Technical Passports
of 7 Strategic Indicators for Integration of the Environment Global Targets in Regional Planning

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Sofia, November 2009

CONTENTS

ABBREVIATIONS

EE – Energy Efficiency

EEA –Energy Efficiency Agency

EEA – European Environment Agency

EEA – Executive Environment Agency

EFA – Executive Forestry Agency

EP – Ecological purpose

EP – Environment protection

EU – European Union

GIS – Geographic Information Systems

GDP – Gross Domestic Product

LTA – Long-Term Assets

MEET – Ministry of Economy, Energy and Tourism

MEW – Ministry of Environment and Waters

MRDPW – Ministry of Regional Development and Public Works

RES – Renewable Energy Sources

NSI – National Statistical Institute

SLM – Sustainable Land Management project

UNCCD – United Nations Convention to Combat Desertification

UNFCCC –United Nations Framework Convention on Climate Change

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I. INTRODUCTION

The current report presents the technical passports of the system of seven indicators which has been developed within the framework of the *Rio Conventions* project. The elaborated system of quantitative indicators aims to access the progress in the field of global environmental issues integration in Bulgaria; that process is being implemented through application of regional policy and strategic planning of regional and/or local development.

The indicators thus developed concern definite sub-national territorial units and characterise certain phenomenon or process; any change of indicators values is clearly and directly related to the three UN Conventions (Rio Conventions):

- UN Convention on Biological Diversity;
- UN Framework Convention on Climate Change;
- UN Convention to Combat Desertification.

This system of indicators intends to serve as a monitoring tool only and doesn't search neither to describe the existent problems nor to integrate the Rio Conventions in the analytical part of various strategic documents which are being elaborated in accordance with the Bulgarian legislation. That is why it includes only statistical indicators that could display dynamic alterations within short periods.

The system addresses sub-national territorial or administrative-territorial units in accordance with the Regional Development Act[1] (level 2 regions, districts, municipalities); that is why the selected indicators differ significantly from similar initiatives on national level. By reason of the facts abovementioned, an important part of the indicators proposed could be calculated only by using the analytical capacities of the Geographic Information Systems (GIS) on already existent spatially defined data for the country's territory.

The developed indicators are based whenever possible on official statistical information, namely on data provided by the Executive Environment Agency and the statististical reporting statements provided by "Environment and Energy Statistics" Division at the National Statistical Institute (NSI). Such information lacks for some indicators; that is why they are being defined in such a way as to allow the use of data provided by other reliable official sources (Energy Efficiency Agency, MEET, etc.).

During the process of system development, the emphasis has been put on the possibility for practical implementation of the identified different indicators and the opportunities for providing output data to use for calculating indicators from sources available in the country. For that reason the developed indicators' technical passports are supplemented by tables containing values already calculated for the respective indicator for the different territorial levels in Bulgaria.

[1] In force since August 31, 2008 г. promulgated in State Gazette, No 50 from May 30, 2008.

II. TECHNICAL PASSPORTS

INDICATOR 1: Relative share of territories subject to anthropogenic impact (infrastructure, residential areas, industrial sites)

1. GENERAL DESCRIPTION

1.1 Target area

Biological diversity

1.2 Key political issue addressed by the indicator

In which regions/municipalities exists intensified anthropogenic impact which causes degradation of natural habitats/ acceleration of biological diversity losses and what changes in regional planning are necessary as a result of that fact?

1.3 Definition of the indicator

The indicator displays the relative share/percentage of the territories subject to anthropogenic impact as part of the entire area of a specific territorial unit (municipality, region, state).

1.4 Background

Destruction, damage and fragmentation of natural habitats are one of the main reasons for acceleration of the process of biological diversity loss worldwide. Processes of urbanisation and strengthening of the anthropogenic impact over more and more territories constitute the leading mechanism through which the number of habitats, being directly destroyed, damaged or threatened to disappear due to human activity, is constantly increasing.

The excessive building-up or construction of tourism-related infrastructure (ski slopes, golf course, small hydroelectric power plants) in constantly increasing number of ”sensible” territories (including protected territories, NATURA 2000 areas, rare and vulnerable habitats and ecosystems such as damp areas, river valleys, forests, etc) has become a very serious problem in Bulgaria during the last few years. The lack of indicators to measure or define the acceptable degree of urbanisation or anthropogenic impact in the different territorial units/on different levels of planning impedes to a great extent the definition of scales, speed and scope of all those processes and, respectively, the development and implementation of adequate government policies. That is why the introduction of such an indicator would be helpful in monitoring those processes and would ensure the possibility to plan appropriate measures for regulation of negative processes on the different levels of planning through legislative and other initiatives.

The indicator *Relative share of the territories subject to anthropogenic impact (infrastructure, residential areas, industrial sites)* has been suggested as a result of the findings of an expert research[2], conducted within the framework of the *Rio Conventions* project. According to that research, the indicator’s priority has been defined as a ‘key” one and its territorial level as a “regional/local” one. The proposed indicator has been approved for use in the statistical practice of Eurostat[3] and makes part of the standard statistical indicators in the pan-European project Urban Audit. [4]. The indicator is in use in all the countries where data cover by CORINE Land Cover project is available and could be used for assessment of the extent of antropogenic impact on local, regional and national levels.

The indicator provides through implementation of periodic monitoring the possibility for presenting the actual condition of each territorial unit, following the trends and development dynamics in the urbanisation processes on the respective territorial levels as well as for comparison with the development trends on European level. The respective national and regional policies in the field of planning and regional development which aim to cease the biological diversity loss in accordance with the international commitments assumed by Bulgaria under the UN Convention on Biological Diversity could be updated and implemented on the basis aforementioned.

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[2]See the report „Indicators for monitoring global environmental issues integration in the process of regional development in Bulgaria – general description”, Alexander Kotsev, PhD, DSc, 2009.

[3] Eurostat is the Statistics Office of the European Communities situated in Luxembourg. Its task is to provide the European Union with statistics at European level that enable comparisons between countries and regions. http://epp.Eurostat.ec.europa.eu/portal/page/portal/Eurostat/home/

[4] Urban Audit provides statistics on 259 cities and towns from 27 European countries in cooperation with Eurostat. It includes almost 300 indicators which give information on various issues in the fields of demography, society, economy, environment, etc. http://www.urbanaudit.org/help.aspx .

1.5 Relation between the indicator and the target area

The anthropogenic influence on the territory is being addressed in the UN Convention on Biological Diversity (ratified by Republic of Bulgaria) and is beyond doubt the most significant factor cause for biological diversity loss. Destruction, damage and fragmentation of natural habitats as a result of human activity are one of the main reasons for biological diversity decreasing. For that reason the increase or decrease of the surface of the territories subject to anthropogenic impact could serve to indirectly measure biodiversity.

In conformity with the Global Strategic Plan for the Convention on Biological Diversity, the member states make the commitment to apply more efficiently and consistently the three aims of the Convention in order to achieve in 2010 a significant slowdown in the current speed of biodiversity loss worldwide as on regional and national level. After the endorsement of the Strategic Plan, the Conference of the States drafted a framework which to facilitate the process of assessment the progress in achievement of the goal in 2010. This framework includes seven target areas; three of which are mentioned below and are directly related to decreasing the speed of biodiversity loss as well as to the proposed indicator:

- Reducing the extent of loss of biodiversity components, including (1) biomes, habitats, and ecosystems; (2) species and populations; and (3) genetic diversity;
- Coping with the threats to biodiversity, including those which arise from external invasive species, climate changes, pollution and habitats changes;
- Maintaining the ecosystems integrity and ensuring the provision of goods and services granted by the ecosystems biodiversity of the very existence of a welfare mankind.

The indicator *Relative share of the territories subject to anthropogenic impact* provides possibility for following the progress in the three target areas and respectively in achieving the goal of slowing down the current speed of biodiversity loss worldwide as on regional and national level.

2. METHODOLOGY AND DATA SOURCES

2.1 Data availability (in Bulgaria and on international level)

On international level Eurostat data could be used as a point of reference; however, they are reliable but incomplete as to all countries/years. In accordance with the Eurostat classification the indicator concerns "built-up and related land" defined in the joint questionnaire of Eurostat/OECD as: residential areas (3.1.); industrial sites (3.2.); mine extraction and dump sites (3.3.); commercial areas (3.4); social services areas (3.5); areas with mixed purpose (3.6); transport and communications areas (3.7); technical infrastructure areas (3.8); recreational and other open areas (3.9). Scattered farm buildings, yards and extensions are not included. The general Eurostat statistics which are available online provide information on the indicator on national level in the EU Member States while excluding data for the following categories: 3.5, 3.6, 3.8, and 3.9.

The online Eurostat data are available for some of the EU Member States only as they include national level information for three base years: 1990, 1995, and 2000. As each of the countries involved provides information on the indicator at different time, the last available overall data update was made on December 19, 2003. The unit of measurement is km^2. For some countries there is a lack of information for all the years considered; that fact hampers the work on defining trends and averaging values for EU15 and EU27 respectively. Information for Bulgaria on this indicator is completely missing in the database.

On national level there are no processed and systematic data for the indicator in a ready-to-use format. In general there are two possible sources of statistically reliable output data for calculation of the indicator values for separate territorial units:

1) ***CORINE Land Cover (Executive Environment Agency)*** – the output data for indicator calculation for the territory of the country, municipalities, districts and level 2 regions are available through the implemented project CORINE Land Cover for the following base years: 1990, 2000, and 2006. The data are provided to the users by the Executive Environment Agency/European Environment Agency after a request in digital format appropriate for work in GIS environment. On the basis of those data thematic samples and GIS analyses of certain classes/categories according to the types of durable usage of the respective territories from the CORINE classification could be made.

The output data are being updated each 5 years by the European Environment Agency and the corresponding institutions in the EU Member States (the last update was made in 2006). The data are obtained through computer and manual processing of satellite pictures, geographic maps and other subsidiary information.

On the basis of the processing thus performed, the land cover is being categorised according to the CORINE Land Cover Nomenclature which is a standard one for EU. The format for data presenting is ARC INFO, the scale 1: 100 000; the

geometric and thematic accuracy of CORINE Land Cover is 85 %. According to the latter's nomenclature, the group "Artificial surfaces" (i.e., anthropogenic objects) includes the following categories:

Level 1	Level 2	Level 3
1. Artificial surfaces	1.1. Urban fabric	1.1.1. Continuous urban fabric
		1.1.2. Discontinuous urban fabric
	1.2.Industrial, commercial and transport units	1.2.1. Industrial or commercial units
		1.2.2. Road and rail networks and associated land
		1.2.3. Port areas
		1.2.4. Airports
	1.3. Mines, dump sites, and construction sites	1.3.1. Mineral extraction sites
		1.3.2. Dump sites
		1.3.3. Construction sites
	1.4. Artificial non-agricultural vegetated areas	1.4.1. Green urban areas
		1.4.2 Sport and leisure facilities

As those are the main types of durable land use which exercise anthropogenic impact on the territories, those land cover classes shall be used for analysing and calculating the indicator values.

2) ***Geogesy, Cartography and Cadastre Agency*** –within the framework of a research on GIS information sources which might be helpful in the application of the Rio Conventions in the process of regional and territorial planning, it has been concluded that the Cadastre Agency has at its disposal well-functioning GIS cadastre and data base in the necessary format which could be used for indicator calculation. In accordance with the Agency policy, part of the information is classified while another is accessible by private users against fee.

In contrast with CORINE Land Cover, the information provided by the Cadastre is much more detailed, accurate and up-to-date thanks to the greater number of the classes/categories to describe the areas subject to anthropogenic impact and the shorter update period (data are being updated whenever a change arrives).

On the basis of the classification for durable land use, the following (cadastre) categories could be used in order to calculate the indicator:

Code	Name of the territory
1	Urbanised territory
2	Transport territory
7	Disrupted territory

On the basis of the classification for durable land use, the data from the following classes could be used in order to calculate the indicator:

Codes	Namee
1000-1050	1. LAND FOR RESIDENTIAL/HOUSING NEEDS
1100-1210	2. LAND FOR PUBLIC BUILDINGS AND ESTATES
1300-1370	3. LAND FOR GREEN SPACES
1400-1500	4. LAND FOR SPORTS FACILITIES
1600-1680	5. LAND FOR RESORT AND RECREATIONAL FACILITIES
1700-1920	6. LAND FOR MANUFACTURING AND WAREHOUSE SITES

2000-2040	7. LAND FOR CULTURE AND HISTORICAL OBJECTS
2100-2310	8. LAND FOR TRAFFIC AND TRANSPORT OBJECTS
2400-2470	9. LAND FOR PIPELINE MACHINERY
3500-3560	18. LAND FOR EXTRACTION SITES
3600-3680	19. LAND OCCUPIED BY INDUSTRIAL AND HOUSEHOLD WASTE
3700-3730	20. DEGRADATED LAND
3800-3810	21. LAND FOR SPECIAL PURPOSE AND USE

The cadastre data are more accurate, detailed and up-to-date in comparison with those of CORINE Land Cover but their calculation requires processing of a larger amount of information because of the greater number of classes and categories of the respective objects in the territories subject to anthropogenic impact. Besides, at the time being the Geodesy, Cartography and Cadastre Agency could not provide data on the entire territory of the country as the available output data concern mainly the highly urbanised territories and regions in Bulgaria.

Both classifications overlap to a high degree as most of the land cover classes correspond to the respective land categories. Certain classes of the cadastre are much more specific and it is impossible to find out their exact counterpart in CORINE Land Cover classification. That makes the development of a correct table on the compatibility between both classifications a hardly feasible task.

In Bulgaria, to the aims of the regional planning in urbanised territories, cadastre classification is now in use because of its being more accurate and detailed while CORINE Land Cover is used chiefly for planning in slightly urbanised regions (protected areas, farm land or forests, etc.).

2.2 Period for data collection/update

The available online data on EU level are being updated at 5 year period; however updated data for the last period are missing (the last update was made in 2003).

The CORINE Land Cover data are provided by the European Environment Agency to the Executive Environment Agency; the data now available are from 1990, 2000, and 2006. Usually the processing of the output data (satellite pictures, etc.) takes too long time and thus slows down the information update – for example, the last data available (2006) have been distributed only in 2008.

In contrast with CORINE Land Cover, the national data provided by the Geodesy, Cartography and Cadastre Agency are being updated whenever a change arrives.

2.3 Units of measurement and sample values

The units of measurements used for that indicator are: square kilometre (km^2) – for calculation of the territories surface, and respectively percent (%) – for calculation of the relative share of the territories subject to anthropogenic impact from the area of the respective territorial unit.

Indicative values on European level – on the basis of the available online data, average values of the percentage of the territories subject to anthropogenic impact in the EU Member States for which data for all the years included in reporting period (1990-2000) are provided, could be defined. The lack of more recent data along with the dynamics of urbanisation processes in the last few years cast doubt on the accuracy of those values.

- ***EU15*** – on the basis of the available data calculations concerning three countries have been made; they show the following average values: the leading country is Belgium where the relative share of the territories subject to anthropogenic impact in 2000 was 18.48 % 2000, followed by Germany where the respective percentage was 12.81% and France with 7.70%. A stable trend for increasing the indicator values during the reporting period 1990-2000 has been confirmed for all the three countries (See Fig.1).

- ***EU 27*** – on the basis of the available data calculations concerning three additional ("new") Member States have been made; they show the following average values: the leading country is the Czech Republic where the relative share of the territories subject to anthropogenic impact in 2000 was 10.27 % followed by Slovakia where the respective percentage was 7.51% and Poland with 6.57%. It should be mentioned that urbanisation values in all the three countries are lower than those of the "old" Member States; values fluctuations exist and lack of an explicit and clear trend of increase in the percentage of the territories subject to anthropogenic impact during the reporting period 1990 -2000 could be observed. (Fig.2).

On the basis of those data the average share of territories subject to anthropogenic impact for EU15 in 2000 could be defined indicatively as 13 %; for EU 27 the value is 10.56%.

Indicative values on national level – on the basis of GIS analyses of the data provided by CORINE Land Cover, values have been calculated for all the municipalities in Bulgaria (*Annex 1)*. That is how average values by municipalities as well as an average value on national level have been calculated.

As a result of the analysis performed, the average value of the indicator on municipality level has been calculated as 5.29%. At the bottom of the rankings are the municipalities of Sapareva Bania whose indicator is 0.56% and Batak whose indicator is 0.57%. The rankings are led by the municipality of Plovdiv where the percentage of territories subject to anthropogenic impact is 47.22%.

The average value of the indicator on national level has been calculated as 5.03% of the entire territory of the country.

Suggestions for target values for Bulgaria – the interpretation and use of the indicator in the process of regional planning would be possible and useful if target (maximally admissible or threshold) values are set for each territorial unit. It is not possible to propose such values within the framework of the current project as they shall be a function of many factors for each individual territory (e.g., population density and demographic trends, degree of biological diversity, availability and surface of protected territories, availability of industry and infrastructure sites of national importance, etc.).

As setting of such values could cause serious conflicts with local authorities, investors and other interested parties, the values shall be defined by an expert team or inter-institutional committee set up individually for each territorial unit on the lowest planning level (i.e., municipality). On that basis maximally admissible values for each level 2 region could be defined and then underpin the respective strategic documents or policies concerning regional planning.

2.4 Possibilities for measuring the indicator

The main possibilities for measuring the indicator constitute analyses performance in GIS environment on the basis of output data provided in the appropriate format. The indicator could be calculated automatically, through development of specialised software tools in addition to the main GIS software in use (ArcView).

2.5 Methodology used for data collection and analysis

The indicator values could be found out through calculation based on the output data; the process could be divided (roughly) in three stages:

- receiving and update of the output data for a specific territorial unit (municipality, region, etc);
- calculation (in GIS environment) of the entire surface in km^2 of the territories subject to anthropogenic impact within the respective territorial unit – on the basis of the CORINE Land Cover and the cadastre data;
- calculation of the share of the territories subject to anthropogenic impact within a certain territorial unit (municipality, region, etc.) in % of the already calculated area in $km^{2.}$

However, the calculation methodology and algorithm should be diversified depending on the difference in the output data because of the discrepancies in the number and characteristics of the classes concerning the territories subject to anthropogenic impact as well as in the GIS operations necessary for their analysis. For example – the CORINE Land Cover data concern mainly the durable land use types while the cadastre data regard directly the territorial division of the country, property types, etc.

2.6 Proposals for improvements in the methodology and monitoring of the indicator for the different planning levels

The development of specialised software products or tools in GIS environment for calculation of the indicator values on various territorial levels (on the basis of the output data from CORINE Land Cover and the cadastre) will facilitate and make faster the process of calculation and update of the indicator.

As it is explained in the text below, although the Indicator 1 has been defined as a key indicator in the "Biodiversity" domain, formulated as it is now, it does not provide a visible relation between the admissible percentage of the territories subject to anthropogenic impact in a certain territorial unit and its significance for the biological diversity protection. That is why a GIS layer containing the borders (polygons) of the protected areas which belong to the European Ecological Network NATURA 2000 should also be included into the GIS data base.

That is why an additional stage, namely "calculation of the surface of the areas included into NATURA 2000" (presented in both km^2 and percentage) should also be included in the methodology for calculation of the indicator. The availability of values for both indicators (i.e., anthropogenic impact and protected territories) will provide us with more clarity and greater possibilities for integration measures aimed to protect the confirmed significant biological diversity for each individual territorial unit to be integrated within regional planning policies.

2.7 Legal and institutional analysis of the indicator

The long-term monitoring of the indicator depends on the creation of an efficient mechanism for data collection, update, processing, storage and analysis. As both sources of output data are state institutions, the necessary steps for performing long-term monitoring by the Ministry of Regional Development and Public Works might be the following:

- organisation of inter-institutional meetings with representatives of the Executive Environment Agency and Geodesy, Cartography and Cadastre Agency aimed to clarify the state of the available resources and the opportunities for joint work related to the indicator monitoring on the different planning levels;
- conclusion of inter-institutional agreements for cooperation and exchange of information; those agreements should contain the mechanisms, commitments, deadlines and format of the provides resources/data geared to implement a long-term monitoring of the indicator on the different planning levels;
- performance of long-term monitoring of the indicator on the various levels of planning.

3. ASSESSMENT OF THE INDICATOR

3.1 Main advantages

The main advantage of the indicator is the possibility for adequate presentation of the share of the territories subject to anthropogenic impact; that allows an assessment of the risk of natural habitats degradation and the processes of biological diversity loss to be made. There is enough reliable and up-to-date information in the country (provided from governmental and institutional sources) for calculation of the indicator, defining trends and performance of comparative.

The indicator is in use in all the countries which use CORINE Land Cover data and provides for correct visual presentation of the established trends and processes as well as for opportune updating. There exists a technological possibility for developing software tools which will make the performance of data/indicator values processing, calculating and updating much faster.

3.2 Main disadvantages

The available data could not be used directly – thematic analyses and calculations in GIS environment should be done in order to find out indicator values for each level and territorial unit.

Although the indicator 1 has been defined as a key indicator in the “Biodiversity” domain, formulated as it is, it does not provide a visible relation between the admissible percentage of the territories subject to anthropogenic impact in a certain territorial unit and its significance for the biological diversity protection (availability of protected territories and zones included in NATURA 2000, availability of rare, protected or endangered species or ecosystems, availability of industrial sites of national significance, density of population, etc.). That makes setting maximally admissible values of the indicator and implementation of adequate governmental policies quite difficult a task.

The specific features of each territory requires calculation and definition of target or maximally admissible values for the lowest territorial units (municipality level); on that basis governmental decisions concerning the regional planning on local, regional and national level could be made.

3.3 Expenditures on the development, monitoring and update of the indicator for the MRDPW strategic planning goals on national, regional and local level

The possible expenditures on the development, monitoring and update of the indicator could be divided into several groups according to the stages in information receiving and processing.

- data receiving and update – as both sources of output data for calculation of the indicator values on national level are state institutions which could provide the data without charge on the grounds of inter-institutional agreements, expenses on data collection are not envisaged for on that stage;
- processing and analysis of the collected data – the processing of the collected data with the purpose of calculation the indicator values should be realised in GIS environment by well-trained experts. The expected expenses on output data processing depend on the choice of the data source by MRDPW. The processing of CORINE Land Cover data requires specialised GIS software, the necessary hardware and respectively, competent experts to work with them. Such a choice would require certain expenditures on purchasing software and equipment needed as well as on training.

  In case that specialised GIS tools be developed, the analysis of the collected data could be performed by a specially trained MRDPW officials; no need of providing additional resources (new jobs or equipment purchase) would arise. The Geodesy, Cartography and Cadastre Agency disposes with specialised software,

equipment and experts so it would be able to process efficiently the output data and to provide MRDPW with indicator values concerning all the territorial levels for which data are available at minimum or no expenses.

- performance of periodic monitoring, preparation and update of a data base – that activity could be performed by MRDPW employees after the respective training and would not require additional resources (e.g., opening of new jobs or equipment purchase). The data base could be created in the information environment of Access data base without need of purchasing a specialised server or software. To that aim the following conditions should be met:

  1) conclusion of inter-institutional agreements with Executive Environment Agency and/or Geodesy, Cartography and Cadastre Agency for provision of information (output data);
  2) development of specialised software tools (functioning in GIS environment) for calculating the indicator values on the basis of the output data;
  3) realisation of training for MRDPW on database maintenance and indicator values calculation.

3.4 Graphic presentation of the indicator

By now two options for presenting the indicator could be proposed:

- ***comparative analysis and defining trends*** - a graph presenting the indicator values for different territorial units for one (determined) period (Fig.1 and 2)

Fig.1 Areas subject to anthropogenic impact - EU 15

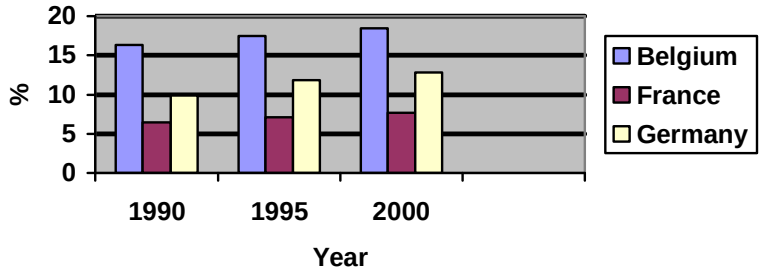
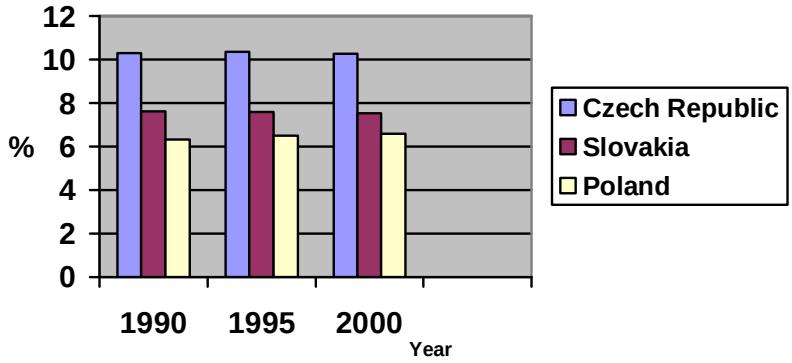


Fig. 2 Areas subject to anthropogenic impact - EU 27



- ***visualisation and surface presenting of the indicator*** – a circular chart which presents the percentage of the territories subject to anthropogenic impact (Fig.3)

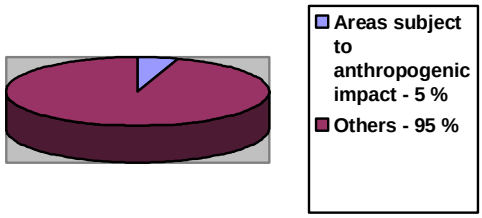


Fig 3 Areas subject to anthropogenic impact – Bulgaria, 2006

3.5 Interpretation of the indicator for the MRDPW strategic planning goals on national, regional and local level

The proposed indicator could be interpreted for the strategic planning goals of MRDPW which concern the degree of integration of the Rio Conventions targets within the regional planning process on national, regional and local level. To the goals of planning the indicator could be used after target values (maximum share/percentage of the territories subject to great anthropogenic impact) have been set up for each municipality.

Those values should be defined after a complex expert assessment of each individual territory made by an expert team or an inter-institutional committee. The assessment shall be based on the analysis of the following factors:

- availability of valuable biodiversity – rare and/or protected species, habitats and ecosystems, protected territories, areas included into NATURA 2000 network and their surface;
- availability of industry sites of national significance – electric power plants, great industry enterprises, extraction sites, etc.
- density of population and demographic tendencies;
- existing pressure and dangers for the biodiversity in the region –damage or destruction of species, habitats, pollution, confirmed law infringements, significant investment projects, etc.

The specific character of each territory requires calculating and defining of maximum permissible indicator values for the lowest territorial units (municipality level). Those values could be legitimated either through their inclusion in legislative acts or through their introduction as target values in key strategic documents (regional plans, programmes, development strategies, etc.) On that basis adequate governance decisions in relation to the regional planning on local, regional and national level could be made while MRDPW would be able to implement systematic monitoring and policy directly aimed to achieving the set targets.

4. TECHNICAL INFORMATION

4.1 Technical information summary

- **Name:** Relative share of territories subject to anthropogenic impact (infrastructure, residential areas, industrial sites)
- **Status:** available
- **Definition:** The indicator depicts the relative share/percentage of territories subject to anthropogenic impact of the entire area of a specific territorial unit (municipality, region, state).
- **Geographic coverage:** Pan-European
- **Time coverage:** after 1990
- **Update frequency:** 5-10 years for CORINE Land Cover; at each change taken place for the Geodesy, Cartography and Cadastre Agency
- **Data sources:** Executive Environment Agency, Geodesy, Cartography and Cadastre Agency

4.2 Possibility for integration with GIS

The appropriate formats (raster image, shp files) in which output data are being provided by both CORINE Land Cover and Geodesy, Cartography and Cadastre Agency ensure the possibility of integration and interpretation of the indicator in GIS environment.

4.3 Sources

1. *Report "Indicators for Monitoring Global Environmental Issues Integration in the Process of Regional Development in Bulgaria –General Description", Alexander Kotsev, PhD, DSc, 2009*

2. *Eurostat http://epp.Eurostat.ec.europa.eu/portal/page/portal/environment/data/main_tables*

3. *Convention on Biological Diversity, http://www.cbd.int/*

4. *Strategic Plan on the Convention on Biological Diversity, Ministry of Environment and Waters*

5. *„Consultation on Clarification and Improvement of the Model for Water Erosion Risk Assessment", Ivan Nikolov, Svetla Rousseva, Vihra Stefanova, 2006.*

6. *Survey „GIS sources of information related to the application of the Rio Conventions in the regional and spatial planning", Maria Novakova*

7. *http://www.eea.europa.eu/publications/COR0-landcover*

8. *http://www.mrrb.government.bg*

9. *www.urbanaudit.org/*

10. *www.geographic.org*

INDICATOR 2: Share between forest, agricultural and urbanised territories

1. GENERAL DESCRIPTION

1.1 Target area

Biological diversity

1.2 Key political issue addressed by the indicator

How do the different types of land use influence biological diversity in a specific territorial unit? What share of the forests and agricultural territories are being lost in the urbanisation process and what changes in the regional planning process are due as a result of it?

1.3 Definition of the indicator

The indicator shows the relative share/percentage of the forest, agricultural and urbanised territories from the overall area of a certain territorial unit (municipality, region, state).

1.4 Background

The destruction, damaging and fragmentation of natural habitats are one of the main reasons for acceleration of the biological diversity loss process worldwide. The urbanisation of new territories as well as implementing unsustainable forest management and agricultural practices are among the most significant factors for the destruction or damage caused to ever increasing number of species and habitats.

Building up or construction of tourist, etc. infrastructure (ski runs, golf courses, small hydroelectric power plants) in increasing number of "sensitive" territories (including protected territories, NATURA 2000 zones, rare and vulnerable habitats and ecosystems such as damp areas, river valleys, forests, etc.) has become too serious a problem in Bulgaria in the last few years. Any unsustainable agricultural practices (such as intensive agriculture and overuse of chemicals) or forestry practices (clear cutting, destruction of the old forests, mono-crops afforestation, etc.) are also able to cause loss of biological diversity.

The lack of indicators to measure or define the permissible limits of urbanisation or the correlation between various types of land use in the different territorial units/planning levels hinders significantly the process of defining scales, speed, and scope of those processes and the development and implementation of appropriate management policies, respectively. That is why the introduction of such an indicator will contribute to the efficient monitoring of those processes and will provide the opportunity for planning appropriate measures in order to regulate the negative processes on the different planning levels through legislative and other necessary initiatives.

The indicator *Share between forest, agricultural and urbanised territories* is being proposed as a result of an expert study[5], undertaken within the framework of the *Rio Conventions* project. According to the study the indicator is defined as being of "key" priority and its territorial level as a "regional/local" one. The proposed indicator is based on several long-established in the Eurostat statistical practice indicators related to land cover types – urbanised territories, forests and agricultural lands. Those indicators are in use in all the countries where there are data available from CORINE[6] Land Cover Project.

On implementation of periodic monitoring the indicator provides the opportunity for presenting the up-to-date situation in each territorial unit, following the trends and development dynamics in the urbanisation processes and the land use types on the respective territorial levels as well as making comparison with development trends on European level. On that basis the respective national and regional policies on planning and regional development aimed to stop the losses of biological diversity in accordance with the international commitments undertaken by Bulgaria under the UN Convention on Biological Diversity could be updated and implemented.

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[5]. *Report "Indicators for Monitoring Global Environmental Issues Integration in the Process of Regional Development in Bulgaria – General Description", Alexander Kotsev, PhD, DSc, 2009.*

[6] CORINE Land Cover is a part of the European Programme *Coordination of information on the environment* and its aim is to provide compatible geographic information on the land cover in the EU Member States, http://www.eea.europa.eu/publications/COR0-landcover

1.5 Relation between the indicator and the target area

Anthropogenic influence on the territory through the types of land use in the respective areas is being addressed in the UN Convention on Biological Diversity (which is ratified by the Republic of Bulgaria) and is indisputably related to the loss of biological diversity. Destruction, damaging or fragmentation of natural habitats as a result of human activity is one of the main reasons for shrinking of biological diversity so that the indicator may be considered as an indirect biodiversity measuring tool.

According to the Global Strategic Plan for the Convention on Biological Diversity the member states shall be bound with more efficient and consistent application of the three targets of the Convention, in order to achieve in 2010 significant slowdown of the current speed of biological diversity loss worldwide as well as on regional and national scale. After the endorsement of the Strategic Plan, the Conference of States elaborated framework which facilitates the progress assessment with regard to achieving the set target for 2010. The framework includes seven target areas; three of them are presented below as they are directly related to the slowdown in the speed of biodiversity loss and the proposed indicator:

- decrease in biodiversity components loss, including: (1) biomes, habitats and ecosystems; (2) species and populations, and (3) genetic diversity;
- coping with the main threats for biodiversity, including those which emerge from external invasive species, climate changes, pollution and habitats changes;
- maintenance of ecosystems integrity and ensuring goods and services which biodiversity in the ecosystems provide in favour of the humanity welfare.

The indicator *Share between forest, agricultural and urbanised territories* provides opportunity for following the advancement in the three target areas and respectively for the achievement of the target of the current slowdown in speed of biodiversity loss worldwide as well as on national and regional levels.

2. METHODOLOGY AND DATA SOURCES

2.1 Data availability (in Bulgaria and on international level)

On international level the Eurostat data could be used as a point of reference for comparative analyses; these data are statistically reliable but do not provide sufficient information for all countries/years. According to the Eurostat classification the indicator concerns "built up and related to them lands", "forests" and "agricultural (farm) land". The accessible online data provided by Eurostat cover only a part of the EU Member States and include national level information for different base years (the unit of measurement is κm^2). The available data for the three main types of land use are to be found in different tables which cover different scopes as regards the geographic area concerned and updating periods.

The most complete data concern the areas subject to anthropogenic impact which make part of the Urban Audit[7] project. Data on forests are available for almost all the countries; however, in table format they are available only for years 1995 and 2000. Additional detailed data for the period 1995-2005 could be found in the Eurostat report *Forest statistics, 2007*. Data on the agricultural land are available for a few countries only; the only year for which there are data for almost all the countries and thus a comparative analysis could be made, is 2001. The lack of information on the three indicators for all the countries and all the years impedes trends defining and values averaging for both EU15 and EU27.

On national level unfortunately there are no processed and systematised data to be used directly. In general there exist two possible data sources for ensuring statistically reliable output data for calculation of the indicator for different territorial units:

1) ***CORINE Land Cover (Executive Environment Agency)*** – the output data for calculating the indicator for the territory of the country, municipalities, districts and level 2 regions are available through the CORINE Land Cover project for the following base years: 1990, 2000, and 2006. The data are provided to the users by the Executive Environment Agency/European Environment Agency after a request made in digital format which is appropriate for work in GIS environment. On the basis of those data thematic excerpts and GIS analyses could be accomplished for certain classes by types of durable land use of the respective territories according to CORINE classification.

[7] Urban Audit provides statistics on 259 cities and towns from 27 European countries in cooperation with Eurostat. It includes almost 300 indicators which give information on various issues in the fields of demography, society, economy, environment, etc. http://www.urbanaudit.org/help.aspx .

The output data are being updated at 5 years by the European Environment Agency and its corresponding institutions in the EU Member States (the last updates are from 2006). The data are collected by computer and manual processing of satellite pictures, geography maps and other subsidiary information.

On the basis of the processing thus completed, the land cover is being categorised in accordance with a standard EU nomenclature CORINE Land Cover. The format for data presentation is ARC INFO, scale 1:100 000; the geometric and thematic accuracy of CORINE Land Cover is 85%. According to the CORINE Nomenclature, the groups "Artificial surfaces", "Agricultural areas", and "Forests areas" include the following categories:

Level 1	**Level 2**	**Level 3**
1Artificial surfaces	1.1. Urban fabric	1.1.1. Continuous urban fabric
		1.1.2. Discontinuous urban fabric
	1.2. Industrial, commercial and transport units	1.2.1. Industrial or commercial units
		1.2.2. Road and rail networks and associated land
		1.2.3.Port areasa
		1.2.4. Airports
	1.3. Mines, dump sites, and construction sites	1.3.1. Mineral extraction sites
		1.3.2. Dump sites
		1.3.3. Construction sites
	1.4. Artificial non-agricultural vegetated areas	1.4.1. Green urban areas
		1.4.2.Sport and leisure facilities
2. Agricultural areas	2.1. Arable land	2.1.1. Non-irrigated arable lands
		2.1.2. Rice fields
		2.1.3. Arable land (complex cultivation patterns)
		2.1.4. Arable land (principally occupied by agriculture)
	2.2. Pastures	2.2.1. Pastures
	2.3. Vineyards and fruit trees and berries plantations	2.3.1. Vineyards
		2.3.2. Fruit trees and berries plantations
3. Forests areas	3.1. Forests	3.1.1. Broad-leaved forests
		3.1.2. Coniferous forests
		3.1.3. Mixed forests
	3.2. Shrub and/or herbaceous vegetation association	3.2.1. Natural grassland
	3.3. Open spaces with little or no vegetation	3.3.1. Transitional woodland shrub
		3.3.2. Bare rock
		3.3.3. Sparsely vegetated areas

As those are the main types of durable land use, related to the indicator, those classes of land cover shall be used for analysis and calculation of the indicator values

2) ***Geodesy, Cartography and Cadastre Agency*** –within the framework of a research on the possible GIS sources of information related to the application of the Rio Conventions in the regional and territorial planning it was found that the Geodesy, Cartography and Cadastre Agency disposes with well- functioning GIS cadastre and data base in the necessary

format which could be used for calculating the indicator. In accordance with the policy of the Agency, some parts of the information is classified while other parts could be provided at request to private customers against fee.

The cadastre information is much more detailed, precise and up-to-date as compared to that provided by CORINE Land Cover because of the existence of a greater number of objects classes which describe the territories subject to anthropogenic impact and the shorter period needed for update (at each change). On the basis of the classification for durable land use, data from the following (cadastre) categories could be used for calculating the indicator:

Code	Name of the territory
1	Urbanised territory
2	Transport related territory
3	Agricultural territory
4	Forests
6	Protected territory
7	Disrupted territory

Moreover, on the basis of that classification, data from the respective classes for each type of territory could be used for calculating the indicator; those data are numerous and provide detailed information for the type of each land estate.

Although the data provided by the cadastre are much more detailed, precise and up-to-date as compared to those provided by CORINE Land Cover, their calculation requires processing of a bigger amount of information because of the greatest number of classes and categories describing territories subject to anthropogenic impact (artificial surfaces). Besides, the Geodesy, Cartography and Cadastre Agency does not have at its disposal the necessary data for the entire territory of the country for the time being; the available output data concerns mainly the highly urbanised territories and regions in Bulgaria.

3) ***Ministry of Agriculture and Food*** – the ministry disposes with its own data bases on the agricultural land and forests areas. The Executive Forest Agency keeps the registry of forest areas and the estates' boundaries (in compliance with the forestry-administrative division of the country) are compatible with the cadastre in the system ALIS (Agriculture Land Information System). Data are available in .zem format and a compatibility conversion with the CORINE Land Cover data is necessary. The available information at the Ministry could be obtained on the basis of an inter-institutional agreement.

2.2 Period for data collection/update

The available online data on EU level have been updated through different periods/timelines for the different types of land-use; for example, updated data on the forest areas after 2000 are not available. The data from CORINE Land Cover are provided by the European Environment Agency to Executive Environment Agency at any update; the available data now presents the situation by 1990, 2000 and 2006 respectively. The processing of output data (satellite images, etc.) usually takes quite a lot of time and that slows down the update of information –e.g, the last data (2006) have been disseminated only in 2008.

Unlike these practices at CORINE, the Geodesy, Cartography and Cadastre Agency updates regularly its data - whenever any change occur. The data of the Executive Forest Agency are being updated on the basis of the Structural forest plans for each forestry unit at 10 year periods.

2.3 Units of measurements and sample values

The units of measurements in use for the indicator are square kilometer (km^2) – for calculation of areas and respectively percent (%) – for calculation of the relative share of the territories subject to anthropogenic impact from the surface of territorial unit examined.

Indicative values on European level – average values could be estimated for three states, respectively on level EU15 and EU27 by taking into consideration the available online data from the Eurostat report *Forest statistics, 2007* and the already calculated average values of areas subject to anthropogenic impact.

State	Total surface, km2	Urbanised territories, %	Forests, %	Agricultural and other land, %

Belgium	3053	18.48	22.9	58.62
Germany	35703	12.81	31.7	55.49
France	55150	7.7	31.4	60.9
Czech Republic	7887	10.27	34.3	55.43
Poland	31269	6.75	30	63.25
Slovakia	4901	7.51	40.1	52.39
Bulgaria	11099	5	33	67

Table 1. Share between forest, agricultural and urbanised territories in EU 15 and EU 27 states

The percentage of forests from the overall territory of EU27 is 42.2 % according to the Eurostat report *Forest statistics, 2007*. There is a distinct trend of a slow increase of the percentage of the forests on EU 27 level by 0.4 % per year.

Indicative values on national level – values for all the municipalities in Bulgaria have been calculated (*Annex 1*) on the basis of GIS analyses made by using CORINE Land Cover data. Furthermore, by considering them, the average values by regions as well as the average value on national level are also been prepared.

Suggestions for target values for Bulgaria – the interpretation and use of the indicator in the process of regional planning would be possible and useful if target (maximally admissible or threshold) shares are set for each territorial unit. It is not possible to propose such values within the framework of the current project as they shall be a function of many factors for each individual territory (e.g., population density and demographic trends, degree of biological diversity, availability and surface of protected territories, availability of industry and infrastructure sites of national importance, etc.).

As setting of such values could cause serious conflicts with local authorities, investors and other interested parties, the values shall be defined by an expert team or inter-institutional committee set up individually for each territorial unit on the lowest planning level (i.e., municipality). On that basis maximally admissible values for each level 2 region could be defined and then underpin the respective strategic documents or policies concerning regional planning.

2.4 Possibilities for measuring the indicator

The main possibilities for measuring the indicator constitute analyses performance in GIS environment on the basis of output data provided in the appropriate format. The indicator could be calculated automatically, through development of specialised software tools in addition to the main GIS software in use (ArcView).

2.5 Methodology used for data collection and analysis

The indicator values could be found out through calculation based on the output data; the process could be divided (roughly) in three stages:

- receiving and update of the output data for a specific territorial unit (municipality, region, etc);
- calculation (in GIS environment) of the entire surface in km^2 of the different types of territories within the respective territorial unit – on the basis of the CORINE Land Cover and the cadastre data;
- calculation of the share of the respective types of territory within a certain territorial unit (municipality, region, etc.) in % of the already calculated area in km^2.

However, the calculation methodology and algorithm should be diversified depending on the difference in the output data because of the discrepancies in the number and characteristics of the classes concerning the respective territories as well as in the GIS operations necessary for their analysis. For example – the CORINE Land Cover data concern mainly the durable land use types while the cadastre data regard directly the territorial division of the country, property types, etc.

2.6 Proposals for improvements in the methodology and monitoring of the indicator for the different planning levels

The development of specialised software products or tools in GIS environment for calculation of the indicator values on various territorial levels (on the basis of the output data from CORINE Land Cover and the cadastre) will facilitate and make faster the process of calculation and update of the indicator.

As it is explained in the text below, although the Indicator 2 has been defined as a key indicator in the "Biodiversity" domain, formulated as it is now, it does not provide a visible relation between the optimum correlation of the different types of land use and its significance for the biological diversity protection. That is why a GIS layer containing the borders (polygons) of the protected areas which belong to the European Ecological Network NATURA 2000 should also be included into the GIS data base.

That is why an additional stage, namely "calculation of the surface of the areas included into NATURA 2000" (presented in both km^2 and percentage) should be also included in the methodology for calculation of the indicator. The availability of values for all the indicators (i.e. subject to anthropogenic impact, agricultural land, forests, and protected territories) will provide us with more clarity and greater possibilities for integration measures aimed to protect the confirmed significant biological diversity for each individual territorial unit to be integrated within regional planning policies.

2.7 Legal and institutional analysis of the indicator

The long-term monitoring of the indicator depends on the creation of an efficient mechanism for data collection, update, processing, storage and analysis. As both sources of output data are state institutions, the necessary steps for performing long-term monitoring by the Ministry of Regional Development and Public Works might be the following:

- organisation of inter-institutional meetings with representatives of the Executive Forest Agency, Executive Environment Agency and Geodesy, Cartography and Cadastre Agency aimed to clarify the state of the available resources and the opportunities for joint work related to the indicator monitoring on the different planning levels;
- conclusion of inter-institutional agreements for cooperation and exchange of information; those agreements should contain the mechanisms, commitments, deadlines and format of the provides resources/data geared to implement a long-term monitoring of the indicator on the different planning levels;

3. ASSESSMENT OF THE INDICATOR

3.1 Main advantages

The main advantage of the indicator is the possibility for adequate presentation of the share of the territories subject to different types of land use; that allows an indirect assessment of the risk of natural habitats degradation and processes of biological diversity loss to be made. There is enough reliable and up-to-date information in the country (provided by governmental and institutional sources) for calculation of the indicator, defining trends and performance of comparative analysis on all the spatial planning levels.

The indicator is in use in all the countries which use CORINE Land Cover data and provides for correct visual presentation of the established trends and processes as well as for opportune updating. There exists a technological possibility for developing software tools which will make the performance of data/indicator values processing, calculating and updating much faster.

3.2 Main disadvantages

The available data could not be used directly – thematic analyses and calculations in GIS environment should be done in order to find out indicator values for each level and territorial unit.

Although the indicator 2 has been defined as a key indicator in the "Biodiversity" domain, formulated as it is, it does not provide a visible relation between the share between territories with different land use in a certain territorial unit and its significance for the biological diversity protection (availability of protected territories and zones included in NATURA 2000, availability of rare, protected or endangered species or ecosystems, availability of industrial sites of national significance, density of population, etc.). That makes setting maximally admissible values of the indicator and implementation of adequate governmental policies quite difficult a task.

The specific features of each territory require calculation and definition of target or maximally admissible values for the lowest territorial units (municipality level); on that basis governmental decisions concerning the regional planning on local, regional and national level could be made.

3.3 Expenditures on the development, monitoring and update of the indicator for the MRDPW strategic planning goals on national, regional and local level

The possible expenditures on the development, monitoring and update of the indicator could be divided into several groups according to the stages in information receiving and processing.

- data receiving and update – as the three sources of output data for calculation of the indicator values on national level are state institutions which could provide the data without charge on the grounds of inter-institutional agreements, expenses on data collection are not envisaged on that stage;
- processing and analysis of the collected data – the processing of collected data with the purpose of calculation the indicator values should be realised in GIS environment by well-trained experts. The expected expenses on output data processing depend on the choice of the data source by MRDPW. The processing of CORINE Land Cover data requires specialised GIS software, the necessary hardware and respectively, competent experts to work with them. Such a choice would require certain expenditures on purchasing software and equipment needed as well as on training. In case that specialised GIS tools be developed, the analysis of the collected data could be performed by a specially trained MRDPW officials; no need of providing additional resources (new jobs or equipment purchase) would arise. The Executive Forests Agency and the Geodesy, Cartography and Cadastre Agency dispose with specialised software, equipment and experts so it would be able to process efficiently the output data and to provide MRDPW with indicator values concerning all the territorial levels for which data are available at minimum or no expenses.
- performance of periodic monitoring, preparation and update of a database – that activity could be performed by MRDPW employees after the necessary training and would not require additional resources (e.g., opening of new jobs or equipment purchase). The data base could be created in the information environment of Access data base without need of purchasing a specialised server or software. To that aim the following conditions should be met:

  1) conclusion of inter-institutional agreements with Executive Environment Agency and/or Geodesy, Cartography and Cadastre Agency for provision of information (output data);
  2) development of specialised software tools (functioning in GIS environment) for calculating the indicator values on the basis of the output data;
  3) realisation of training for MRDPW on database maintenance and indicator values calculation.

3.4. Graphic presentation of the indicator

By now two options for presenting the indicator could be proposed:

- ***comparative analysis*** – a graph which presents the different values of the indicator for different territorial units for a specific period of time; Fig. 1 presents data on France, Germany, Belgium, Czech Republic, Poland, Slovakia, and Bulgaria by the three indicators: urbanised territories (UT); forest territories (FT), and agricultural and other territories (AT).

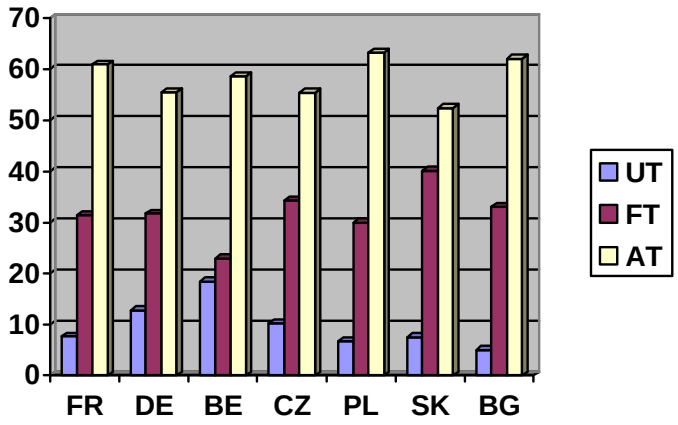

Fig. 1 Share between forests, agricultural and urbanised territories in EU, 2005

- ***visualisation and surface presentation of the indicator*** – a circular diagram which shows the percentage of the different types of land use from the entire surface of the respective territorial unit. (Fig.2)

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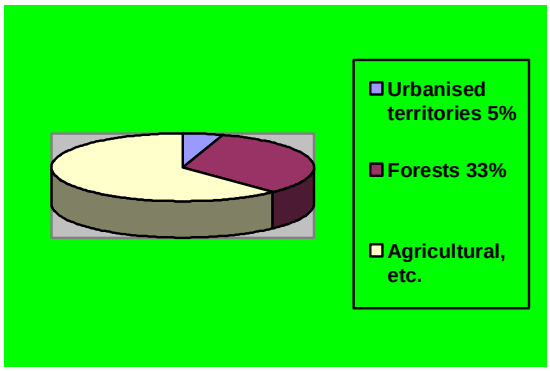

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Fig. 2 Share between forests, agricultural and urbanised territories – Bulgaria, 2005

3.5 Interpretation of the indicator for the strategic planning goals of MRDPW on national, regional and local level

The proposed indicator could be interpreted for the strategic planning goals of MRDPW which concern the degree of integration of the Rio Conventions targets within the regional planning process on national, regional and local level. To the goals of planning the indicator could be used after optimal (target) values (percentage share between forests, agricultural land and the territories subject to anthropogenic impact) have been set up for each municipality.

Those values should be defined after a complex expert assessment of each individual territory made by an expert team or an inter-institutional committee. The assessment shall be based on the analysis of the following factors:

- availability of valuable biodiversity – rare and/or protected species, habitats and ecosystems, protected territories, areas included into NATURA 2000 network and their surface;
- availability of industry sites of national significance – electric power plants, great industry enterprises, extraction sites, etc.
- density of population and demographic tendencies;
- main economy sectors which are significant for local population livelihood;
- existing pressure and dangers for the biodiversity in the region –damage or destruction of species, habitats, pollution, confirmed law infringements, significant investment projects, etc.

The specific character of each territory requires calculating and defining of maximum permissible indicator values for the lowest territorial units (municipality level). Those values could be legitimated either through their inclusion in legislative acts or through their introduction as target values in key strategic documents (regional plans, programmes, development strategies, etc.)

On that basis adequate governance decisions in relation to the regional planning on local, regional and national level could be made while MRDPW would be able to implement systematic monitoring and policy directly aimed to achieving the set targets.

4. TECHNICAL INFORMATION

4.1 Summary of the technical information

- **Name:** Share between forest, agricultural and urbanised territories
- **Status:** available
- **Definition:** the indicator shows relative share/percentage of the forest, agricultural and urbanised territories from the overall area of a certain territorial unit (municipality, region, state).
- **Geographic coverage:** Pan-European

- **Time coverage:** after year 1990.
- **Update frequency:** 5-10 years for CORINE Land Cover; at each change occurred – data by the Geodesy, Cartography and Cadastre Agency, 10 years – Executive Forests Agency data.
- **Data sources:** Executive Environment Agency**,** Executive Forests Agency, Geodesy, Cartography and Cadastre Agency

4.2 Possibilities for integration with GIS

The output data provided by CORINE Land Cover and the Geodesy, Cartography and Cadastre Agency in an appropriate format (raster image, shp files) allow the indicator to be completely integrated and interpreted in GIS environment. Data by Executive Forest Agency need to be converted from .zem format into .shp format.

4.3 Sources:

1. *Report "Indicators for Monitoring Global Environmental Issues Integration in the Process of Regional Development in Bulgaria –General Description", Alexander Kotsev, PhD, DSc, 2009*
2. *Eurostat http://epp.Eurostat.ec.europa.eu/portal/page/portal/environment/data/main_tables*
3. *Convention on Biological Diversity, http://www.cbd.int/*
4. *Strategic Plan for the Convention on Biological Diversity, MEW*
5. *„ Consultation on Clarification and Improvement of the Model for Water Erosion Risk Assessment", Ivan Nikolov, Svetla Rousseva, Vihra Stefanova, 2006*
6. *Survey „GIS sources of information related to the application of the Rio Conventions in the regional and spatial planning", Maria Novakova*
7. *http://www.eea.europa.eu/publications/COR0-landcover*
8. *http://www.mrrb.government.bg*
9. *www.urbanaudit.org/*
10. *www.geographic.org*

INDICATOR 3: Greenhouse gases emissions (in CO_2 equivalent) per capita

1. GENERAL DESCRIPTION

1.1 Target area

Climate change

1.2 Key political issue addressed by the indicator

What is the amount of greenhouse gases per capita in a certain territorial unit and what changes in the regional development policies does that impose?

1.3 Definition of the indicator

The indicator depicts the amount of greenhouse gases (in CO2 equivalent) per capita in a certain territorial unit (municipality, region, state).

1.4 Background

Greenhouse gases are at the root of the anthropogenic influence on the climate changes. The carbon dioxide which is being released in the process of burning fossil fuels and other sources amounts to about 40 % of all greenhouse gases; that is the reason other greenhouse gases are equated to it by calculation of CO_2 equivalents. The calculation of the amount of the greenhouse gases per capita in the respective territorial unit allows the revealing of regional differences and the conduct of comparative analysis.

Through implementation of permanent monitoring, the indicator provides the possibility to show the current state of the problem in each territorial unit, following the trends and development dynamics as to the amount of the gases generated on the respective territorial levels as well as allows making comparison with the European level trends. On that basis the respective national and regional policies for planning and regional development aimed to diminish the greenhouse gases emissions in accordance with the international commitments undertaken by Bulgaria under the UN Framework Convention on Climate Change could be updated and implemented.

1.5 Relation between the indicator and the target area

The UN Framework Convention on Climate Change (UNFCCC) [8] provides for the framework requirements on the intergovernmental measures for fighting climate changes. The most important goal of the Convention is to achieve stabilisation of the greenhouse gases concentration in the atmosphere as those reflect influence of the human activity on climate system. The Convention is ratified by 189 countries and has become effective since March 21,1994. Republic of Bulgaria signed the UNFCCC in 1992, ratified it in 1995 and since then the Convention is in force on the country's territory.

The legally binding status of the Convention has been significantly strengthened by the Kyoto Protocol [9] (1997) which shares the tasks and targets, principles and institutions of the Convention but engages the developed countries (states under Annex I) with individual, legally binding targets for limitation or reduction of their greenhouse gases emissions. By the time being, the Kyoto Protocol has been ratified by 168 states as well as by the European Economic Council. Bulgaria signed the Protocol in 1998, ratified it in 2002 and it became effective for the state in 2005. The Bulgarian target under the Kyoto Protocol is an emissions' reduction by 8 % as compared to the reference (base) year1990 when the emissions of Bulgaria were 75 million tons.

The indicator *Greenhouse gases emissions (in CO_2 equivalent) per capita* provides the possibility to follow the progress in the three target areas and respectively the achievement of the goal to alleviate the climate changes in regional and national scale.

[8] *http://unfccc.int/2860.php*

[9] http://unfccc.int/kyoto_protocol/items/2830.php

2. METHODOLOGY AND DATA SOURCES

2.1 Data availability (in Bulgaria and on international level)

On international level, the Eurostat data[10],, which are statistically reliable and provide information on all the EU countries by years could serve as a point of reference for comparative analyses. By now the available online data concerning EU15 and EU27 states cover the period 1990-2007 and were last updated in 2009. The data on yearly greenhouse gases emissions are been calculated and reported by the European Environment Agency on the basis of the states commitments under UNFCCC, Kyoto Protocol and Decision 280/2004/EU. [11].

Two methodologies have been endorsed as an international standard for evaluation of the greenhouse gases emissions in the atmosphere: CORINAIR[12] (Coordinated Information on the Environment in the European Community - AIR) and IPCC[13] (Intergovernmental Panel on Climate Change). CORINAIR is being applied mainly within Europe and is used for data reporting in accordance with the requirements of the CLRTAP (Convention on Long-Range Transboundary Air Pollution) [14].

IPCC's field of application is much broader and encompasses the states which have signed the agreements to reduce the greenhouse gases emissions in accordance with the Kyoto Protocol. If compared to CORINAIR, IPCC requires fewer details for evaluation of emissions – summarised information on the basis of the available standard statistical data on the most important greenhouse gases. The so-called "Kyoto Basket" includes the six most important greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF6). The influence which is result of changes land and forestry use on the amount of greenhouse gases is not considered at statistics preparation.

The emissions are being weighted on the basis of the global greenhouse potential of each gas. The following weight factors are being used for equating greenhouse gases emissions to CO_2 equivalent through their greenhouse potential: CO_2 =1, CH4=21, N2O=310, SF6=23900. HFCs and PFCs include a great number of different gases which have different greenhouse potentials and are being calculated separately.

The available data on population allow calculations and analyses to be made on different territorial levels (EU15 and EU 27).

On national level – in Bulgaria the data on the emissions in the atmosphere are being reported by the Executive Environment Agency which prepares the reports submitted to international organizations. Dynamic rows of reliable statistical data under IPCC are available for the country since 1988 (base year); under CORINAIR – since 1990. The main sources of primary information constitute specialised and other observations implemented by the respective bodies within the Ministry of Environment and Waters and the National Statistic Institute. Additional data from the Ministry of Agriculture and Food, the Ministry of Economy, Energy, and Tourism, etc could also be used.

The Executive Environment Agency is the official emissions data source under both methodologies. Data on the amount of the spent fuels, resources and material as well as on the production output are being used for emissions evaluation. These data are being multiplied by the so called "Emissions factors" for the respective pollutants in order to find the amount of the emissions. Additional socio-economic and other information is also used.

Emissions data (calculated by whichever of the two methodologies) meet the respective international standards. As the IPCC methodology lies at the root of the agreements on reduction of the greenhouse gas emissions and Eurostat data are based on using t, it is recommendable the stakeholders to use these very data for calculation of the indicator values as well as for making comparative analysis. However, on regional level only data under CORINAIR methodology are available at NSI. The gases classification made under this methodology excludes two groups of greenhouse gases envisaged under IPCC – hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) making thus the precise calculation of greenhouse gases (in CO_2 equivalent) on regional level impossible.

The available data on the population allow calculations and yearly analyses to be conducted on all territorial levels (municipalities and planning regions).

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[10] Eurostat is the Statistics Office of the European Communities situated in Luxembourg. Its task is to provide the European Union with statistics at European level that enable comparisons between countries and regions. http://epp.Eurostat.ec.europa.eu/portal/page/portal/Eurostat/home/

[11] http://www.iklim.cevreorman.gov.tr/abdirektifler/iklim/i01.pdf

[12] http://www.eea.europa.eu/publications/EMEPCORINAIR5/

[13] http://www.ipcc.ch/

[14] http://www.unece.org/env/lrtap/

2.2 Period for data collection and updating

The emissions data are being collected, processed and reported to the international organizations on yearly basis. The data on population are also reported and published by NSI yearly.

2.3 Units of measurement and sample values

The used units of measurement as this indicator is concerned are tons CO_2 equivalent greenhouse gases per capita from the population of the respective territorial unit.

Indicative values on national and European level – while EU (in general) meets certain difficulties at achieving the targets of the Kyoto Protocol, the available data shows that Bulgarian greenhouse gas emissions in CO_2 equivalent have reached the amount of 52.8 million tons in 2008 which puts the country among the very few European countries which have already met their Kyoto Protocol target.

The values of the indicator, however, are growing rather fast during the last reporting period (which is not the case with the EU27 level values); that fact is a result of the ever decreasing population of the country and emissions increasing thanks to the stabilisation of the Bulgarian economy and industry.

Region / year	1999	2001	2003	2005	2007
EU 27	10.48	10.56	10.58	10.41	10.19
Bulgaria	8.45	8.53	9.14	9.15	9.87

Fig. 1 Comparative data on the amount of the released greenhouse gases (in CO_2 equivalent) per capita of the population of EU27 and Bulgaria.

Suggestions for the minimal, maximal and average values for Bulgaria – the Bulgarian target according to the Kyoto Protocol is a reduction of the emissions by 8 % towards the reference (base) year 1990 when the Bulgarian emissions were 75 million tons. At the time being the Bulgarian emissions are by 30% less than year 1990 because of the economic collapse during 1990s .

Those margins could be used by Bulgaria either in the process of emissions trade in accordance with the set mechanisms of the Kyoto Protocol or for neutralisation of future emissions which the country might generate. Furthermore, the Protocol provides for the choice of lower target values and base years so that the UNFCCC targets could be achieved faster.

If such threshold values on national level would be defined, target values on lower territorial levels (planning regions and municipalities) could also be set.

2.4 Possibilities for evaluation of the indicator

Only the data on the emissions calculated through CORINAIR could be provided on territorial level – by administrative or other regional indication. The data on greenhouse gases emissions under IPCC could be reported on national level only.

That is why by now the indicator values on regional level could be calculated on the basis of the emissions of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) while the emissions of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF6) will be excluded from the analysis because of the lack of statistical data.

2.5 Methodology used for data collection and analysis

The data are being collected on a yearly basis by the respective units of the MEW, namely the Regional Inspectorates of Environment and Waters, and NSI. Only the data under the CORINAIR system that could be analysed by administrative or other types are being collected on regional level. The data on the greenhouse gases emissions under IPCC are being reported only on national level.

2.6 Proposals for improvement in the methodology and monitoring of the indicator for the different planning levels

The introduction of a system for reporting IPCC data on regional level will allow the data reporting and making comparative analyses in accordance with that internationally recognised system. The development of specialized software

products or tools for calculation of the indicator's values on the different territorial levels (on the basis of the output data obtained by Executive Environment Agency and NSI) will considerably facilitate the process of calculating and updating the indicator.

2.7 Legal and institutional analysis of the indicator

The long-term monitoring of the indicator depends on the possible creation of an efficient mechanism for data collection, update, processing, storage and analysis. As the sources of output data are state institutions, the necessary steps for performing long-term monitoring by the MRDPW might be the following:

- organisation of inter-institutional meetings with representatives of the Executive Environment Agency and NSI aimed to clarify the state of the available resources and the opportunities for joint work related to the indicator monitoring on the different planning levels;
- conclusion of inter-institutional agreements for cooperation and exchange of information; those agreements should contain the mechanisms, commitments, deadlines and format of the provides resources/data geared to implement a long-term monitoring of the indicator on the different planning levels.

3. ASSESSMENT OF THE INDICATOR

3.1 Main advantages

The main advantages of that indicator are concluded in the possibility for adequate presentation of the amount of the greenhouse gases released in the atmosphere; thus an adequate assessment of the performance of the country's commitments to the UNFCCC could be made. In Bulgaria sufficiently reliable and updated information (to be obtained from state institutions) is available so it is possible to calculate indicator values, define trends and make comparative analyses. CORINAIR data permit performing analyses on all the levels of territorial planning.

3.2 Main disadvantages

The available data could not be used directly; for each level and territorial unit calculations on the basis of the output data (greenhouse gases in tons and the number of population) should be done for receiving the indicator values. The lack of the system for reporting the IPCC data on regional level does not allow data reporting and comparative analyses under this internationally recognized system on lower territorial levels.

3.3 Expenditures on the development, monitoring and updating of the indicator for the strategic planning goals of MRDPW on national, regional and local levels

The possible expenses concern the development, monitoring and updating of the indicator could be divided in several groups in accordance with the stages of information collection and processing:

- obtaining data – as both sources of output data for calculation of the indicator values on national level are state institutions which could provide the data without charge on the grounds of inter-institutional agreements, expenses on data collection are not envisaged on that stage;
- processing and analysis of the collected data – the processing of the collected data could be realised in Microsoft Office Excel or by specifically developed software tool. The analysis could be performed by MRDPW employees after the necessary training and does not require additional resources (such as opening new jobs or purchasing equipment);
- performance of periodic monitoring, realisation and updating of data bases – the activity could be performed by MRDPW employees after the necessary training and does not require additional resources (such as opening new jobs or purchasing equipment).

3.4 Graphic presentation of the indicator

By now the following options for graphic presentation of the indicator with the purpose of doing comparative analysis and trends defining could be proposed – a chart which presents the different values of the indicator for various territorial units for a certain period (Fig.2):

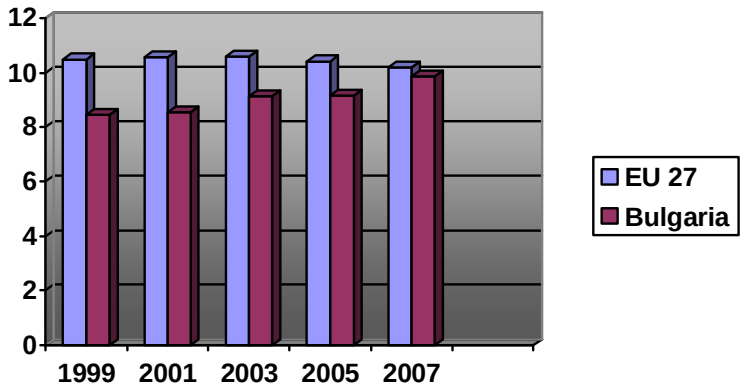

Fig. 2.Comparative data on greenhouse gases (in CO_2 equivalent) per capita for EU27 and Bulgaria in graphic format

3.5 Interpretation of the indicator as for the strategic planning aims of MRDPW on national, regional and local level

The proposed indicator could be analysed for the strategic planning aims of MRDPW on national, regional and local level after setting target values (amount of released greenhouse gases) for each municipality.

Those values shall be defined after a complex expert evaluation of each individual territory (region or municipality); the evaluation shall contain analysis of the following factors:

- presence of industry sites of national importance – electric power plants, great industrial enterprises, etc.
- density of population and demographic development trends.

The specific features of each territory require calculating and defining of maximum permissible indicator values for the lowest territorial units (municipality level). Those values could be legitimated either through legislative acts or through their introduction as target in key strategic documents (regional plans, programmes, development strategies, etc.) On that basis adequate governance-concerning decisions in relation to the spatial planning on local, regional and national level would be made while MRDPW would be able to implement systematic monitoring and purposeful policy for achieving the set targets.

4. TECHNICAL INFORMATION

4.1 Summary of the technical information

- **Name:** greenhouse gases emissions (in CO_2 equivalent) per capita
- **Status:** available
- **Definition:**the indicator reveals the amount of greenhouse gases (in CO_2 equivalent) per capita in a specific territorial unit (municipality, region, state)
- **Geographic coverage:** Pan-European
- **Time coverage:** after year 1988.
- **Update frequency:** yearly
- **Data sources:** Executive Environment Agency, NSI

4.2 Possibility for integration with GIS

Disposing with output data concerning certain territorial units provides full possibilities for integration and interpretation of the indicator in GIS environment.

4.3 Sources:

.11. Report "Indicators for Monitoring Global Environmental Issues Integration in the Process of Regional Development

in Bulgaria –General Description", Alexander Kotsev, PhD, DSc, 2009

12. *NSI http://www.nsi.bg/*
13. *Executive Environment Agency http://nfp-bg.eionet.eu.int/ncesd/bul/index.html*
14. *European Environment Agency http://www.eea.europa.eu/*
15. *Eurostat http://epp.Eurostat.ec.europa.eu/portal/page/portal/environment/data/main_tables*
16. *UNFCCC http://unfccc.int/2860.php*
17. *IPCC http://www.ipcc.ch/*
18. *EPA http://www.epa.gov/RDEE/energy-resources/calculator.html*
19. *http://www.iklim.cevreorman.gov.tr/abdirektifler/iklim/i01.pdf*
20. *http://www.eea.europa.eu/publications/EMEPCORINAIR5/*
21. *http://www.unece.org/env/lrtap/*
22. *http://www.ieta.org/ieta/www/pages/index.php?IdSitePage=123*

INDICATOR 4: Expenditures for long-term assets with ecological purpose

1. GENERAL DESCRIPTION

1.1 Target area

Biodiversity, Climate changes, Combating desertification

1.2 Key political issues addressed by the indicator

In which regions/municipalities environment protection policies and activities are among the financially secured priorities for local development?

1.3 Definition of the indicator

The indicator reveals the amount of the expenditures for acquiring and maintenance of long-term assets with ecological purpose for a certain territorial unit (region, state).

1.4 Background

The amount of expenditures on environmental protection and recovery depict directly the significance of ecological policies implemented in this field on national and regional level. The amount of expenditures for obtaining and maintenance of long-term assets with ecological purpose is a significant factor for environment protection and recovery.

On national level the indicator comprises the amount of expenditures for acquiring and maintenance of long-term assets as well as expenditures on the environment-related events committed in the state/respective territorial unit for a certain period of time. Herein expenditures allocated to the following axes are included:

- on water resources;
- on recirculating water supply;
- on air protection;
- on oil and underground waters protection;
- on forests protection;
- on biodiversity protection and protected territories and objects safeguarding;
- on hunting and fish-breeding undertakings;
- on waste treating;
- on protection by noise;
- on research and development activity;
- on educational. training and other similar activities;
- on administrative activities;
- aon monitoring and control equipment.

The indicator has been proposed as a result of an expert study[15], implemented within the framework of the "Rio Conventions" project. The indicator priority has been defined in a research as a "key" one while its territorial level is "regional". Thanks to its significance for analysis of the policies for environment protection and recovery, the proposed indicator has a significant number of equivalents on European level – in the Eurostat [16].statistical practice.

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[15] *Report "Indicators for Monitoring Global Environmental Issues Integration in the Process of Regional Development in Bulgaria –General Description", Alexander Kotsev, PhD, DSc, 2009*г.

[16] Eurostat is the Statistics Office of the European Communities situated in Luxembourg. Its task is to provide the European Union with statistics at European level that enable comparisons between countries and regions. http://epp.Eurostat.ec.europa.eu/portal/page/portal/Eurostat/home/

The output data for calculating the indicator for the districts and level 2 regions in the country could be obtained by NSI on the basis of the financial reporting statements of the economy entities. Because of the too general and unspecific nature of the data, a due knowledge of the territorial unit in question and the economy entities active on its area is essential so that incorrect interpretations could be avoided.

The indicator reveals the amount of expenditures spent on reduction of the consequences of the anthropogenic pressure on the environment. As far as a great amount of the damages on the environment are being caused by manufacturing activities, the expenditures on long-term assets with ecological purpose shall be compared to the GDP (Bulgarian State Standards by branches) as well as to indicators for the amount of pollution per GDS/BSS unit.

1.5 Relation between the indicator and the target area

In total the expenditures on environment protection and recovery address all the problems regarded in the Rio Conventions. The allocation of more budget funds and drawing external investments in the field of environment show indirectly to what degree the targets of the Rio Conventions are being integrated into regional level policies.

On national level the indicator is related to the following national strategies and priorities:

- The National Strategy for Regional Development of the Republic of Bulgaria 2005-2015;
- Investment Encouragement Strategy in Republic of Bulgaria

The indicator *Expenditures for long-term assets with ecological purpose* provides the possibility for tracking the progress in the respective strategic axes and respectively for achieving the targets under the three Conventions on regional and national level.

2. METHODOLOGY AND DATA SOURCES

2.1 Data availability (in Bulgaria and on international level)

On international level – the Eurostat system of indicators includes several indicators related to the expenditures on protection and recovery of the environment; the main of which are the following:

- *Environment-related expenditures made by the public sector (in % of GDP)* – expenditures for earmarked activities aimed to prevent, reduce and eliminate pollution or other damages to environment (includes both investments and operating costs);
- *Environment protection related expenditures made by the industry (in % of GDP)* – expenditures for earmarked activities aimed to prevent, reduce and eliminate pollution or other damages to environment (includes both investments and operating costs). Industry sector includes ores or minerals extraction, manufacturing/production activities, energy industry and water supply;
- *Operating environment-related costs made by the public sector (in % of GDP)* – personnel expenditures as well as other operating costs related to environmental protection;
- *Operating environment-related costs made by the industry (in % of GDP)* – personnel expenditures as well as other operating costs related to environmental protection;
- *Ecological investments made by the public sector (in % of GDP)* – all the yearly expenditures on equipment and land using related to environmental protection;
- *Ecological investments made by the industry (in % of GDP)* – all the yearly expenditures on equipment and land using related to environmental protection.

Statistics on the indicators enumerated are being kept on EU level but they are hardly comparable with the proposed Indicator 4 because of the different background, collection methodology, reporting units, etc.

On national level – the indicators on long-term assets with ecological purpose are included in the national programme for statistical research and the "Environment and Energy" Department at NSI disposes with output data which form a long dynamic row to allow comparison between different years be made.

The data sources are statistical observations on state and local authorities as well as on enterprises whose activities contribute to environmental pollution and they are thus expected to make the relevant expenditures with ecological purpose.

2.2 Period for data collection and update

The data are being collected, analysed and presented on a yearly basis by the National Statistic Institute.

2.3 Units of measurements and sample values

The unit of measurement which is in use in Bulgaria for this indicator is thousands BGN/per year for the respective territorial unit. The main EU level unit of measurement is % of GDP in order to avoid the difficulties at calculating currency equivalents, purchasing power parity [17], etc.

Indicative values on European level – at this moment no indicative values on EU level could be defined due to the lack of comparable data.

Indicative values on national level – data on the indicator values on national level and by planning regions (level 2) are presented below in Table 1; they estimated on the basis of the yearly NSI reports and cover the period 2000- 2007.

Table 1. EXPENDITURES ON ENVIRONMENT PROTECTION AND RECOVERY BY STATISTICAL REGIONS AND DISTRICTS [1]

Statistical regions	Total expenditures on environment protection (thousands BGN)							
	2000	2001	2002	2003	2004	2005 [2]	2006	2007
Bulgaria	433282	608376	473533	569750	655232	629944	1010095	1164817
Northwestern	81324	179914	112901	112937	123088	77552	76759	123162
North-Central	28526	22898	24118	23465	35879	38984	43865	70471
Northeastern	54557	58656	45546	60205	77925	137743	105338	160353
Southeastern	131746	110818	114829	146920	135619	73374	266360	246696
Southwestern	79308	181847	126216	156884	217177	235961	424339	410999
South-Central	56615	52747	49923	69339	65544	66330	93434	153136

Expenditures on environment protection and recovery include expenditures on acquirement and expenditures on maintenance. The expenditures on monitoring and control equipment are also included.

Since 2005 depreciation expenditures are not included into expenditures with ecological purpose

Proposals for target values for Bulgaria – as such values would be a function of too many factors and variables (governmental policy, investments climate and interest, availability of financing programmes in the field of environment protection), they could not defined within the framework of the current project.

2.4 Possibilities for measuring the indicator

The indicator shall be calculated in the basis of the data received by specialised statistical observations and by using an Eurostat methodology which is being implemented in all EU countries.

Aggregation to second administrative-territorial level is somewhat possible because it is unrealistic task to require the enterprises with territorial branches/structures to keep accountancy on territorial level.

Correct interpretation of the indicator requires good knowledge of the specific territory and various events which take place at the economic entities active on it.

[17] PPP allows to equalize the purchasing power of different currencies in their home countries http://en.wikipedia.org/wiki/Purchasing_power_parity

2.5 Methodology used for data collection and analysis

The indicator is being calculated by NSI on the basis of data received by specialised statistical observations. The work is performed through using a Eurostat methodology which is being implemented in all EU countries.

NSI publishes on a yearly basis data on the expenditures on long-term assets with ecological purpose. Additional processing or analyses of the output data could be made at request and respectively charged

The output data for calculating the indicator for districts and level 2 regions in the country are available by NSI on the basis of the statistical reporting statements of the economic entities.

2.6 Proposals for improvement of the methodology and monitoring of the indicator for the different levels of planning

The indicator reveals the amount of the funds spent on reducing the consequences of the anthropogenic pressure on environment. As far as a great part of the damages to environment are caused by industry (production) activities, the expenditures on long-term assets with ecological purpose shall be compared/juxtaposed to GDP (BSS by branches) as well as to indicators on the amount of pollution per unit GDP/BSS.

The possibility for obtaining territorially bound data by the enterprises which have territorial structures shall be examined and considered as such data would ensure more precise interpretation of the indicator on regional level.

2.7 Legal and institutional analysis of the indicator

The long-term monitoring of the indicator depends on the creation of an efficient mechanism for data receiving, updating, processing, storage and analysis. As far as the output data source is a state institution, the necessary steps for implementation of long-term monitoring by MRDPW could be the following:

- organisation of inter-institutional meetings with NSI representatives in order to clarify the state of the resources available, the possibilities for cooperation related to the indicator monitoring on the different planning levels;
- conclusion of inter-institutional agreements for cooperation and exchange of information wherein the mechanisms, commitments, deadlines/terms and format of the provide resources/data for implementation of long-term monitoring of the indicator on the different levels of planning are described.

3. ASSESSMENT OF THE INDICATOR

3.1 Main advantages

The main advantage of the indicator is the availability of enough statistically reliable data on national level.

3.2 Main disadvantages

As the damages to environment are closely related to industry (production activity), the main disadvantage is the lack of connection between the indicator values and GDP (for example, expenditures on long-term assets with ecological purpose per unit of GDP). That is why the comparison with the European level trends and policies is difficult to make.

3.3 Expenditures related to development, monitoring and update of the indicator for the strategic planning goals of the MRDPW on national, regional and local level

The possible expenditures related to the development, monitoring and update of the indicator could be divided into several groups in accordance with the stages of data receiving and processing:

- data finding and update – as the source of the output data for calculating the indicator values is a state institution which could provide the data without fee, expenditures on data finding are not envisaged on that stage;
- processing and analysis of the collected data – the analysis of the collected data could be conducted by MRDPW experts. On this stage there is no need of ensuring additional resources (opening of new jobs or purchase of equipment);
- implementation of periodic monitoring, development and update of data base – this activity could be performed by MRDPW officials after training and would not require additional resources (new jobs opening or purchase of equipment). The data base could be created in the information environment of Access database without any need of purchasing a server or specialised software. The following conditions should be fulfilled to:
    1) conclusion of inter-institutional agreements with MRDPW for providing of information (output data);

2) orgainsation of training for MRDPW experts dedicated to maintenance of database and calculation of the indicator values.

3.4 Graphic presentation of the indicator

For the time being two options for graphic presentation of the indicator could be proposed:

1) Percentage presentation – on national level the expenditures on long-term assets with ecological purpose (LTAEP) are presented as a percentage of GDP for the respective year – Fig.1

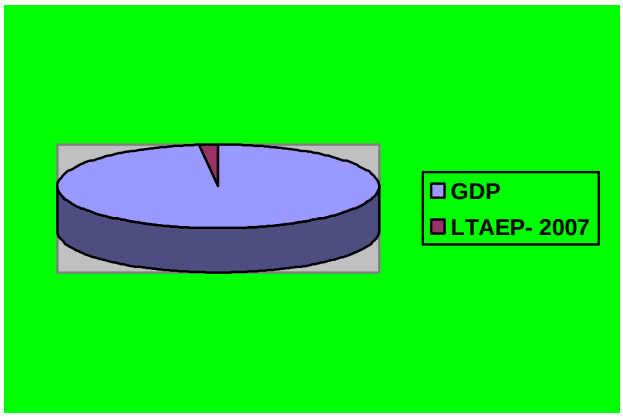

Fig.1. Expenditures on long-term assets with ecological purpose as a percentage of GDP for year 2007.

2) Graphic presentation –following trends for a certain territorial unit during a specific period – Fig.2.

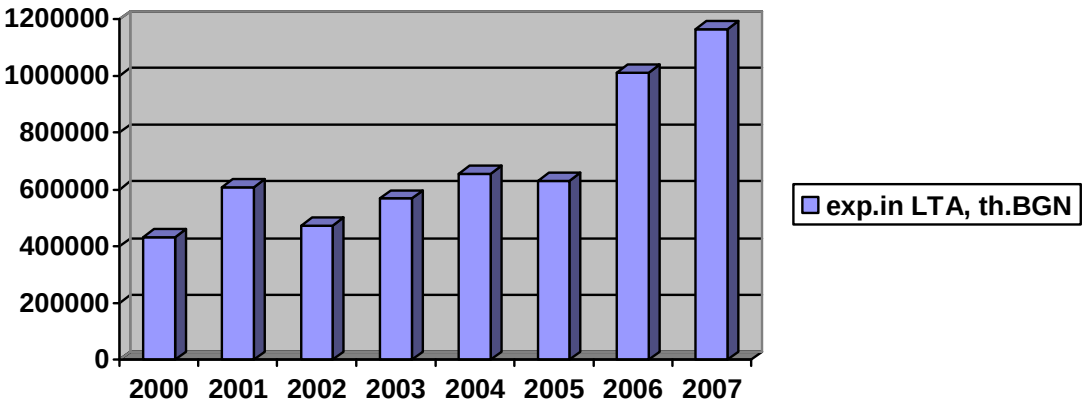

Fig. 2. Expenditures on LTAEP in Bulgaria during 2000-2007.

3.5 Interpretation of the indicator for the MRDPW strategic planning goals on national, regional and local level

The proposed indicator could be interpreted for the MRDPW goals related to monitoring concerning the degree of integration of the Rio Conventions targets within the regional planning process on national, regional and local level. To the goals of planning the indicator could be used after target values (maximum share/percentage of the territories subject to anthropogenic impact) are being set up for each municipality.

On such a basis adequate governmental decisions concerning the regional planning on local, regional and national level could be made while MRDPW would be able to conduct systematic monitoring and purposeful policy for achieving the set targets.

4. TECHNICAL INFORMATION

4.1 Summary of the technical information

- **Name:** Expenditures on long-term assets with ecological purpose
- **Status:** available
- **Definition:** the indicator reveals the amount of the expenditures on acquiring and maintenance of long-term assets with ecological purpose for a specific territorial unit (region, state)
- **Geographic coverage:** Pan-European
- **Time coverage:** after 2000
- **Update frequency:** yearly
- **Data resources:** NSI

4.2 Possibility for integration with GIS

The providing of territorially bound output data in an appropriate format provides full possibilities for integration and interpretation of the indicator in GIS environment.

4.3 Sources

23. *Report "Indicators for Monitoring Global Environmental Issues Integration in the Process of Regional Development in Bulgaria – General Description", Alexander Kotsev, PhD, DSc, 2009*
24. *Eurostat http://epp.Eurostat.ec.europa.eu/portal/page/portal/environment/data/main_tables*
25. *NSI http://www.nsi.bg/*
26. *Executive Environment Agency http://nfp-bg.eionet.eu.int/ncesd/bul/index.html*
27. *European Environment Agency http://www.eea.europa.eu/*

INDICATOR 5: Expenditures for long-term assets with ecological purpose per capita

1. GENERAL DESCRIPTION

1.1 Target area

Biodiversity, Climate changes, Combating desertification

1.2 Key political issue addressed by the indicator

In which regions/municipalities environment protection related activities and policies are among the local development priorities which benefit by financial guarantees?

1.3 Definition of the indicator

The indicator reveals the amount of the expenditures for acquiring and maintenance of long-term assets with ecological purpose per capita for a certain territorial unit (region, state) within a calendar year.

1.4 Background

The amount of expenditures on environmental protection and recovery depict directly the significance of ecological policies implemented on national and regional level. The amount of expenditures on obtaining and maintenance of long-term assets with ecological purpose is a significant factor for environment protection and recovery.

The indicator shows the amount of the expenditures per capita aimed to decrease the negative consequences of the anthropogenic impact on environment. On national level the indicator comprises the amount of expenditures for acquiring and maintenance of long-term assets as well expenditures on the environment-related events committed in the state/respective territorial unit for a certain period of time. Herein expenditures allocated to the following axes are included:

- on water resources;
- on recirculating water supply;
- on air protection;
- on oil and underground waters protection;
- on forests protection;
- on biodiversity protection and protected territories and objects safeguarding;
- on hunting and fish-breeding undertakings;
- on waste treating;
- on protection by noise;
- on research and development activity;
- on educational. training and other similar activities;
- on administrative activities;
- on monitoring and control equipment.

The indicator has been proposed as a result of an expert study[18], implemented within the framework of the Rio Conventions project. The indicator priority has been defined in a research as a "key" one while its territorial level is "regional". Thanks to its significance for analysis of the policies for environment protection and recovery, the proposed indicator has a significant number of equivalents on European level – in the Eurostat [19].statistical practice.

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[18] *Report "Indicators for Monitoring Global Environmental Issues Integration in the Process of Regional Development in Bulgaria – General Description", Alexander Kotsev, PhD, DSc, 2009*

[19] Eurostat is the Statistics Office of the European Communities situated in Luxembourg. Its task is to provide the European Union with statistics at European level that enable comparisons between countries and regions.
http://epp.Eurostat.ec.europa.eu/portal/page/portal/Eurostat/home/

The output data for calculating the indicator for the districts and level 2 regions in the country could be obtained by NSI on the basis of the statistical reporting statements of the economy entities. Because of the too general and unspecific nature of the data, a due knowledge of the territorial unit in question and the economy entities active on its area is essential so that incorrect interpretations could be avoided.

The indicator allows comparisons to be made between the expenditures for acquiring long-term assets in the different territorial units taking into consideration not the gross sum but the number of population in the respective territorial unit.. As far as a great amount of the damages on the environment are being caused by industry (namely, production activity), the expenditures on long-term assets with ecological purpose per capita shall be compared to the GDP (Bulgarian State Standards by branches) as well as to indicators for the amount of pollution per GDS/BSS unit.

Furthermore, the indicator values when juxtaposed with the total amount of investments in a certain territorial unit could reveal to what extent environment protection has become a regional development priority.

1.5 Relation between the indicator and the target area

In total the expenditures on environment protection and recovery address all the problems regarded in the Rio Conventions. The allocation of more budget funds and drawing external investments in the field of environment (per capita) show indirectly to what a degree the targets of the Rio Conventions are being integrated into regional level policies.

On national level the indicator is related to the following national strategies and priorities:

- The National Strategy for Regional Development of the Republic of Bulgaria 2005-2015;
- Investment Encouragement Strategy in Republic of Bulgaria

The indicator *Expenditures for long-term assets with ecological purpose per capita* provides the possibility for tracking the progress in the respective strategic axes and respectively for achieving the targets under the three Conventions on regional and national level.

2. METHODOLOGY AND DATA SOURCES

2.1 Data availability (in Bulgaria and on international level)

On international level – the Eurostat system of indicators includes several indicators related to the expenditures on protection and recovery of the environment; the main of which are the following:

- *Environment-related expenditures made by the public sector (in % of GDP)* – expenditures for earmarked activities aimed at prevention, reduction and elimination of pollution or other damages to environment (includes both investments and operating costs);
- *Environment protection related expenditures made by the industry (in % of GDP)* – expenditures for earmarked activities aimed to prevent, reduce and eliminate pollution or other environmental damages (includes both investments and operating costs). Industry sector includes ores or minerals extraction, industrial production activities, energy industry and water supply;
- *Operating environment-related costs made by the public sector (in % of GDP)* – personnel expenditures as well as other operating costs related to environmental protection;
- *Operating environment-related costs made by the industry (in % of GDP)* – personnel expenditures as well as other operating costs related to environmental protection;
- *Ecological investments made by the public sector (in % of GDP)* – all the yearly expenditures on equipment and land using related to environment protection;
- *Ecological investments made by the industry (in % of GDP)* – all the yearly expenditures on equipment and land using related to environment protection.

Statistics on the indicators enumerated is being kept on EU level but they are hardly comparable with the proposed Indicator 5 because of the different background, collection methodology, reporting units, etc. As to the data on population there are enough reliable statistical data available online and comparative analyses are possible to make.

On national level – the indicators on long-term assets with ecological purpose are included in the national programme for statistical research and the "Environment and Energy" Department at NSI disposes with output data which form a long dynamic row to allow comparison between different years be made.

The data sources are statistical observations on state and local authorities as well as on enterprises whose activities contribute to environmental pollution and they are thus expected to make the relevant expenditures with ecological purpose.

The demographic indicators include a number of sub-indicators among which is the number of population on municipalities, districts and planning regions level.

2.2 Period for data collection/update

The data are being collected, analysed and presented on a yearly basis by the National Statistic Institute.

2.3 Units of measurements and sample values

The unit of measurement which is in use in Bulgaria for this indicator is thousands BGN/per capita/per year for the respective territorial unit. The main EU level unit of measurement is % of GDP in order to avoid the difficulties at calculating currency equivalents, purchasing power parity [20], etc. Among Eurostat indicators no such an indicator is present and statistical data on it is not available.

Indicative values on European level – at this moment no indicative values on EU level could be defined due to the lack of comparable data.

Indicative values on national level – data on the indicator values on national level and by planning regions (level 2) are presented below in Table 1; they estimated on the basis of the yearly NSI reports and cover the period 2000- 2007.

Year	**2005**	**2006**	**2007**
Population, No of people	7718750	7679290	7640238
Expenditures on LTAEP, BGN.	629944000	1010095000	1164817000
Expenditures on LTAEP /per capita– BGN./person/year	81.61	131.53	15.,46

Table 1 Expenditures on long-term assets with ecological purpose per capita (2005-2007)

A table containing detailed calculations of the indicator by planning regions for the period 2005-2007 could be found in Annex 1.

Proposals for target values for Bulgaria – as such values would be a function of too many factors and variables (governmental policy, investments climate and interest, availability of financing programmes in the field of environment protection), they could not defined within the framework of the current reference.

2.4 Possibilities for measuring the indicator

The indicator shall be calculated in the basis of the data received by specialised statistical observations and by using an Eurostat methodology which is being implemented in all EU countries.

Aggregation to second administrative-territorial level is somewhat possible because it is unrealistic task to require the enterprises with territorial branches/structures to keep accountancy on territorial level.

Correct interpretation of the indicator requires good knowledge of the specific territory and various events which take place at the economic entities active on it.

2.5 Implemented methodology for data collection and analysis

The indicator is being calculated by NSI on the basis of data received by specialised statistical observations. The work is performed through using a Eurostat methodology which is being implemented in all EU countries.

NSI publishes on a yearly basis data on the expenditures on long-term assets with ecological purpose. Additional processing or analyses of the output data could be made at request and respectively charged

The output data for calculating the indicator for districts and level 2 regions in the country are available by NSI on the basis of the statistical reporting statements of the economic entities.

[20] PPP allows to equalize the purchasing power of different currencies in their home countries http://en.wikipedia.org/wiki/Purchasing_power_parity

All economically active entities are objects of observation; the annual report submitted to the NSI is a data collection tool. As this information is checked and juxtaposed with the declarations submitted by the companies and enterprises to the National Revenues Agency (which are subject of a special statistical check, in addition), data could be considered reliable.

The indicator shall be calculated as correlation between the amounts of long-term assets with ecological purpose for the period examined and the average yearly number of population for the same period. At calculating the indicator, the numerator includes the amount of expenditures on LTAEP while the denominator shall be the average (yearly) number of the population of the territorial unit.

KLTAEP=LTA/Si

The average yearly number of population is the arithmetic mean between the number of the population at the end of the preceding year and the end of the reporting year. Data on the population number and structure are obtained through the periodic census and the respective calculations on the natural and mechanical population growth rates (the operational demographic statistics kept in the years between two censuses.)

Data on population and the demographic events occurred (in territorial section) are presented in accordance with the administrative-territorial division of the country by December 31 of the respective year.

2.6 Proposals for improvement of the methodology and monitoring of the indicator for the different levels of planning

The indicator reveals the amount of the funds spent on reducing the consequences of the anthropogenic pressure on environment. As far as a great part of the damages to environment are caused by industry (production) activities, the expenditures on long-term assets with ecological purpose shall be compared/juxtaposed to GDP (BSS by branches) as well as to indicators on the amount of pollution per unit GDP/BSS.

The possibility for obtaining territorially bound data by the enterprises which have territorial structures shall be examined and considered as such data would ensure more precise interpretation of the indicator on regional level.

2.7 Legal and institutional analysis of the indicator

The long-term monitoring of the indicator depends on the creation of an efficient mechanism for data receiving, updating, processing, storage and analysis. As far as the output data source is a state institution, the necessary steps for implementation of long-term monitoring by MRDPW could be the following:

- organisation of inter-institutional meetings with NSI representatives in order to clarify the state of the resources available, the possibilities for cooperation related to the indicator monitoring on the different planning levels;
- conclusion of inter-institutional agreements for cooperation and exchange of information wherein the mechanisms, commitments, deadlines/terms and format of the provide resources/data for implementation of long-term monitoring of the indicator on the different levels of planning are described/stated.

3. ASSESSMENT OF THE INDICATOR

3.1 Main advantages

The main advantage of the indicator is the availability of enough statistically reliable data on national level. Another one is the relation between the amount of the expenditures on LTAEP and the number of people in a certain territorial unit.

3.2 Main disadvantages

As damages to environment are closely related to industry (production activity), the main disadvantage/drawback is the lack of connection between the indicator values and GDP (for example, expenditures on long-term assets with ecological purpose per unit of GDP). That is why the comparison with the European level trends and policies is difficult to make.

3.3 Expenditures related to development, monitoring and update of the indicator for the strategic planning targets of the MRDPW on national, regional and local level

The possible expenditures related to the development, monitoring and update of the indicator could be divided into several groups in accordance with the stages of data receiving and processing:

- data finding and update – as the source of the output data for calculating the indicator values is a state institution which could provide the data without fee, expenditures on data finding are not envisaged on that stage;

- processing and analysis of the collected data – the analysis of the collected data could be conducted by MRDPW employees. On this stage there is no need of ensuring additional resources (opening of new jobs or purchase of equipment);
- implementation of periodic monitoring, development and update of data base – this activity could be performed by MRDPW employees after training and would not require additional resources (new jobs opening or purchase of equipment). The data base could be created in the information environment of Access data base without any need of purchasing a server or specialised software. The following conditions should be fulfilled to:
    1) conclusion of inter-institutional agreements with MRDPW for providing of information (output data);
    2) orgainsation of training for MRDPW experts dedicated to maintenance of database and calculation of the indicator values.

3.4 Graphic presentation of the indicator

The proposed graphic presentation of the indicator allows to follow the trends for a certain territorial unit during a specific period of time – Fig. 1.

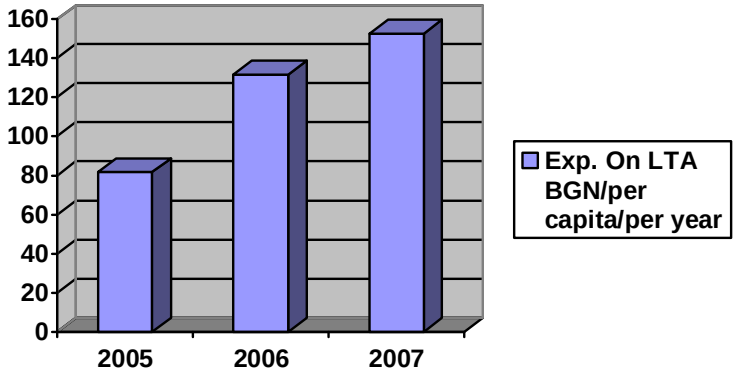

Fig 1 Expenditures on LTA with ecological purpose per capita in Bulgaria (2005-2007)

3.5 Interpretation of the indicator for the strategic planning goals of MRDPW on national, regional and local level

The proposed indicator could be interpreted for the MRDPW goals related to monitoring concerning the degree of integration of the Rio Conventions targets within the regional planning process on national, regional and local level. To the goals of planning the indicator could be used after target values (maximum share/percentage of the territories subject to anthropogenic impact) are being set up for each municipality.

On such a basis adequate governmental decisions concerning the regional planning on local, regional and national level could be made while MRDPW would be able to conduct systematic monitoring and purposeful policy for achieving the set target

4. TECHNICAL INFORMATION

4.1 Summary of the technical information

- **Name:** expenditures on long-term assets with ecological purpose per capita
- **Status:** available
- **Definition:** the indicator reveals the amount of the expenditures for acquiring and maintenance of long-term assets with ecological purpose per capita for a certain territorial unit (region, state) within a calendar year.
- **Geographic coverage:** Pan-European
- **Time coverage:** after year 2000 r.
- **Update frequency:** yearly
- **Data sources:** NSI

4.2.Possibility for integration with GIS

The providing of territorially bound output data in an appropriate format provides full possibilities for integration and interpretation of the indicator in GIS environment.

4.3 Sources

28. *Report "Indicators for Monitoring Global Environmental Issues Integration in the Process of Regional Development in Bulgaria – General Description", Alexander Kotsev, PhD, DSc, 2009*
29. *Eurostat http://epp.Eurostat.ec.europa.eu/portal/page/portal/environment/data/main_tables*
30. *NSI http://www.nsi.bg/*
31. *Executive Environment Agency http://nfp-bg.eionet.eu.int/ncesd/bul/index.html*
32. *European Environment Agency http://www.eea.europa.eu/*

INDICATOR 6: Share of territories subject to a high erosion risk

1. GENERAL DESCRIPTION

1.1 Target area

Combating desertification

1.2 Key policy issue addressed by the indicator

In which regions/municipalities exists high erosion risk, which are the main factors which exert influence on that process and what changes in the regional planning does the existence of such a risk impose?

1.3 Definition of the indicator

The indicator shows the relative share/percentage of the territories subject to high erosion risk from the entire area of a certain territorial unit (municipality, region, state).

1.4 Background

Erosion is one of the most unfavourable natural processes; it leads to soil degradation and desertification. The process of erosion is usually caused by a complex of natural factors and anthropogenic influence (urbanisation, intensive farming and deforestation); however, the process is reversible and could be regulated through implementation of adequate policies and measures for sustainable land management. Being too significant a phenomenon which has to be counteracted in order to protect soil, erosion is being addressed by several international, national and sub-national legislative and strategic documents.

The indicator *Share of territories subject to a high erosion risk* shows the share of territory subject to high risk of erosion because of natural and anthropogenic factors which should be examined in the background of:

- Natural indicators (type of soil, watershed, precipitation, etc.);
- Land use indicators – types of land use which are related to increased erosion risk (e.g., hoeing crops whose cultivation require often treatments which destroy the surface layer of the soil);
- Indicator on the area of the territories wherein measures for combating erosion have been taken.

The indicator has been proposed as a result of an expert study[21] realised within the framework of the Rio Conventions project. The indicator priority has been defined in a research as a "key" one and its territorial level is "regional/local". The proposed indicator has been recognized for use in the statistical practice of Eurostat[22]. but systematised data on European level on it still miss.

The indicator proposes possible relation between a number of natural factors (terrain, precipitation, type of soil) and anthropogenic activities (type of land use, measures for combating erosion) and could be used for assessment the soil erosion risk on local, regional and national level. That is why at the performance of periodic monitoring the indicator provides possibility for revealing the current erosion state in each territorial unit, following the trends and development dynamics in the erosion processes on the respective territorial levels, influence exerted on the process by the respective land use practices as well as the efficiency of the undertaken measures for combating erosion. On that basis the respective national and regional policies for planning and regional development aimed to halt the process of degradation and land loss in accordance with the international commitments undertaken by our country under the UN Convention to Combat Desertification (UNCCD) [23]. could be updated and implemented.

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[21] *Report "Indicators for Monitoring Global Environmental Issues Integration in the Process of Regional Development in Bulgaria – General Description", Alexander Kotsev, PhD, DSc, 2009*

[22] Eurostat is the Statistics Office of the European Communities situated in Luxembourg. Its task is to provide the European Union with statistics at European level that enable comparisons between countries and regions. http://epp.Eurostat.ec.europa.eu/portal/page/portal/Eurostat/home/

[23] UNCCD http://unccd-slm.org/files/UNCCD_Convenion_BG.pdf

1.5 Relation between the indicator and the target area

The UN Convention to Combat Desertification was adopted in Paris on June 17, 1994 and entered into force on December 26, 1994 (i.e., ninety days after its 50the consecutive ratification). More than 150 states, including Bulgaria are now parties by the Convention. According to the text of Convention "combating desertification" includes activities which are part of the integrated land development in the interest of the sustainable development and aim to:

i) prevention and/or decreasing land erosion, and

ii) recovery of partially eroded lands.

The achievement of those targets and monitoring the progress thereof is directly related to the introduction of the proposed indicator.

With regard to the undertaken commitments by Bulgaria under the Convention a National Action Programme for Sustainable Land Management and Combating Desertification (NAP). [24]. NAP is a main tool through which the principles and goals of the UNCCD and sustainable land management (SLM) are being transformed into concrete activities and are bound with administration's activities. The ultimate goal is the creation of a functional and working institutional framework for its application. The aim of NAP is to clarify the reasons which contribute to the lack of sustainability in land management and to the process of desertification and to define the practical measures for SLM and combating desertification as well as the necessary resources for implementation the specific actions. The strategic objective and strategic axes of NAP are the following:

Strategic objective: Limitation of the land degradation and combating desertification for preservation and development of the capacity of the eco-systems towards a clean, safe and attractive environment, long-term economic stability and better quality of live

Strategic axes:
I: Improvement of the legislative framework and policies for sustainable land management and combating desertification
II: Maintenance and improvement of the productive and ecological potential of land resources and their sustainable use.
III: Science and education in support of the sustainable land management policies
IV: Integration and application of polices for SLM at local level
V: Improvement of information exchange, engagement and participation of civil society in the decision-making process for sustainable land management and combating desertification

The indicator *Share of territories subject to a high erosion risk* provides possibility for following the progress in the five strategic axes and respectively for achievement the aim to halt the processes of desertification and land degradation worldwide as on regional and national level.

2. METHODOLOGY AND DATA SOURCES

2.1 Data availability (in Bulgaria and on international level)

On international level – data for comparative analyses are not available. The indicator *Soil subject to erosion risk* is included within the Eurostat system of indicators but data on it are not yet available online.

On national level – processed and systematised data on the indicator are available and ready for use on the basis of the developed GIS model for assessment of water erosion risk [25] within the framework of the *Capacity building for sustainable land management* [26]. project (SLM).

The output data for calculating of the indicator for the country's territory, municipalities, districts and level 2 regions are available through the implemented project CORINE Land Cover for the following base years: 1990, 2000, and 2006. The data shall be granted to the users by Executive Environment Agency/European Environment Agency after a request in digital format appropriate for work in GIS environment. The output data are being updated each 5 years by the European Environment Agency and its corresponding institutions in the EU Member States (the last update was made in 2006). The data are received through computer and manual processing of satellite pictures, geographic maps and other subsidiary information.

[24] http://unccd-slm.org/files/3-NAP_final_BG_Sept.pdf

[25] http://unccd-slm.org/files/1-Water%20Erosion%20model_BG.pdf

[26] PROJECT Sustainable land management, http://unccd-slm.org/

On the basis of the processing thus realised, the land cover is being categorised in accordance with the standard EU nomenclature "CORINE Land Cover". The format for data presenting is ARC INFO, scale 1:100000; the geometric and thematic accuracy of CORINE Land Cover is 85%.

Additional data on the water erosion risk are available at the National System for Environmental Monitoring at Executive Environment Agency, "Land and Soil" Department as well as at Farm Accountancy Data Network and Bulgarian Survey on Agricultural and Economic Activities Observation

2.2 Period for data collection/update

The CORINE Land Cover data are being provided by the European Environment Agency to the Executive Environment Agency at each update; the data available at the time being covers 1990, 2000, and 2006. The processing of the output data (satellite pictures, etc.) takes too long time and thus slows down the information update – i.e., the last data available (from year 2006) have been distributed in 2008.

The water erosion risk assessment model which was developed by SLM is being updated yearly by the Environment Executive Agency on the basis of received information on a number of variables which concern erosion processes – amount and intensity of precipitation, applied agricultural practices and grown crops, combat erosion measures.

2.3 Units of measurements and sample values

The units of measurements used are square kilometer (km^2) – for calculation of the areas and, respectively, percent (%) – for calculation of the relative share of the territories subject to risk of erosion as compared to the area of the respective territorial unit.

Indicative values on European level – by the time being no average values of the percentage of the lands subject to erosion risk on EU level could be defined due to the lack of data available online.

Indicative values on national level – indicative values for all the municipalities in Bulgaria have been calculated on the basis of GIS analyses through the *Model for assessment of the water erosion risk* (*Annex 1*). That model developed by SLM includes assessment of the possible and actual erosion risk; to that aim soils are divided into 6 categories on the basis of their susceptibility to erosion (Table 1).

Encoding used	Susceptibility to erosion
0	Residential areas, waters, rocks
1	Very poor susceptibility to erosion
2	Poor susceptibility to erosion
3	Average susceptibility to erosion
4	Average to strong susceptibility to erosion
5	Strong susceptibility to erosion
6	Very strong susceptibility to erosion

Table 1. Classification of soils according to their susceptibility to erosion

The municipality of Opan (Stara Zagora district) has been declared as the municipality with the lowest common susceptibility to erosion on the basis of the calculations performed; on its territory 68.12 % of the soil are poorly susceptible to erosion. The rankings are lead by the municipality of Tryavna on whose territory 78.12 % of the soils are very strongly susceptible to erosion.

As a result of the analysis performed, average values by classes are been set for the entire country. They are presented in Table 2.

Susceptibility to erosion by classes for the entire territory of Bulgaria															
Classes	**0**		**1**		**2**		**3**		**4**		**5**		**6**		**Total**
Unit of me.	km^2	%	km^2	%	km^2	%	km^2	%	km^2	%	km^2	%	km^2	%	
Area	6668.952	6.03 %	4214.069	3.81 %	13137.964	11.88 %	20362.004	18.41 %	58234.759	52.66 %	3594.563	3.25 %	4378.010	3.96 %	110590.321

Table 2. Susceptibility to erosion by classes in Bulgaria

It has been found out on the basis of the analyses that the greatest share of the soils in Bulgaria (52.66 %) are with average to strong susceptibility to erosion.

Suggestions for target values for Bulgaria – the interpretation and use of the indicator in the regional planning process would be possible and useful if target values on the respective territorial level are set. Those values could concern the decrease of the actual erosion risk in each territorial unit and could be defined after expert analyses on the lowest administrative level, i.e., municipalities.

2.4 Possibilities for measuring the indicator

The main possibilities for measuring the indicator concern the performance of GIS analyses through the model for assessment the water erosion risk which was developed by SLM. The calculation of the indicator could be done automatically, through development of specialised software tools in addition to the used main GIS software (ArcView).

2.5 Methodology used for data collection and analysis

The model for water erosion assessment is a geographic information system (GIS) integrated with a model for forecasting the possible average yearly soil loss due to erosion, specially adjusted to the situation in Bulgaria. The model helps to:

- localise territories which require special care and need purposeful/selective research and measures application aimed to limit erosion;
- choose measures and technologies to combat/counteract erosion in order to reduce soil loss within a certain watershed/catchment area;
- model the climate changes influence on soil and and plants resources;
- model the water resources potential and surface runoff;
- set the territories for waters protection;
- assess the desertification risk;
- develop legislative measures for protection the soil of erosion.

The model classifies the soils in six classes according to their susceptibility to erosion. The model allows calculation of the potential and real erosion risk on a certain geographic level thanks to the analysis of a series of indicators and data.

The model and data base are maintained and updated on a yearly basis by experts of the Executive Environment Agency.

2.6 Suggestions for improvement in the methodology and monitoring of the indicator for the different levels of planning

The development of specialised software products or tools in GIS environment for calculation the values of the indicator on the different territorial levels (on the basis of the CORINE Land Cover and the SLM model output data) will make the process of calculation and update of the indicator significantly easier and faster.

2.7 Legal and institutional analysis of the indicator

The long-term monitoring of the indicator depends on the creation of efficient mechanism for data collection, update, processing, storage and analysis. As far as the output data source is a state institution, the necessary steps for implementation of long-term monitoring by MRDPW could be the following:

- organisation of inter-institutional meetings with Executive Environment Agency representatives in order to clarify the state of the resources available, the possibilities for cooperation related to the indicator monitoring on the different planning levels;

- conclusion of inter-institutional agreements for cooperation and exchange of information wherein the mechanisms, commitments, deadlines/terms and format of the provide resources/data for implementation of long-term monitoring of the indicator on the different levels of planning are described/stated.

3. ASSESSMENT OF THE INDICATOR

3.1 Main advantages

The main advantages of the indicator concern the availability of a complex SLM model for assessment of erosion risk which provides the possibility for an adequate modeling and dividing the erosion risk in different categories on various territorial levels. Another important advantage of the model is its relation to several anthropogenic (type of land use, measures to combat erosion, etc.) and natural factors (type of soil, terrain, precipitation, etc.) which allows to monitor the influence of the human activity over the land degradation and recovery.

3.2. Main disadvantages

The main disadvantage of the indicator and the developed model for assessment is that only values for potential and actual erosion risk could be defined on modeling basis but no specific statistical values of the soil loss in the country are used (due to the lack of such statistical information).

3.3 Expenditures related to the development, monitoring and update of the indicator for the strategic planning goals of MRDPW on national, regional and local level

The possible expenditures related to the development, monitoring and update of the indicator could be divided into several groups in accordance with the stages of data receiving and processing:

- data finding and update – as the source of the output data for calculating the indicator values is a state institution which could provide the data without fee, expenditures on data finding are not envisaged on that stage;
- processing and analysis of the collected data – the analysis of the collected data in GIS environment by experts of the Executive Environment Agency. Additional analyses for calculating the indicator values on different territorial levels are necessary; they could be conducted by MRDPW officials after the necessary training. On this stage there is no need of ensuring additional resources (opening of new jobs or purchase of equipment);
- implementation of periodic monitoring, development and update of data base – this activity could be performed by MRDPW officials after training and does not need/require additional resources (new jobs opening or purchase of equipment). The data base could be created in the information environment of Access data base without any need of purchasing a server or specialised software. The following conditions should fulfilled to that goal:
    1) conclusion of inter-institutional agreements with Executive Environment Agency and/or the Cadastre Agency for providing of information (output data);
    2) development of specialised software tools (working in GIS environment) for calculating the indicator values from the output data;
    3) orgainsation of training for MRDPW officials responsible for maintenance of data base and calculation of the indicator values.

3.4 Graphic presentation of the indicator

By now two options for graphic representation of the indicator could be proposed:

1) By percentage - presentation of the areas of a certain territorial unit with different degree of susceptibility to erosion – Fig. 1

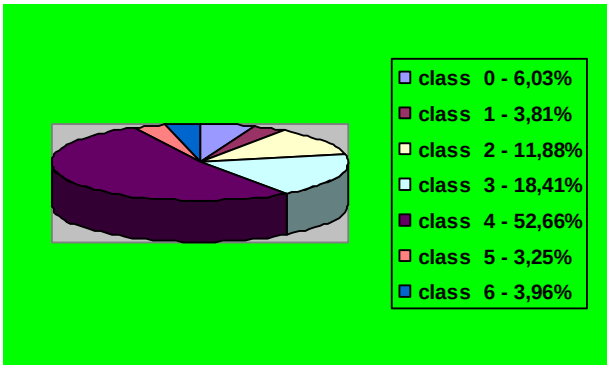

Fig. 1. Susceptibility to erosion of soils in Bulgaria (by classes)

2) By mapping – presentation of the geographic distribution of the areas in a certain territorial unit with different susceptibility to erosion – which include presentation of the risks in categories and location - Fig.2.

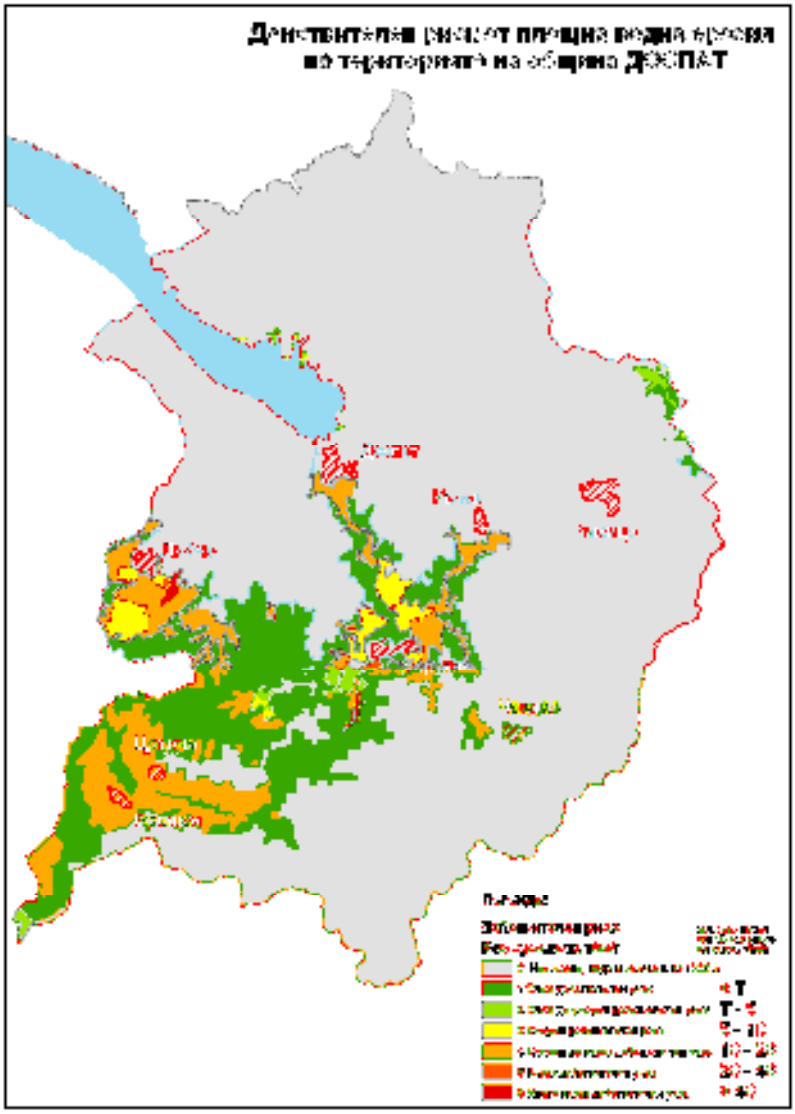

Fig. 2 Existing risk of erosion on the territory of Dospat municipality

3.5 Interpretation of the indicator for the MRDPW strategic planning goals on national, regional and local level

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The proposed indicator could be interpreted for the MRDPW goals concerning the monitoring on the extent of integration of the Rio Conventions targets in the process of regional planning on national, regional and local level. The indicator could be used to the goals of the planning after defining target values (maximum share/percentage of the territories subject to erosion risk) for each municipality.

On that basis adequate governmental decisions concerning regional planning on national, regional and local level could be made; the MRDPW would be able to conduct systematic monitoring and purposeful policy for achievement the set targets.

4. TECHNICAL INFORMATION

4.1 Summary of the technical information

- **Name:** Share of the territories subject to high erosion risk
- **Status:** available
- **Definition:** the indicator shows the relative share/percentage of the territories subject to high erosion risk from the entire area of a certain territorial unit (municipality, region, state)..
- **Geographic coverage:** Pan-European
- **Time coverage:** after year 1990
- **Frequency of update:** yearly
- **Data sources:** Executive Environment Agency

4.2 Possibility with integration with GIS

The provision of output data from CORINE Land Cover by the Executive Environment Agency in an appropriate format (raster image, shp files) provides full possibilities for integration or interpretation of the indicator in GIS environment.

4.3 Sources

33. *Report "Indicators for Monitoring Global Environmental Issues Integration in the Process of Regional Development in Bulgaria – General Description", Alexander Kotsev, PhD, DSc, 2009*
34. *„ Consultation on Clarification and Improvement of the Model for Water Erosion Risk Assessment", Ivan Nikolov, Svetla Rousseva, Vihra Stefanova, 2006*
35. *Survey „GIS sources of information related to the application of the Rio Conventions in the regional and spatial planning", Maria Novakova*
36. *Eurostat http://epp.Eurostat.ec.europa.eu/portal/page/portal/environment/data/main_tables*
37. *UNCCD http://unccd-slm.org/files/UNCCD_Convenion_BG.pdf*
38. *NAP, http://unccd-slm.org/files/3-NAP_final_BG_Sept.pdf*
39. *Erosion model, SLM http://unccd-slm.org/files/1-Water%20Erosion%20model_BG.pdf*
40. *PROJECT Sustainable Land Management, http://unccd-slm.org/*
41. *http://www.eea.europa.eu/publications/COR0-landcover*
42. *http://www.mrrb.government.bg*

INDICATOR 7: Degree of achieving the national target for use of RES and energy efficiency

1. GENERAL DESCRIPTION

1.1 Target domain

Climate changes

1.2 Key political issue addressed by the indicator

To what extent are the activities aimed to encourage the introduction of energy efficiency and usage of renewable energy sources important within a certain territorial unit?

1.3 Definition of the indicator

The indicator depicts the amount of saved energy through implementing measures for energy efficiency and the amount of energy produced by renewable energy sources within a certain territorial unit (municipality, region, state) as compared with the national targets set in that field.

1.4 Background

Reducing to minimum the losses of electric power and guaranteeing of ecologically clean/environment friendly electric power through RES contributes directly to decreasing the usage of fossil fuels for energy production and thus plays quite a positive part in diminishing human activity influence on climate changes.

Greenhouse gases are at the root of the human influence on climate changes. The amount of carbon dioxide which is a result of burning fossil fuels and some other sources consists 40 % of all greenhouse gases; that is why it is regarded as a key factor in climate changes. Energy production by RES is the main alternative of the energy production through burning fossil fuels. As the former is considered as "clean" energy regarding greenhouse gases (in particular CO_2) emissions in the atmosphere, the wider use of renewable energy sources has been strongly encouraged by the provisions of various international and national strategic documents.

The introduction of energy efficiency measures constitutes the other pivot aimed to diminish energy losses and respectively CO_2 emissions on international level. The goal of the energy efficiency measures is to optimise the energy consumption in both industry and households through raising efficiency and decreasing losses in the course of generating, transfer and use of energy.

The indicator *Degree of achieving the national target for use of RES and energy efficiency* has been suggested in order to provide the opportunity for presentation of the actual situation in the respective territorial unit, following the trends and dynamics of measures related to climate protection on different territorial levels as well as for comparison with the set national targets in the two areas and with the European level tendencies. On that basis the respective national and regional planning and regional development policies could be updated and implemented with the purpose of reducing greenhouse gases emissions in accordance with Bulgaria's international commitments undertaken by the country under the UN Framework Convention on Climate Change.

1.5 Relation between the indicator and the target area

Energy efficiency and the relative RES share growth are directly related to the UN Framework Convention on Climate Change (UNFCCC) [27]. The Convention provides for the framework requirements for intergovernmental measures aimed to fight climate changes. The most significant goal of the Convention is to achieve stabilisation of greenhouse gases concentrations in the atmosphere as those are directly related to human activity influence on climate system. The Convention is ratified by 189 states and is in force since March 21, 1994. Bulgaria has signed the Convention in 1992, ratified it in 1995; the Convention is in force for our country since the date of ratification.

The legally binding status of the Convention has been promoted to a significant extent by the 1997 Kyoto Protocol[28]; the latter shares the task, principles and institutions of the Convention but binds the developed states (countries enumerated in Annex I) with individually specified, legally binding targets for limitation of or decrease in their greenhouse gases emissions. By now 168 countries and the EU have ratified the Kyoto Protocol. Bulgaria has signed it in 1998 and ratified it in 2002, it is in force since 2005.

[27] *http://unfccc.int/2860.php*

[28] http://unfccc.int/kyoto_protocol/items/2830.php

In implementation of the country's obligations under Directive 2001/77/EC and Directive 2006/108/EC, the National Long-Term Programme for Usage Encouragement of Renewable Energy Sources 2005-2015 (adopted by a Decision of the Council of Ministers from October 19, 2006) states the indicative target of 11% share of the electric power being produced by RES in the gross domestic consumption in 2010. The Programme is in accordance with the general concept for RES development in the country as well as with the set indicative targets for production of electric power from RES and the means for their achievement. The Programme also sets down measures and policies aimed to encourage the usage of RES in the energy balance of the country.

The indicator is also directly related to Directive 2006/32/EC on energy end-use efficiency and energy services. The Directive sets the main goal of all Member States which is to reach until 2016 saving of fuels and energy at the rate of 9 % of the average value of the energy –end consumption during the period 2001-2005.

Strategic documents on national level which depict the international commitments of the country and to which the indicator is also related are as follows:

- Directive 2001/77 of the European Parliament and of the Council on the promotion of electricity produced from renewable energy sources in the internal electricity market;
- Directive 2006/32 of the European Parliament and of the Council on energy end-use efficiency and energy services;
- Directive 2002/91 of the European Parliament and of the Council on the energy performance of buildings;
- Energy Strategy of Republic of Bulgaria;
- National Long-Term Programme for Usage Encouragement of Renewable Energy Sources 2005-2015;
- First National Action Plan on Energy Efficiency – 2008-2010;
- National Long-Term Programme for Energy Efficiency until 2015.

The indicator *Degree of achieving the national target for use of RES and energy efficiency* allows the progress in the target areas related to UNFCCC to be followed as well as the degree of accomplishing the set target to limit climate changes on regional and national scenes.

2. METHODOLOGY AND DATA SOURCES

2.1 Data availability (in Bulgaria and on international level)

Both markers for reporting he indicator are ensured with up-to-date and statistically reliable national level data to be received respectively by MEET and Energy Efficiency Agency; combined with the data under Indicator 3 they would present the overall picture of the state of implementation of Bulgaria's commitments on different levels in compliance with UNFCCC and the Kyoto Protocol.

The availability of comparable data on EU level (by Eurostat and other sources) concerning those indicators will give the possibility for making comparative analyses and defining trends. Most probably, since 2010 data on the indicators would be collected by NSI on regional level too, taking into consideration the Eurostat requirements. The creation of regional structures of Energy Efficiency Agency would as well contribute to ensuring regional level data.

On international level the Eurostat[29], data which are statistically reliable and provide yearly information for all countries could serve as a point of reference. The RES assessment system developed by Eurostat includes the following indicators:

- *Electric power produced by RES* – measurement unit - % of the overall energy consumption per year;
- *Primary production of renewable energy* – measurement unit - 1,000 tons in oil equivalent (toe)
- *Primary production of renewable energy per sectors/types (solar, hydro, etc)* – measurement unit - 1, 000 toe.

A system of specific indicators concerning indexes such as primary and end-use consumption of energy, primary and end-use energy efficiency, etc., on which there are enough statistically reliable data on level EU 27 is being in use regarding energy efficiency.

[29]Eurostat is the statistical office of the European Union situated in Luxembourg. Its task is to provide the European Union with statistics at European level that enable comparisons between countries and regions. http://epp.Eurostat.ec.europa.eu/portal/page/portal/Eurostat/home/

On national level: in Bulgaria the data to use for calculation of the indicators are provided by the following institutions:

- *Ministry of Economy, Energy and Tourism* – on the basis of the annual reports for implementation of the respective strategic documents;
- *Energy Efficiency Agency* – on the basis of the annual reports for implementation of the respective strategic documents.

The available now data on the indicator allow calculations and analyses on national level to be made while on the lower territorial levels (municipalities and planning regions) such calculations are impossible because of the lack of output data. However, we have to take into consideration the fact that the Energy Efficiency Agency is in the process of establishing its regional structures all over the country; that would allow collection and analysis of information on energy efficiency and RES on regional level.

NSI is also in the course of introducing indicators concerning the collection and analyses of data on energy efficiency and RES in the country in accordance with its reporting obligations towards Eurostat. So it is highly possible that after 2010 the indicator would benefit from availability of more reliable statistical data for calculation of its values on different territorial levels.

2.2 Period for data collection/update

The data on the progress in achieving national strategic goals and priorities which regard RES and EE are reported on by the respective institutions yearly.

2.3 Units of measurement and sample values

The units of measurements used for both indicators are the following:

1) Energy produced by RES – measured in в GWh and/or % (share) of the electric power produced by RES in the gross internal consumption;
2) Saved energy through application of EE measures – measured in saved MWh or toe.

Indicative values on national and European level – according to the Kyoto Protocol, each EU Member State has set national targets for using RES and measures to achieve those targets. On the basis of the Member States reports, the European Commission defines to what extent the national indicative targets are in compliance with the overall indicative target of 12% of the gross national energy consumption until 2010; in particular with the indicative share of 22,1 % of electric power produced by renewable energy sources in the overall electric energy consumption of the Community until 2010.

The Directive 2006/32 of the European Parliament and of the Council on energy end-use efficiency and energy services sets the main goal of all Member States – they should reach till 2016 saving of fuels and energy at the amount of 9% of the average value of the end-use energy consumption during the period 2001-2005.

Suggestions for minimum, maximum and average values for Bulgaria – the target of Bulgaria as set in the Kyoto Protocol is reducing the greenhouse gases emissions with 8% as compared to the values of the year 1990 defined as base year, i.e., reference point in the Protocol; the Bulgarian emissions were then 75 million tons.

Target values for energy production by RES have been set on the basis of the Kyoto Protocol and the Directive 2001/77/EC; they have been defined as 11 % of the country's overall energy production. This target (11%) has been reached in 2007 thanks to the favourable weather conditions. However, because of the lack of sufficient precipitation and the fact that the main share of RES energy is been produced by hydroelectric power plants, in 2008 the target has not been achieved (6.5 %).

Bulgaria has endorsed as its indicative national target for energy saving until 2016 an amount of not less than 9% of the end-use energy consumption for 9 years (average 1% per year) in implementation of Directive 2006/32. That means that the country should guarantee saving energy and fuels of total value of 627 ktoe.

The absolute value of the indicative target for Bulgaria which the country ought to prove as the amount of the energy saved during the next 9 year period shall be defined on the basis of the data on the end-user energy consumption during the last five years for which relevant statistical data have been published, i.e., 2001- 2005.

Unlike the energy efficiency measures, the targets for development of renewable energy sources cannot be assessed on a regional level by now because of the different potential for their use determined by the specific geographic and climate factors in various territorial units.

2.4 Possibilities for measuring the indicator

The possibilities for measurement the indicator include comparative analyses made on the basis of the output data provided by the respective state institutions (Energy Efficiency Agency and MEET).

2.5 Methodology used for data collection and analysis

The indicator values could be found out through calculation on the basis of the output data; the process could be (roughly) divided into two stages:

- receiving and updating of the output data for a specific territorial unit (municipality, region, etc.) under both indicators;
- comparing the values thus calculated with the set strategic targets in both fields (RES and EE) on national level.

On the basis of the comparative analysis conclusions on the efficiency of the respective regional policies could be made and consequently the necessary measures be taken.

2.6 Proposals for improvement of the methodology and monitoring of the indicator for the different planning levels

N/A

2.7 Legal and institutional analysis of the indicator.

The long-term monitoring of the indicator depends on the creation of an efficient mechanism for data collection, update, processing, storage and analysis.

As far as the output data source is a state institution, the necessary steps for implementation of long-term monitoring by MRDPW could be the following:

- organisation of inter-institutional meetings with Energy Efficiency Agency, MEET and Bulgarian Investments Agency representatives in order to clarify the state of the resources available and the possibilities for cooperation in the process of the indicator monitoring on the different planning levels;
- conclusion of inter-institutional agreements for cooperation and exchange of information wherein the mechanisms, commitments, deadlines/terms and format of the provided resources/data for implementation of long-term monitoring of the indicator on the different levels of planning are clearly stated.

3. ASSESSMENT OF THE INDICATOR

3.1 Main advantages

The main advantage of the indicator includes the possibility for uniting/merging the values of two different sub-indicators; that allows to assess the progress under the three strategic axis for fulfilling the state commitments under UNFCCC (along with Indicator 3).

3.2 Main disadvantages

The main disadvantage of the indicator is the fact that calculation and reporting of its values shall be made under two different sub-indicators; that complicates the work on the indicator and makes it more labour consuming. That also makes impossible an integrated presentation of the indicator (as the national target under one of the sub-indicators might be reached but under the other one - not).

3.3 Expenditures on development, monitoring and update of the indicator for the MRDPW strategic planning targets on national, regional and local levels

The possible expenditures concerning the development, monitoring and update of the indicator could be divided into several groups in accordance with the stages of data receiving and processing:

- data finding and update – as the source of the output data for calculating the indicator values is a state institution which could provide the data without charge, expenditures on data finding are not envisaged in that stage;
- processing and analysis of the collected data – the analysis of the collected data could be performed in Microsoft Office Excel or through especially developed software tool. The analysis could be made by MRDPW experts after the respective training. On this stage there is no need of ensuring additional resources (opening of new jobs or purchase of equipment);

- conducting of periodic monitoring, development and update of data base – this activity could be performed by MRDPW officials and does not require additional resources (new jobs opening or purchase of equipment).

3.4 Graphic presentation of the indicator

The graphic presentation of the indicator concerns presenting data under both sub-indicators in order to visually demonstrate trends and allows comparative analysis to be made. Fig. 1 reveals a comparative analysis between the set indicative targets for 2010 for the Member States and the amount of the reached share of electric power produced by RES in the gross domestic consumption of electric power in 2006.

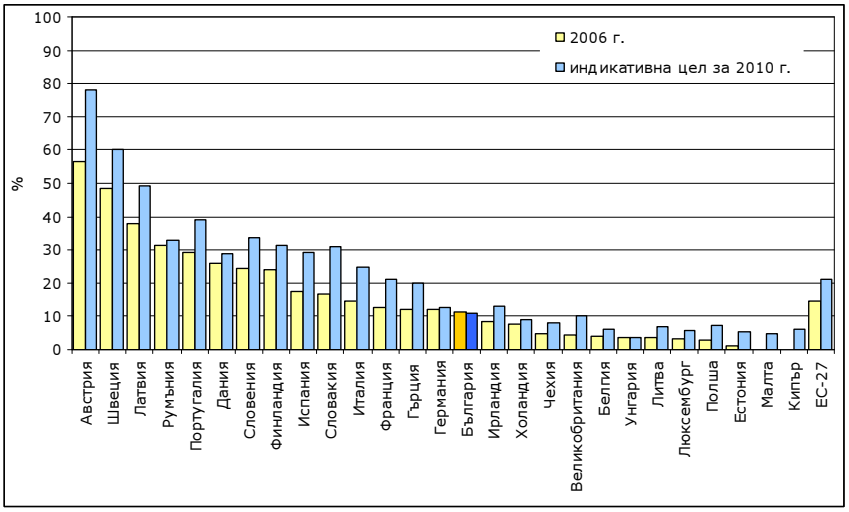

Fig. 1 Share of the produced electric power by RES in the gross domestic energy consumption for 2006 and indicative targets for 2010 for the Member States and total for the EU 27 (Source: European Commission)

In 2008 the electric power produced by RES (pumped storage hydroelectricity plants excluded) is 2 891.9 GWh and has a share of 6.5 % in the gross production of electric power in the country (fig.2)

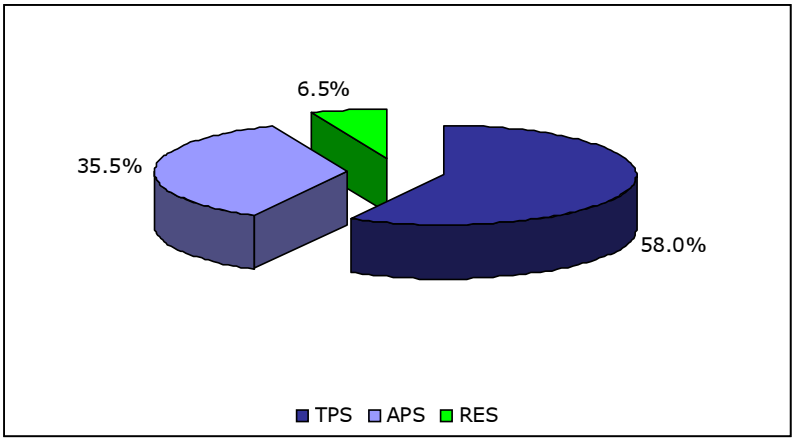

Fig. 2 *Structure of the gross electric power production (pumped storage hydroelectricity plants excluded) for 2008 in Republic of Bulgaria*. (Source: Fuels and energy balances for 2008 of the MEET)

3.5 Interpretation of the indicator for the MRDPW strategic planning goals on national, regional and local level

The proposed indicator could be interpreted for the MRDPW strategic planning goals on national, regional and local level only after the creation of data base which to provide possibility for making comparative analyses on different territorial levels.

The assessment of the progress in achieving the national targets in both axes could indicate to what extent the fulfillment of country's commitments under UNFCCC is among the regional planning priorities in the respective territorial unit.

In general, the energy efficiency indicator is more relevant for assessment of the local policies for regional planning; the explanation is that it is not dependent on the availability of potential for RES usage and on the specific climatic or weather conditions.

4. TECHNICAL INFORMATION

4.1 Summary of the technical information

- **Name**: Degree of achieving the national target for use of RES and energy efficiency
- **Status**: available
- **Definition**: The indicator depicts the amount of saved energy through implementing measures for energy efficiency and the amount of energy produced by renewable energy sources within a certain territorial unit (municipality, region, state) as compared with the national targets set in that field.
- **Geographic coverage**: Pan-European
- **Time coverage**: after year 2000
- **Update frequency**:yearly
- **Data sources**: Energy Efficiency Agency, MEET

4.2 Possibility for integration with GIS

The availability of territorially bound data provides complete possibility for integration and interpretation of the indicator in GIS environment.

4.3 Sources:

43. *Report "Indicators for Monitoring Global Environmental Issues Integration in the Process of Regional Development in Bulgaria – General Description", Alexander Kotsev, PhD, DSc, 2009*
44. *NSI http://www.nsi.bg/*
45. *Executive Environment Agency http://nfp-bg.eionet.eu.int/ncesd/bul/index.html*
46. *European Environment Agency http://www.eea.europa.eu/*
47. *Eurostat http://epp.Eurostat.ec.europa.eu/portal/page/portal/environment/data/main_tables*
48. *Energy Efficiency Agency http://www.seea.government.bg/index.php/dox*
49. *MEET http://www.mi.government.bg/about/links.html*
50. *Energy Efficiency Fund http://www.bgeef.com/display.aspx*
51. *Information system on international cooperation: http://www.devco.government.bg/LANGbg/public/portal/about.php*
52. *Bulgarian Investments Agency http://www.investbg.government.bg/index.php*
53. *Association of Producers of Ecological Energy http://www.apeebg.org/info.php?pg=news&level=2&subm=4&newsid=1169*
54. *Bulgarian National Bank http://www.bnb.bg/bnb/home.nsf/vPages/S_FDI_ADS_F_I_1999-2008_stock/$File/1999-2008_S_FDI_Stock_industry_A-bg.xls*
55. *State Energy and Water Regulatory Commission, http://www.dker.bg/index.htm*

III. CONCLUSION

1. Assessment of the readiness for introduction of the already developed system of indicators

We can conclude on the basis of the developed technical passports for the system of strategic indicators that by now the latter are secured with reliable statistical output data, generated by trustworthy sources. These data could be used for calculation and monitoring of values of the respective indicators on national level.

As far as it is completely possible to calculate the values of all indicators on national level, that is not the case with the different groups of indicators regarding the provision of information and availability of GIS connected information at the lower planning levels (region, municipality, residential area). The indicators whose values shall be calculated on the basis of analyses in GIS environment benefit from greatest amount of information available (i.e., Indicators 1, 2, and 6); the next in the line according to that criterion are those indicators for whose calculation NSI and the Executive Environmental Agency generate regional level data (i.e., indicators 3, 4, and 5) while by the time being the available output data for indicator 7 only allow analyses to be made on national level.

With regard to the forthcoming establishing of regional structures of the NSI and Executive Environmental Agency and the expected introduction of monitoring indicators with regard to energy efficiency and renewable energy sources in the work of NSI, the problem shall be solved soon and all the indicators would be secured with output data for analyses on regional and local level.

2. Necessary steps for introduction and functioning of the proposed system of indicators

The first steps necessary for introducing the system of indicators have already being implemented by MRDPW; they concern the inclusion of the system in various strategic documents for regional planning and a number of secondary legislation acts. The next model steps for institutionalisation and putting into practice of the system of indicators may be the following:

- concluding inter-institutional agreements – in order to ensure output data for calculating the indicators; the agreements will be concluded with the respective governmental institutions – Executive Environmental Agency, NSI, Energy Efficiency Agency, Ministry of Economy, Energy and Tourism;
- development of software – software for automatic calculation of the indicators, based on analyses in GIS environment for different territorial levels and units by assigned indicators;
- development of structure for data bases – containing information on indicators at MRDPW and instructions for its maintenance and update;
- trainings for MRDPW officials– work with the developed software, data base, monitoring of the system of indicators and conducting of analyses.

3. Expenditures related to the process of monitoring of the chosen indicators on behalf of MRDPW

In the current situation there is no immediate need of purchasing additional equipment and software or jobs creation thanks to the availability of the necessary equipment, software and well-trained experts at the MRDPW. That is why the main expenditures for monitoring of the chosen indicators by MRDPW will be the following:

- software application development – the development of three GIS analyses tools is expected to be completed in the final stage of the implementation of the project *Rio Conventions*; the necessary funding will be ensured under the project framework during the first half of 2010;
- development of data base structure – containing information on indicators at MRDPW and instructions for its maintenance and update – the data base does not require purchase of additional server or specialised software applications (it could be created under Microsoft Excel or Access Database); that is why such expenditures are not envisaged. The structure and the instructions for its use could be developed by MRDPW officials or an external expert within a few working days.
- trainings for MRDPW experts – trainings of the experts in charge for working with the developed software tools, database, system of indicators monitoring and analyses preparation could be outsourced to external subcontractors to complete it within 1-2 working days.
- indicators monitoring – expenditures for monitoring and generating of thematic analyses on different territorial units in accordance with the introduced criteria could be met by two possible ways: through

including those obligations in the jobs descriptions of the respective officials at MRDPW or through assuring of additional remuneration on basis of working hourly/daily rate (by funding under external projects, etc).

4. Possibilities for further development of the proposed system of indicators

Although the proposed system of indicators encompasses indicators under the three Rio Conventions, it is a bit too general and should be subject to further development and improvement. The improvement to come would be aimed to find a better balance between and specification of the number and scope of the indicators distributed according fields, their particularities, calculation methodology as well as the possibilities for data analysis for the periodic monitoring.

However, this would only be possible after the introduction of the system as it is now and the analysis of its advantages and disadvantages after a certain time of operation (on annual basis). That is why at the current stage it is necessary to take all the steps and make all the efforts to introduce the system and make it functioning in the format which is being suggested in the current assignment.

IV. APPENDIX

Annex 1 Data on indicators 1 and 2 (territory in sq.km and relative share in %) for all the municipalities in Bulgaria (*Source: Expert analyses in GIS environment, 2009*)

Annex 2 Expenditures on environment protection and recovery per capita by statistical regions and districts (2000-2007) *(Source - NSI, 2009)*

Annex 3 Soil susceptibility to erosion in all the municipalities in Bulgaria *(Source – Expert analyses in GIS environment, 2009)*