waste packaging and plastic.

According to data from the Federal Office of Statistics\(^{28}\) for 2006, there were 33,493 hectares of reaped grain (wheat, rye, barley, and oat). Based on the known data on the relationship of the bean mass and straw mass, we got data on annual amount of harvest residuals of 12,000 tons. Moreover, around 15% of total produce silage and hay remains unused, so the estimate is that in 2006, the amount of mouldy silage and hay was around 70,000 tons/year. Around 500 tons/year of waste plant tissue is created by removing plant mass from boundaries, canals, along the roads, uncultivated land, economic yards, etc. (ambrosia and other types of weed).

According to available data from border crossings in BiH, the estimate is that annual import of pesticides in the FBiH is around 1,200 tons. If we presume that the share of packaging in the total gross mass of packaging of pesticides is some 15%, we get the amount of 180 tons/year of waste packaging created by using pesticides (contains hazardous substances). Speaking of other waste plastic and packaging, based on the previous practice on agricultural farms, we can estimate the amount of this type of waste, which is 1,230 t/yr.

---

\(^{28}\) \text{http://www.fzs.ba/Podaci/poljoprivreda2006.htm}
Production of waste in agriculture – cattle farming [P] – Activities in cattle farming create large amounts of waste substances which have to be disposed in environmentally acceptable way. In the area of the FBiH, most of the waste created on farms and fish farms is in a form of waste animal tissue; stable manure on farms and waste from dead fish. The estimate is that the most of waste is in cattle farming is generated in the form of cattle manure on farms. The estimates for the FBiH are ranging up to 4.6 million tons/year of produced cattle manure.

On the other hand, considering the number of live stock in the area of the FBiH, and empirical estimations of mortality of live stock on farms, the estimate is that there are 4700 tons/year of waste animal tissue. Annual amount of dead fish in fish farms is estimated to 40 tons/year.

Based on available data on total livestock industry in the FBiH and average mortality for healthy live stock, and livestock died from various diseases, we can get data on average total number of dead animals during 2006. Mortality of certain types of livestock and poultry is estimated based on presumptions that around 2 % of total number of grown cows will die, around 6 % of total number of small ruminants (sheep, goats), around 7 % of total number of grown poultry and around 4 % of total number of grown swine.

The estimate is that the most of waste tissue originate from production of cows (1866 tons/year) and sheep (1625 tons/year), while in goat farming there are 135 tons/year, swine - 377 tons/year and poultry and hens - 665 tons/year. According to available data on paid damage compensations and the records of the Federal Ministry of Agriculture, Water Management and Forestry – Veterinary Sector, 14 cows and 1603 sheep died in 2006 from various diseases. Considering the fact that an average weight of a sheep is 50 kg and a cow - 400 kg, we get a data on total production of animal tissue in amount of around 86 tons/year, caused by various diseases.

Speaking of stable manure, its amount and chemical structure can vary depending on number and type of animal, age, digestibility of meal, proteins and cellulose in meal, etc. Earlier researches estimated daily and annual amount of stable manure for each type of animals, and these data were used for calculation of total production of stable manure in the FBiH in 2006. The amount of produced stable manure in the FBiH has been estimated, while data on its collection, disposal on the farm and possible processing out of the place where it was produced are currently not available. Most of the stable manure, i.e. 80% is scattered on cultivated land.

Production of waste in forestry [P] – Exploitation of forest wood types, which had gone through an uncontrolled expansion during the war, and partially, in not so intensive form, continued until present days, resulted in intensified production of waste from forest exploitation. The amount of gross wood mass and forest wood types in 2006 (coniferous and deciduous trees total) was 2,593,736 m³, and achieved production of assortments (net mass) was 2,217,333 m³. The difference in total amount of gross wood mass and achieved production of forest wood assortment in the FBiH in 2006 was around 376,400 m³. This is basically biodegradable waste from the use of forest, which is basically organic substance which, through its further degradation, mostly presents a base for nutrition of other segments of ecosystem and remains in forest.

The area under organic production [R] – Organic production of food is based on biological control and
production of fruit with high health value. That requires careful cultivation of land, maintenance and raising its fertility, strengthening resistance of fruit to hazardous organisms and use of natural limiting factors for diseases and pests. Application of plant protection products is limited to the minimum. Firstly, this pertains to use of preparations which pollute land, water and air as little as possible. Chemical growth regulators cannot be used to manage growth, or to improve colour or shine of fruit.

Based on the data from the Association of Agricultural Producers of Integral Production - Gradacac, in 2006, in the FBiH, the area under integral production of fruit was 145 hectares of apple, 52 hectares - pear, 56 hectares - plum, 5.5 hectares strawberry and 1.4 hectares - raspberry, which, all together amount to 259.9 hectares. Considering the total area under orchards in the FBiH, that makes only 0.62% of it under integral production of fruit. In comparison with total cultivable land in the FBiH, that is just 0.04 % of land under integral production of fruit.

**Area under integral production [R]** – Integral production of fruit is an ecologically oriented procedure. Priorities are preservation and protection of natural conditions, and prevention of use of any kind of chemicals. That implies healthy land, chemically untreated seed and prohibition of use of chemical substances. Organic production has incorporated all modern achievements, both in the field of food and nutrition, and in what we call social justice or democracy.

Standards for organic production in BiH have been prepared. However, lack of regulated legal infrastructure (legislation, appropriate subsidies), caused this area of production being developed spontaneously and uncoordinatedly. In 2006, there was 116 hectares of land under organic production in the FBiH, (this implies areas „organic and under conversion“). Comparing to total cultivated land in the FBiH, that makes 0.016 %.

**Figure 52: Forestry waste (m³/yr)**

**Figure 53: Organic production**

---


30 According to data received from certification houses OK, KRAV and ECO CERT.

31 Data received from the Association of Agricultural Producers of Integral Production - Gradacac, Street VI bataljon bb, Gradačac.
Total land with integral production: 0.036%

- Apple: 0.0202%
- Pear: 0.0072%
- Plum: 0.0078%
- Strawberry: 0.0008%
- Raspberry: 0.0002%

**Figure 54:** Integral production [R]
4. ENVIRONMENTAL SITUATION IN THE FBiH
4.1 Nature

Nature of the Federation of Bosnia and Herzegovina has unique spatial and climate organisation and the highest level of diversity in all segments, not only in the area of the Western Balkans, but in Europe in general. Emphasised original forms of development and existing biological, geological and hydro-ecological diversity, through a long geological period, have resulted in highly valuable nature characteristics, comprised in the natural heritage of the FBiH. By the level of diversity of natural values and distribution of heritage, FBiH is at the top of the scale of spatial and environmental uniqueness.

Ecologic heterogeneity of the area of the Federation of Bosnia and Herzegovina, geomorphologic and hydrological diversity, specific geological past and diversity of eco-climate have caused fairly rich living world in our territory. Flora, fauna and fungi of the Federation of Bosnia and Herzegovina are among the most diverse in entire Europe, and a high level of endemism and relictness makes it significant at the global biological diversity level.

At geographically rather small area, as in very few other places in Europe, there are several endemic development centres, in which the processes of creation of new species are still ongoing. Particularly specific are numerous river canyons (canyons of rivers Una, Neretva, Drina, canyons and cliffs of confluents in the source and upper flow of Bosna).

Under the highest mountain tops, in the area of cirques, there are centres of growth of glacial flora and fauna, as a remarkable proof of process after the ice age in the Balkans Peninsula. Over 450 species and subspecies of vascular plants have the characteristics of certain level of endemicity, which puts the flora of the Federation of Bosnia and Herzegovina among the most unique and exceptional in Europe.

Conspicuous diversity of insects (particularly hydrophilic), representatives of ichthiofauna and mammals, makes the FBiH recognizable in Europe, and for some groups (cave organisms and fish in Karst plunging rivers) unique in the entire World.

As core factors of diversity in the Federation of Bosnia and Herzegovina, the following could be listed:

- diversity of terrestrial habitations through: the presence of rocks of different geological age, diversity of master substrate, types of land, unique and diverse forms of relief, and diversity of climatic conditions;
- diversity of aquatic habitation through: rich and diverse hydrologic network (mountain lakes, springs, mountain streams, brooks, rives, plunging rivers, bare, ponds, swamps, thermal sources, brackish water and sea);
- long-lasting processes and anthropogenesis;
- diverse ontogenesis processes.

Living world in various habitations in the FBiH is today making numerous communities and ecosystems specific only for this area, the Balkans and Europe. Therefore, we can speak of a high level of endemicity within biologic and ecologic diversity.

Based on the estimation of the situation, there are following distinguished characteristics of landscape and biological diversity in the FBiH:

- high level of generic, species and ecosystem diversity;
- high level of preservation of landscape diversity, significant for Europe and globally;
- significant level of changes, considering the distribution and composition of climatogenic ecosystems;
- pronounced trend of loss of biological and landscape diversity, caused by a wide range of anthropogenic factors.

At the same time, significant level of vulnerability of biological and landscape diversity is reflecting in identified:

- critically endangered species/habitations/ecosystems/landscapes of local, regional and global importance;
- habitations and ecosystems with large number of
endemic and relict or endangered species or with a high level of biological diversity;
- ecosystems with significant economic and ecologic value;
- landscapes with significant biologic and cultural diversity.

In managing biodiversity of the Federation of Bosnia and Herzegovina, there should be a special place for the priorities pertaining to a long-term protection, such as:

- diversity of endemic relict species, species endangered at national, European and global level; economically important species and autochthonic generic resources;
- richness of cannons and cliffs as growing centres of flora, fauna and vegetation, as well as refuges of biodiversity of tertiary age;
- diversity of habitats of common areas of growth and naturally rare habitats (peat lands, salt marshes, mountain springs, sea cliffs, smaller swamps, small caves, etc.);
- diversity of Karst ecosystem as greatest natural phenomenon (Karst fields, plunging rivers, caves and Karst);
- diversity of high-mountain ecosystems – islands of preservation of glacial flora and fauna;
- diversity of the ecosystems of a province of relict pine trees on various geologic substrates (limestone, dolomites, ophiolites, travetines, etc.).

### 4.2 Waters

Bosnia and Herzegovina has a relatively diverse climate picture, with three different climates shifting in a fairly small geographic distance:

1. In Herzegovina – modified Mediterranean (maritime),
2. In Central Bosnia – continental/mountain (alpine),

Average precipitation varies between 1000 and 1500 litres/m² in maritime belt, over 1000-1200 litres/m² in Central Bosnia, to 700-800 litres/m² at the north of the country. Average annual amount of available water is 36.4 km³, i.e. around 10.000 m³ per capita, which is significant amount, but it is not spatially nor temporally well distributed. The most capacious is the basin of Neretva with Trebisnjica.

Indicator of use of freshwater resources (CSI 018) calculated for water areas of the Adriatic Sea and the basin of Sava in the area of the FBiH shows that there is a significant availability of water as a resource and that it can be used even more intensively. It is presumed (Alcamo et al., 2000) that, considering the influence on water ecosystems, index of exploitation can grow even over 40%. On the other hand, captured amounts are not being rationally used, mostly in the water management segment, where losses are in average around 50%.

Data on amount of water used for water supply, provided by public utility companies are often based on estimates. The estimates show that out of total amount of delivered water, 70% goes to households. Larger industrial facilities are mostly using their own sources.

Currently, there are around 7000 hectares of agricultural land being irrigated (water area of the Adriatic Sea), with average consumption of around 3000 m³/hectares/year.

Generally, it can be said that the quality of surface waters is a bit better than in 1992. That is exclusively due to the fact that large industrial facilities have been closed or significantly reduced their capacities.

The quality of underground waters cannot be evaluated at the moment, because there are no data.

The water protection system requires significant resources in all segments (damage recovery, regular maintenance). Other problems are potentially endangered and currently unprotected areas, and even urban zones of certain municipal centres.

### 4.3 Land

Land area or land (Land, FAO-1975), encompasses the area including: soil, climate, hydrology, geology, vegetation in a range in which it influences the possibility of its utilisation and results of human activities, as well as socio-economic parameters. In other words, modern concept of land management implies that land, apart from production, has a whole set of other functions, which are the foundation of establishing a well-balanced development of a country. Those other functions include: ecologic-regulatory (receiver, collector and exchanger of various contaminations), climatic-regulatory, role of the “carrier” of infrastructure,
function of water purifier, source of genetic wealth and protection of biologic diversity, function of shaping a landscape and a function of earth as historic medium. Considering this multifunctionality of land, the FAO, Interdepartmental Working Group on Land Use Planning (1994), has proposed a definition of land, which should be considered in forming a classification of land use: "Land is inseparable space of land surface connecting all attributes of biosphere immediately above and beneath this surface, including the climate, land and geologic forms, hydrology (lakes, rivers), animal and plant population, human settlements and physical changes created as a result of previous and present activities (terraces, facilities for preservation of water, drainage, roads, building, etc). Exactly this definition present a starting point for estimate of the situation of this resource in the FBiH, as well as for proposal of the strategy for its protection, i.e. development of a new system of a sustainable land management.

Land in BiH, and particularly in the FBiH is very diverse, from both genetic and ecological point of view. However, generally, there is not much soil of a high class of bonity (around 14% of soil from I to III of bonity class). Therefore, it is not surprising that 40% of land is shallower than 30 cm, while there is 17% of very shallow land. The situation regarding quality, availability and sensibility is additionally complicated by the fact that the slope of 84,2% of the territory is bigger than 13%. In order to complete the picture of availability, and „economic and ecological capacity“ of land, it is important to point out very low availability of ploughed fields per capita - 0,17 hectares, which is rather concerning. All of these natural features and the pronounced need for accelerated economic development are significantly threatening the quality and „economic-ecological capacity“ of land, at the same time increasing the risk of disappearance of soil (there is an estimate that around 3,000 hectares of soil annually disappears in BiH). These facts are indicating that soil is extremely sensitive resource and that it should be used extremely carefully.

On the other hand, current situation, with lack of basic planning-analytical document-spatial plan of the FBiH, where competences related to land use and granting the right to use land were not clearly defined between different levels of authority, with obsolete laws incompatible with existing administrative organisation (Law on Mining from 1993), and lack of clear reporting and registering policies (registries, cadastre, etc.) at different levels of authority, has resulted in a “chaos in the area” endangering land, particularly agricultural land.

Although impressive by number (15), existing legislative acts are only partially addressing the problem of integral land management, which generally contributes to the above described situation. Lack of institutional framework (mechanisms) needed for implementation of these laws is additionally complicating the situation. Thus, the Law on Agricultural Land and the Law on Spatial Planning and Land Use have foreseen the establishment of an integrated information system on land, which implies prior cadastre forming (of e.g. pastures), technical maps and various registries (of e.g. polluters, etc.). However, this legal obligation still remains a „dead letter“, since there is no an institution which can fulfil this obligation, nor there are financial assets planned for development of such an information system.

The consequence of the situation aforementioned is lack of reliable data on land, its quality and changes over the time. Since there is no systematic tracking or a single quantitative / qualitative feature of land, it is not surprising that there are no relevant and reliable information on land contamination (heavy metals, POPs, etc.), or maps of the most important land damages, regardless of their cause. In other words, problem of land contamination is not systematically presented or tracked, so there are no basic preconditions for planning of elimination / minimizing of negative effects on human health and biodiversity. This presents a real problem, both in the terms of reduction of „economic and environmental capacity of land”, and regarding significant risk for health of population, and by that, indirectly for public costs related to reduced productivity of population and the costs of health protection.

High level of poverty and informal economy is creating additional pressure on land, i.e. additionally jeopardizing “economic-ecological” capacity of land. This pressure is reflecting in excessive exploitation of mineral raw materials, wood and forest products, then in application of various unsustainable production practices in forestry and agriculture. The consequence of such practices is definitely the appearance of various types of land damages (e.g. erosions, land compression, reduced productivity, etc.), which can ultimately result in vanishing of land. In other words, this way damages not only soil, but also a biodiversity and re-
duces the quality and beauty of landscape, which reflects negatively on the possibility of diversification of economic activities (firstly, this implies various forms of tourism and exploitation of forest products) and initiation of production with higher level of additional value. In a word, such practices significantly reduce “economic-ecological” capacity of soil and unable development of rural areas, at the same time jeopardizing the stability of social-economic development of the country.

Investing in improvement of land quality exists only in some cantons, and it is being financed from the funds formed from fees collected to the change of use of agricultural land. These funds are being spent (there are no data for all cantons) in line with the program which is every year adopted by a competent ministry. However, these programs are partial and often created in a way to improve only economic capacity of land (related to agricultural production). Therefore, we can say that there are partial efforts, but there is no general plan of systematic termination of problems and protection of land at the FBiH level, which significantly reduces the efficiency of investments in improvement of land quality. In other words, there are no even initial forms of systematic agro-environmental programs, which are supposed to ensure the strengthening of “economic-ecological” capacity of land through the promotion and incentives for sustainable techniques of use of mineral resources, forest, forest products and agricultural land. It is important to point out that establishing of these programs will be our obligation in the EU accession process (this issue is regulated by the EC Directive EC No 1698/2005).

All of the above leads to the conclusion that land in the FBiH is a very sensitive resource and that, if we want to ensure minimum requirements for establishing of a long-term well balanced socio-economic development, we have to establish an integral land management system (ISUZ). That task will not be accomplished without the involvement of civil society and strengthening of capacities of local communities, whose task will be creating and implementation of rural development project in the EU accession process. Experiences from Slovenia and other countries which have just recently become members of the EU proves that (most of the) problems related to quality and protection of land can be avoided through the programs of rural and regional development. However, for successful “mobilisation of money” from these funds, it is necessary to have a competent local community and administration, and plans for co-financing of such projects. Therefore, strengthening the role and activities of nongovernmental sector is extremely important.

4.4 Ambient Air

Despite of the low level of industrialisation and urbanisation, issue of the quality of air in BiH in the period from 1970 to 1990 has had a significant place in overall environmental issues. In the after-war period, in which some facilities have been closed, some of them changed the owner and went through technologic transition and the new facilities have been built in line with the environmental legislation of the FBiH, this issue has lost some of its significance.

The main causes of the current excessive air pollution in the FBiH are:

- Type of the industry (basic industry);
- High energy intensity in industry;
- High calorific losses in residential sector;
- Inadequate constructions of furnace, room heaters and low power boilers, mostly made by western European licences (constructed for different types of coal), preventing efficient and low-polluting combustion of domestic coal;
- Lack of guidance for the coal use depending on the quality of coal and local ecological conditions;
- Lack of refined coal or suitable forms of biomass for the needs of small furnaces;
- Weak maintenance of energy and industrial plants, particularly the equipment which the emission of polluting substances depends on;
- Inappropriate treatment of the issue of air pollution through creating of spatial and urban plans.

What makes the situation even more dramatic are:

- Lack of strategic commitment of the state regarding the routing of energy supply, particularly renewable energy sources;
- Lack of any kind of programs of reconstruction of calorific losses in housing and business area;
- Insufficient development of the air quality system as a tool in air quality management.

Instruments such as preparation of the environmental impact studies and activity plans defined under the Law on Air Protection are giving positive results. Besides, an active
Approach to obligations set in the international conventions and involvement in international programs, particularly those pertaining to emission of acid gases ($SO_2$ and $NO_x$), would give good results in parallel reduction of air pollution and improvement of economic efficiency of economy.

Technologies (of non-energetic pollution) in one country usually have less than 10% in the share of air pollution. In the FBiH, this type of pollution was rather significant, with the ferrous metallurgy leading. “BH Steel Zenica” and “Ispak” coke industry are now undergoing technological restructuring, procedures of obtaining environmental licences are ongoing and it is still not known what kind of emission they will have after the restructuring. Paper industry in BiH “Natron Maglaj”, as a significant source of air pollution, is also in the process of technological restructuring. These facilities are emitting whole range of chemicals (hydrocarbons, organic sulphur compounds, volatile organic compounds, etc). Production of cement is also a part of technological pollution, but the most polluting substances are solid particles, whose emission is regulated easier than emission of gases from technological facilities.

4.5 Waste Management

Municipal waste. In the FBiH, the annual waste production is 270 kg per capita. Waste is not collected selectively, and it happens often that in municipal waste there are certain categories of industrial, medical and other types of waste. Total of 40% of waste collected is disposed at municipal non-sanitary dumpsites, and there are 54 of them in the FBiH. Total of 36% of produced waste is not treated by utility companies at all. In situation of generally bad coverage with waste collection services, it can be expected that there is a large number of unorganised and uncontrolled dumpsites. In the territory of the Federation, there are around 2,000 locations with so-called uncontrolled (wild) dumpsites, covering the area of 974,221 m², except for Sarajevo Canton and Canton 10, where such dumpsites were not discovered in all municipalities. In other cantons, they exist everywhere, most of them are in Zenica-Doboj and Tuzla Canton. Municipal, industrial, inactive waste and animal origin waste is disposed there. Currently, in the FBiH there are only two sanitary landfills, in Sarajevo and in Zenica. Three sanitary landfills are being prepared, while 32 municipalities do not have a status solved and/or an inter-municipal agreement signed for regional waste disposal.

The basis for the development of regional management are waste management plans, which, in line with the Law on Waste, were supposed to be adopted by cantons. Most of the cantons have not adopted a plan or a regulation defining the conditions for planning of waste management in municipalities, or their tasks. Waste Management Plan was adopted at the end of 2008 only by Zenica – Doboj Canton, while Sarajevo Canton, also in 2008, adopted a Construction Waste Management Plan. For realisation of the concept of regional waste management, in all of its aspects and levels, it is necessary to clearly define realistic financing sources, in order to have the concept successfully implemented. Existing sources (the World Bank loan and budgetary assets of certain cantons) are not sufficient for complete implementation of the concept. Revenues collected from a

Figure 55: Regional sanitary landfill Mošćanica (Zenica)
single economic instrument «Users fee for collection and disposal of municipal waste», with a collection rate varying from 50 to 70%, are insufficient for a “full cost recovery” (costs of collection and disposal completely covered by users). Even in the case of a 100% collection of fees, it is almost impossible to finance development projects stimulating application of the principles from the Law on Waste: prevention, separate collection and recycling, from the collected revenues. The results achieved in the recycling of packaging waste are supporting this claim. The regulation on the system of fees and deposits for the packaging waste was not adopted. There are no economic instruments promoting the prevention of waste production and recycling, or subsidies for investments in the recycling facilities and the network of collection and transport of raw materials.

Industrial waste. Industry in the FBiH annually produces around 2.4 millions of tons of waste, with less of the 0.5% of mass being hazardous waste. Only 10% of produced industrial waste is adequately disposed, while the rest of it is inadequately disposed on unprotected ground inside or out of industrial facilities. Due to variety and composition, effects of industrial waste to the environment are numerous and various. Industrial sectors which, by the quantity and characteristics of the waste they produce, present the most significant generators of industrial waste are: thermal and hydroelectric power plants, mines, metallurgical industry, metal processing industry, part of the basic chemical industry and leather industry. The estimate is that at least 170 hectares of total unprotected land in the area of the FBiH is covered by accumulated inadequately disposed industrial waste from large industrial facilities, mostly slag and ashes form large industrial boilers. There are no available data on quantity and categories of waste produced by industrial facilities. It is expected that these data will be available after all existing subject industrial facilities and plants submit a request for approval of activity plans, i.e. request for the issuance of environmental permits, in line with the Law on Environmental Protection. In line with the Law on Waste Management of the FBiH (Articles 19 and 20), industrial facilities subject to obligation of acquiring environmental permit shall be obliged to prepare a waste management plans and appoint persons in charge for waste management issues.

Waste from Agriculture, Forestry and Cattle Farming
Annually, in the FBiH there are:

- Around 12.000 tons of harvest residues, 70.000 tons of musty silage and hay, 500 tons/year of waste plan tissue created by removing plant mass from boundaries, canals, along the roads, uncultivated land, economic yards, etc. (ambrosia and other types of weed),
- Around 180 tons of waste packaging from pesticides (containing hazardous substances), and 1.230 tons/year of other waste packaging and plastic (fertilizers, seeds bags, seed material packaging);
- Around 4.800 tons/year of waste animal tissue (mortality of healthy cattle and cattle died from contagious diseases in 2006), around 40 tons/year of dead fish, and around 4,6 million tons/year of produced stable manure, out of which 40% ends up as waste, i.e. around 1,85 million tons/year;
- Around 376.400 m3/year of waste from exploitation of forests, which is biodegradable, remains in forests.

Managing this type of waste is at very low level, since there is no application of an adequate system of disposal of this type of waste, particularly waste from animal tissue, which present environmental and a healthcare problem. The Law on Waste foresees that, in cooperation with the Federation ministry of Agriculture, Water Management and Forestry the following regulations should be adopted:

1. special requirements for biodegradable agricultural waste;
2. terms and requirements for the use of sewage mud in agriculture;
3. terms and requirements for animal waste;
4. terms and requirements for residues and waste produced in production and use of chemicals in agriculture.

Considering the critical condition of disposal of animal origin waste, there is an urgent need for finding a solution for this problem in ecologically and sanitary acceptable manner.

The Rulebook on Animal Waste and other non-hazardous materials of natural origin used in agriculture ("Official Gazette of the FBiH", no. 8/08) sets the types of animal waste and other non-hazardous materials which can be used in agriculture, conditions under which they can be used, methods of disposal and types of animal waste and
other materials prohibited for use in agriculture.

Medical waste. Total production of waste from healthcare institutions in the FBiH is 2,2 kg/person/year, or approximately 5000 tons/year of which some 50% is hazardous medical waste. Total production of waste from veterinary institutions is 20 tons/year. Waste from healthcare and veterinary institutions is mostly collected without separation at source, and mostly mixed with municipal waste. In the FBiH, 18% of waste from healthcare institutions and 12% of waste from veterinary institutions is disposed of to sanitary landfills, 0,5 % of waste is encapsulated and/or exported for safe disposal, while the rest of waste is disposed of inadequately and most of the times together with municipal waste. Only two healthcare institutions and two veterinary institutions in the FBiH have equipment for safe disposal of a part of medical waste.

The Rulebook on Medical Waste Management (“Official Gazette of the FBiH, no. 77/08) sets the general principles of waste management, planning of medical waste management through establishing of a waste management board and transferring of medical waste to third party. Moreover, the Rulebook has established a system of planning a medical waste treatment and medical waste management aiming to reduce the risk for healthcare staff, workers in waste management, public and environment.

According to the Advisory Board for Environment / FMOIT, for the last several years, the FBiH has exported around 40.000 tons of hazardous waste, for an adequate disposal in other countries.
5. ENVIRONMENTAL PROTECTION ACTION PLAN
The Action Plan of the Federation Strategy has been prepared as a scheme of all environmental components addressed in the Federation Strategy (air, land, nature and waste) through legal and institutional framework, with economic instruments of environmental protection, with systematized titles of measures, planned deadlines and institutions responsible for its implementation. Moreover, the needed assets and sources of financing for individual projects and activities which require financing were defined.

Considering a long-lasting procedure of adopting the Federation Strategy, certain activities from the Action Plan had to be started, and some of them have been already completed.

In this phase, it is important to make an analysis of the implementation of the Action Plan for all individual components until now, with appropriate selection of priorities for possible implementation, considering actual availability of financial assets and institutional capacities for the next three years (2010-2012) for which the Budget Framework Document is prepared. Besides the assets planned in the Budget of the Federation of BiH, for implementation of the Action Plan, it will be necessary to activate the FBiH Fund for Environmental Protection, and complete upgrading of its economic instruments, in line with the Law on Environmental Protection Fund of the FBiH (Official Gazette of the Federation of BiH no. 33/03).

5.1 FEDERATION STRATEGY OF ENVIRONMENTAL PROTECTION – GENERAL

5.1.1 Review of commenced activities from the Action Plan

- Drafting Environmental Law at the level of Bosnia and Herzegovina;
- Implementation of the Agreement on Establishing of Energy Community;
- Permanent analysis of harmonisation of regulations with EU environmental acquis;
- Drafting Law on Protection from Noise;
- Initiating activities on ratification of other international environmental conventions and protocols;
- Drafting Law on Mining;
- Changes and amendments to the Law on Concessions.

5.1.2 Proposal of the priority activities from the Action Plan for the next three years

- Adoption of the Strategy on Harmonisation with the EU environmental protection legislation;
- Harmonisation of national legislation (horizontal and vertical).

5.2 PROTECTION OF NATURE

5.2.1 Review of activities from the Action Plan which were completed

- Ratified Protocol on Biological Safety („Official gazette of BiH – International Agreements “, no. 12/08);
- Ratified Convention on the Conservation of European Wildlife and Natural Habitats („Official gazette of BiH – International Agreements “, no. 08/08);
- Ratified Convention on International Trade in Endangered Species of Wild Fauna and Flora („Official gazette of BiH – International Agreements “, no. 11/08);
- Enacted Law on Genetically Modified Organisms („Official gazette of BiH”, no. 23/09).

5.2.2 Review of commenced activities from the Action Plan

- Drafting new Law on Nature Protection, aiming to create a legal framework for implementation of measures from the Strategy and harmonisation with EU regulations;
- Permanent analysis of harmonisation of existing Law on Nature Protection with acquis for protection of nature;
- Enacting concrete plans for managing invasive species for ambrosia (Ambrosia Artemisifolia).
5.2.3 Proposal of the priority activities from the Action Plan for the next three years

- Adoption of the Law on Nature Protection and drafting and adoption of implementation regulations;
- Adoption of the Regulation for the program Natura 2000;
- Initiating ratification of The Convention on the Conservation of Migratory Species of Wild Animals and the Convention on European Landscapes;
- Establishing a Federation Institution competent for protection of nature;
- Categorisation of habitations and ecosystems;
- Preparation of the Flora of the Federation of BiH, Fauna of the Federation of BiH and Fungia of the Federation of BiH;
- Preparation of the distribution map of ecosystems;
- Preparation of the Red Book of Plants;
- Preparation of the Red Book of Animals;
- Preparation of the Red Book of Fungi;
- Preparation of the Red Book of Living Communities;
- Establishing new protected areas in line with the EU standards and developing of an effective network of protected areas with ecological corridors, with previous scientific evaluation of natural values, and preparing the plans for sustainable management of protected areas;
- Preparation of functional data base on biologic and geologic diversity and other relevant attributes of protected areas with GIS maps of protected areas;
- Program Natura 2000 – protected areas in Europe;
- Inventory of geographic interpretation of invasive species with establishing of appropriate data base;
- Identification and development of the most acceptable methodology and establishing of appropriate institutions for implementation of monitoring on situation regarding biologic and geologic diversity;
- Review of existing situation of previously protected areas.

5.3 AIR PROTECTION

5.3.1 Review of activities from the Action Plan from the Strategy which are ongoing

- Ruling out the use of substances damaging the ozone layer;
- Changes and amendments to the Law on Air Protection;
- Adoption of new and harmonization of existing regulations with the EU regulations;
- Cooperating within the EMEP;
- Establishing the CDM (Clean Development Mechanisms) Bureau for implementation of the Kyoto Protocol and the system for utilization of the CDM flexible mechanism of foreign support for implementation of projects in the Federation of BiH;
- Preparation of the national report on emission of gases causing the greenhouse effect, identification of the effects and the needed measures of reconstruction and adaptation.

5.3.2 Activities planned for the next three years

- Appointing and capacitating focal point for the Convention on the Long-Range Transboundary Air Pollution - LRTAP Convention;
- Initiating ratification and implementation of the Protocol on the Limitation of SO2 and NOx emission, along the LRTAP Convention;
- Access to other protocols, along the LRTAP Convention;
- Preparation of the Study on the threshold value of SO2 for thermal power plants on the line of emission threshold of the LRTAP Convention, Directive 2001/80/EC on the limitation of emissions of certain pollutants into the air, and the Contract on the SE Europe Energy Community;
- Changes and amendments to the emission threshold value from the combustion facilities;
- Establishing energy counselling centres;
- Establishing federation and cantonal networks for air quality monitoring;
- Establishing the Quality Assurance/Quality Control (QA/QC) system, collection of data and their exchange within the EEA;
- Preparation of the Instruction for preparation of register of air emissions;
- Instruction on application of the register of emissions and atmospheric model in planning of air quality within spatial/urban plans;
- Managing air polluting chemicals.

5.4 WASTE MANAGEMENT

5.4.1 Review of activities from the Action Plan which were completed

- Adoption of the Law on Changes and Amendments to the Law on Waste Management, in order to create legal
preconditions for implementation of measures from the Strategy and corrections of definitions;
- Drafting and adopting technical instructions on the best available techniques for butcheries, industries related to meat and fish processing, fish farming and cattle and poultry farming in BiH.

5.4.2 Review of commenced activities from the Action Plan

- Preparation of bylaws for managing: construction waste, waste batteries and accumulators, electric and electronic waste, old vehicles, old tires, equipment containing PCB and PCT, waste asbestos and packaging waste;
- Establishing of legal framework (law) on chemicals;
- Increase the number of citizens involved in organized waste collection;
- Creating conditions for sanitary disposal of capacities for at least five years (define regions, prepare feasibility studies for the region and a regional waste management centre, prepare environmental impact studies);
- Reconstructing existing areas under inadequately disposed hazardous and nonhazardous waste (update a list of “hot spots”, environmental permits, Feasibility Studies on abandoned depots, restoration of abandoned depots).

5.4.3 Proposal of the priority activities from the Action Plan for the next three years

- Drafting and adopting waste management plans set by the Law;
- Establishing capacities for adequate disposal of hazardous waste (Key feasibility study for defining acceptable alternatives for disposal of certain types of waste, support to technical improvement of existing combustion capacities);
- Introducing the system of separated collection of biodegradable, inorganic and hazardous substances waste and their packaging in agriculture and forestry;
- Implementation of the training program on proper collection and disposal of biodegradable waste;
- Preparing the feasibility study for the most acceptable concept of waste management for animal waste in the FBiH;
- Establishing regional collection depots (6-8) for collection, refrigerating and disposal of animal origin waste, and purchasing transport vehicles for every collection centre;
- Creating and implementing public awareness raising campaign on waste treatment issues, promoting an integrated system of waste management;
- Collecting and recycling packaging waste;
- Improving existing and establishing new capacities for recovery of energy or materials;
- Introducing efficient measures for reduction and prevention of disposal of the WEEE as unsorted waste, though introduction of the schemes of return of used techniques to the original waste producer;
- Preparation of an entity plan of biodegradable waste management (which will foresee the model of establishing of collection centres for composting of biodegradable waste, as a possibility to use this type of waste as biofuel);
- Preparation of standards on the best practices of biodegradable waste use;
- Stimulating development of market for reusing and recycling of organic waste;
- Regulating disposal of waste pesticides and other hazardous substances through the principle of responsibility;
- Organizing programs of capacity strengthening for legislators, decision makers, cantonal/municipal authorities, directors of healthcare and veterinary institutions, employees in healthcare and veterinary institutions, and employees in municipal utility companies working on collection and disposal of medical waste;
- Preparation of the Study with a program of development of information system on waste;
- Purchasing equipment and training the employees.

Estimated financial assets for implementation of the Action Plan of the Federation Strategy for a ten year period, in the amount of 295 million KM, should be allocated to the budgets of the Federation and cantons through the FBiH Environmental Protection, from the funds of the European union (Pre-Accession Instruments - IPA), credits and grants.

It has been foreseen that the Government of the Federation of BiH should provide 5 million KM a year for the Budget of the Federation of BiH, and that the FBiH Environmental Protection Fund should be fully operational.

Operativeness of the Fund implies its establishing, i.e. appointing of a new Board of Directors and the Director of the Fund, and appropriate staffing, purchase of equipment and accommodation. Moreover, apart from existing source of funds provided through water fees, which are already
being collected in the Fund in line with the FBiH Law on Water, it is necessary to establish and develop other economic instruments based on the principle: polluter pays, user pays, and other additional fees which will be paid at registration of vehicles, in line with the FBiH Law on Environmental Protection Fund (Official Gazette of the FBiH no. 33/03).

In case the above-mentioned funds are not available, i.e. operational, that will directly influence the implementation of the Action Plan of the Federation Strategy.

In order to establish a consistent information system for environment in the future, as a precondition for preparation of comprehensive reports on environmental situation, based on reliable and timely data and information, it is necessary to have an institution at the level of the Federation of BiH to perform these duties. Previous concept was oriented towards establishing of the Environmental Agency of BiH, which would integrate data and information from entity reference centres, which will probably have to be given up due to the most recent political opposition of the Government of Republika Srpska regarding this issue.

Possible establishing of a new institution similar to the Environmental Agency at the level of the Federation of BiH, would definitely, due to difficult economic situation, have serious obstacles, so it would be better to follow possible solutions within existing legislative and institutional framework. The most practical and efficient solution could be the FBiH Fund for Environmental Protection, which, with appropriate changes or amendments to the Statute, could assume the activities related to establishing and maintenance of the information system for environment and preparation of periodical reports on environmental situation. This means that all of the Federation institutions referent for certain environmental components (Federation Hydrometeorological Institute; Federation Institute for Agropedology; Water Agency – both basins; Federation Geology Institute; Federation Institute for Statistics; Federation Bureau for Geodetic and Property Relations, future Federation Institute for Water Protection, etc.), as set under the Law on Environmental Protection, would be obliged to organize and send reliable, timely and correct data and information within their competence to the Fund for Environmental Protection of the Federation of BiH.