

KOSOVA IN GLOBAL MAP

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Abstract

Global mapping is an international collaborative initiative, aiming to develop globally homogeneous geographic data set at the ground resolution of 30 arc seconds. The primary objective of Global Mapping (GM) project is to contribute to the sustainable development through the provision of base framework geographic dataset, which is necessary to understand the current situation and changes of environment of the world.

Actually in the web site of ISCGM (www.iscgm.org) are available downloading of GM version 0, GM Version 1 data of 74 countries-regions who has already finished own countries GM data, as well the GM V1 (GLCNMO and Percent tree cover) for whole world. From the South East European countries, only Macedonian (2006), Romanian (2009) and Bulgarian (2009) datasets has already published within the Global Map.

The Republic of Kosova within the project for the compilation of the global map is represented by the Kosova Cadastral Agency (KCA), as the responsible institution for Kosova's cartography at the national level. Preparation of Kosova's GM data has been proceed in academic level within the geodesy department of the University of Prishtina, with aim to support, help and improve young cartography in Kosova. Existing topographic maps in scale 1:200.000, ortho photo images from year 2004, as well as the official data from governmental institutions (Kosova Cadastral Agency, Ministry for planning, Ministry for transport and State statistical office) has been utilized as source data.

In this paper in details will be presented the whole process of data preparing, quality and outputs of Kosova's GM data.

Key words: Global map, Kosova, ISCGM, GM vector data, transportations, population centers, boundaries, drainage.

1. INTRODUCTION

Contemporary trends in the field of geospatial data for the purpose of the better recognition of the environment from the local up to the global level have intervned heavily in the map of international character dedicated for consistent use by the nations worldwide.

The first map of an international significance is the International World Map (IWM) at scale 1:1.000.000, which has its

origin since 1891, when it was proposed for the first time for compiling. Ever since, till the beginning of 90ies of the last century, this project failed to result in a uniform World map.

As a response against the failure of the IWB and the needs imposed by the digital cartography and GIS, in 1994 was launched the idea of creating of the Global Map (GM) in digital form, which to date has resulted in the compilation of approximately 50 % of Globe. GM database contains four vector layers (population centers, transportations, drainage and boundaries) at scale 1:1.000.000 and as much raster layers (land cover, land use, vegetation and elevation) with spatial resolution of 30" (arc seconds of longitude and latitude).

The Republic of Kosova within the project for the compilation of the GM is represented by the Kosova Cadastral Agency (KCA), as the institution responsible for cartography in Kosova at the national level.

In this paper are given the need for inclusion of the spatial data of Kosova as independent and sovereign state within the GM, as well as four vector layers which have been created according to standards of GM. This vector database is in the phase of processing and including in GM's webpage- www.iscgm.org.

2. GLOBAL MAPPING

Global mapping is an international collaborative initiative through voluntary participation of national mapping organizations of the world, aiming to develop globally homogeneous geographic data set at the ground resolution of 1km for raster data and vector data in scale 1:1.000.000, and to establish concrete partnership among governments, NGOs, private sectors, data providers and users to share information and knowledge for sound decision-making. The primary objective of Global Map project is to contribute to the sustainable development through the provision of base framework geographic dataset, which is necessary to understand the current situation and changes of environment of the world. The purpose of the Global Map is to accurately describe the present status of the global environment in international cooperation of respective National Mapping Organizations (NMOs) of the world, aimed for (Idrizi, 2007a):

- Monitoring and early warning systems for natural disasters;
- Monitoring and management of natural resources;
- Assessment of the trends of environment changes;
- Local, national and multinational physical development planning; and
- Informed decision-making of policy makers with a strategic database.

International Steering Committee for Global Mapping (ISCGM) has been playing a central role in the development of the Global Map data sets. It was established on 1996 year in Tsukuba - Japan. The ISCGM comprises heads of National Mapping Agencies (NMA's), international organizations, and academic institutions.

Actually in the web site of ISCGM (www.iscgm.org) are available downloading of GM version 0 for whole globe, GM Version 1 (national and regional version) data of 74 countries/regions (who has already finished the GM data of their own countries, figure 1), and Global Map version 1 (global version) for whole globe. From the South East European countries, only Macedonian (2006), Romanian (2009) and Bulgarian (2009) datasets has already published within the Global Map. Their data are available for free downloading through the ISCGMs web site. In general, downloading of GM data is available for non-commercial use, vie internet and it is free of charge.

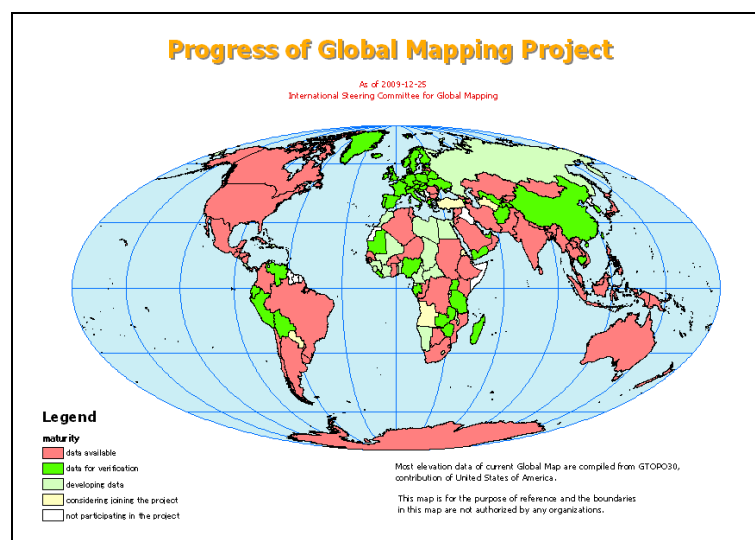


Figure 1. Progress of Global mapping project till 25.12.2009 (www.iscgm.org, 01.04.2010)

Global mapping project is adapted according to international agreements and it is in bulk in accordance with the International Organization for Standardization (ISO) TC 211, namely ISO recommendations for geographic data standards, as well as to give fruitful impact to the international-global initiatives as GSDI (global spatial data infrastructure), GEOSS (global earth observation system of systems) ext. Till today, in a period of nine years, GM standards has been developed very frequently and they can found in six specifications for global map data, i.e. version 1 (16.03.2000), version 1.1, version 1.2, version 1.2.1, version 1.3 and the last one version 2 (25.10.2009). The scheme of standards for data developing defined in global map specifications is shown in next figure 2.

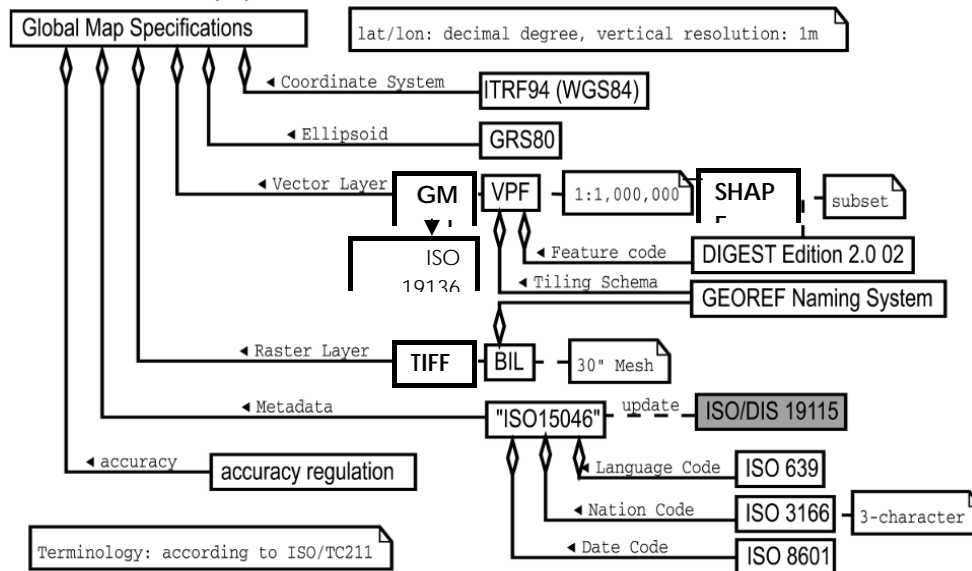


Figure 2. Scheme of Global Map data (Sasaki, 2005)

3. GLOBAL MAP DATA OF KOSOVA

3.1. Participation of Kosova in global mapping project

Based on fact that the GM project is for noncommercial purposes, participation in it is voluntary. Eligible for participation has only the national mapping organizations, which are the governmental responsible institutions for mapping and spatial data developing on national level. Involvement by an organization in the project in generally is categorized in three levels, i.e. as Level A, B and C. *Level A* means that institution will prepare the data set of own country and other countries, the *Level B* mean that institution will prepare the data set of own country, and the *Level C* mean that institution will give all necessary data, preparation will be done by ISCGM. The Republic of Kosova participate in global mapping project since 23.10.2003 in Level B, through Kosova Cadastral Agency (KCA) as national mapping organization (figure 3).

Country	Organization	Status
Italy	*Italian Geographic Military Institute	Direct+Euro
Jamaica	*National Land Agency-Surveys and Mapping Division	Released
Japan	*Geographical Survey Institute	Released
Jordan	*Royal Jordan Geographic Center	Released
Kazakhstan	*Scientific Technical Enterprise of Digital Cartography and GIS, The Committee for Management of Land Resources, Ministry of Agriculture STE "Kartiform"	Released
Kenya	*Survey of Kenya	Released
Kiribati	*Survey Management Division	Released
Kosovo / UNMK	*Kosovo Cadastral Agency	Released
Kosovo / UNMK	*State Survey of Geodesy and Geodesy of Kosovo Republic	Released
Lao People's Democrati Republic	*National Geographic Department	Released
Latvia	*Geospatial Information Agency of Latvia	Released
Lebanon	*National Center for Remote Sensing *Lebanese Army Geographic Affairs (LAQA)	Released
Liberia	*Liberian Cartographic Service	Released
Libyan Arab Jamahiriya	*The Libyan Center for Remote Sensing and Space Science	Released
Liechtenstein		EuroGlobalMap
Lithuania	*National Center of Remote Sensing and GeoInformatics "GIS Centras"	Direct+Euro
Luxembourg	*Administration du Cadastre, et de la Topographie	EuroGlobalMap
Madagascar	*National Institute of Cartography and Hydrography	Released
Malawi	*Survey Department, Ministry of Lands, Housing, Physical Planning and Surveys	Released
Malaysia	*Department of Survey and Mapping Malaysia	Released

Figure 3. Part of list of participants in GM project (www.iscgm.org, 02.04.2010)

3.2. Source data for Global Map dataset of Kosova

Global Map dataset can be acquired through various types of sources. Typical sources are analogue/digital maps produced by participating organizations, Vmap level 0, GTOPO30 and GLCC. Analogue/digital maps produced by participating organizations, which are the maps at scales of 1:200.000 to 1.000.000 are the most appropriate base materials for Global Mapping. Other maps can also be used if the maps are appropriate sources for Global Mapping project under political, technical or other conditions of the organization participant.

In a case of Kosova's GM data, due to the current conditions in governmental institutions related to spatial data, all source data have been supplied by the governmental responsible institutions:

- Kosova cadastral agency,
- Ministry of environment and spatial planning,
- Ministry of transport and telecommunication,
- Statistical office of Kosova, and
- Geography department – Faculty of Natural Sciences and Mathematics – University of Prishtina - Prishtine.

Kosova institutions given in upper list were provided all necessary and updated data for developing vector GM dataset for Kosova, which were in various map scales and different formats. All received data have been modified and generalized according to GM specification.

3.3. Global Map vector data of Kosova

3.3.1. Global Map vector data

The Global Map datasets encompass the entire globe at a scale of 1:1.000.000, equivalent to 1km resolution. Spatial features are organized into thematic layers in either vector or raster formats with each layer containing logically related geographic information.

Global Map dataset basically includes eight layers, i.e. four vector layers and four raster layers (table 1). Beside them, the land cover and percent tree cover as contents of GM level 1 – global version are also a part of GM data in raster format.

Table 1. Global Map data set layers (national/regional version)

<i>Vector Layers</i>	<i>Raster Layers</i>
Transportation	Elevation
Boundaries	Land Cover
Drainage	Land Use
Population Centers	Vegetation

The features of the vector data are represented by the three basic spatial geometrical forms: points, lines and polygons. Each map feature is allocated a category number that is used to link the geometrical data with descriptive-attribute data. The non-locational information about a feature instance stores as attributes, which can be mandatory or optional attributes, stored in roman characters without diacritical marks. In vector data model text features may also be included but they are optional. Vector data in the GM is partially topologically structured, i.e. features stored as lines and polygons are individually structured. Vector layers and the associated feature types, defined in GM specifications are given in the following table 2 (Idrizi, 2007b).

Table 2. Feature class, name, type and inclusion of vector layers

Layer	Feature Class	Feature Name	Feature Type	Inclusion	
Transportation	Airport	Airport/Airfield	Point	Optional	
	Rail yard	Railroad yard/ Marshalling yard	Point	Optional	
	Railroad	Railroad	Line	Mandatory	
	Road	Road	Line	Mandatory	
	Trails and Tracks line	Trail (Vehicle Tracks)	Line	Mandatory	
	Structures	Bridge/Overpass/ Viaduct	Ferry route	Line	Optional
			Tunnel	Line	Optional
			Transportation Text	Text	Text

Boundaries	Political Boundary	Administrative area	Point	Mandatory
	Coast Line	Coastline/Shoreline	Line	Mandatory
	Political Boundary Line	Administrative Boundary	Line	Mandatory
	Ocean/Sea	Water (except inland)	Polygon	Mandatory
	Political Boundary	Administrative area	Polygon	Mandatory
	Political Entity Text	Text	Text	Optional
Drainage (Hydrography)	Miscellaneous	Dam/Weir	Point	Optional
		Island	Point	Optional
		Spring/Water-hole	Point	Optional
	Aqueduct/Canal/Flume/Penstock	Inland Water	Line	Optional
	Miscellaneous	Dam/Weir	Line	Optional
	Water Course	River/Stream	Line	Mandatory
	Inland Water	Inland Water	Polygon	Mandatory
	Water Text	Text	Text	Optional
Population Centers	Built-up area	Built-up area	Point	Optional
	Miscellaneous Population	Settlement	Point	Optional
	Built-up area	Built-up area	Polygon	Optional
	Population Text	Text	Text	Optional

The vector data of Global Map can be found in VPF (Vector Product Format), SHAPE and GML (Geography Markup Language) formats. VPF is a standard format, structure, and organization for large geographic databases that are based on a geo-relational data model, combinatorial topology and set theory, and are intended for direct use. Because the utilization of VPF files is so limited by the existing GIS software's, on October 10th 2008 the existing GM vector data (national/regional version) has been published in SHAPE format also, which is more simple and user-friendly format. On October 25th 2009, the GML (standardized in ISO19136) format has replaced former VPF as the official distribution format of GM data (ISCGM, GM specifications-version 2, www.iscgm.org), which provides a standard format for transferring digital geographic data.

3.3.2. Process of preparing of Global Map vector data of Kosova

GM vector data of each country store in ten separate layers – shape files. Names of shape files and the features within them are shown in the next table:

Table 3. Titles of shape files of GM vector data and features within them

Shapefile	Features
transp.shp	Airport, Rail yard
transl.shp	Railroad, Road, Trails and tracks line, Structures (bridge, tunnel, ferry route)
bndp.shp	Political boundary
bndl.shp	Political boundary line, Coast line
bnda.shp	Political boundary, Ocean/Sea
hydrop.shp	Miscellaneous (Dam/Weir, Island, Spring/Water-hole)
hydrol.shp	Aqueduct/Canal/Flume/Penstock, Water course
hydroa.shp	Inland water
popp.shp	Builtup area, Miscellaneous population
popa.shp	Builtup area

Nine of ten shape files, shown in table 3, have been created as first step of developing GM vector dataset of Kosova. Only the shape file “bndp.shp” was not created, because in a case of Kosova there is no area smaller than 1km², which belongs to boundary layer. In next figure 4, are shown the shape files of the Kosova's GM vector data. Shape files were created by defining of state coordinate system of the Republic of Kosova named “KOSOVAREF01”, as spatial reference of shape files. This system has been used for data preparing because all source received data were in KOSOVAREF01.

3.3.3. Global Map vector data of Kosova

Based on results derived from analyses and processing of population centers data, within the layer of population centers of Kosova's GM in total have been included 58 population centers, i.e. 30 cities and 28 settlements, shown in figure 7. In other site, from the results derived from analyses of transportations in Kosova, all highways, railroads, roads of first and second order, some local roads and Prishtina airport have been include within the transportations layer of Kosova's GM data, shown in figure 8. Within the drainage (hydrography) layer of Kosova's GM data, based on results derived from analyses of hydrography of Kosova, 20 rivers, 6 lakes and 4 dams have been include, which can be shown in figure 9. Finally based on results emerging from analyses of boundaries of Kosova in national and local level, within the boundary layer have been added national boundary line and all boundaries of municipalities, shown in figure 10.

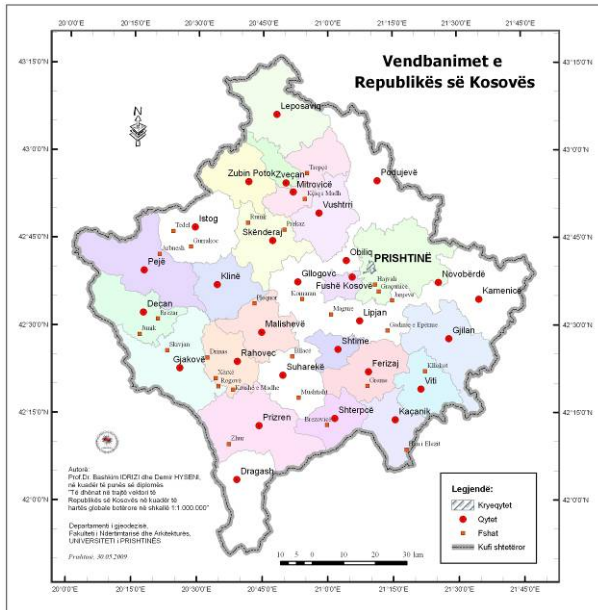


Figure 7. Population centers within Kosova's GM data (Hyseni, 2009)

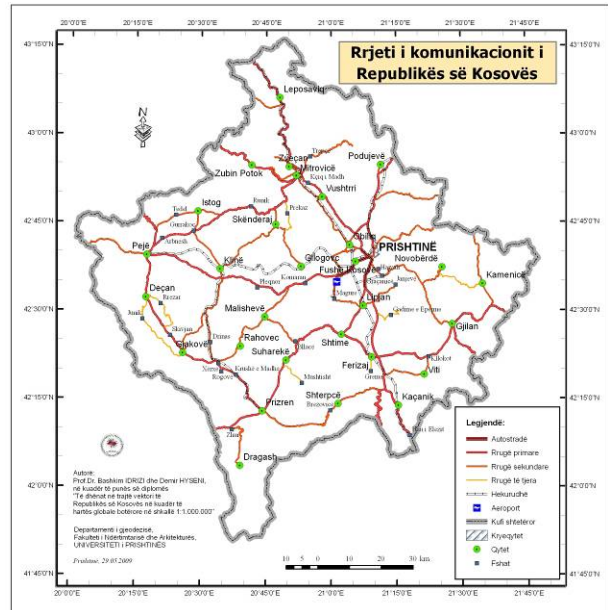


Figure 8. Transportations within Kosova's GM data (Hyseni, 2009)

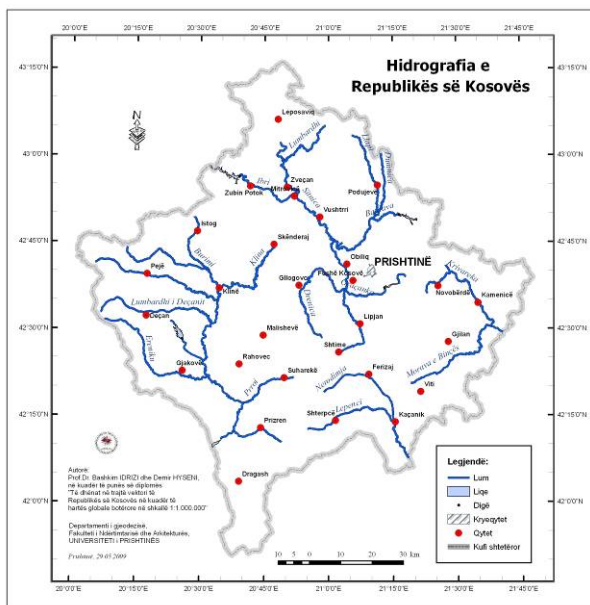


Figure 9. Drainage within Kosova's GM data (Hyseni, 2009)



Figure 10. Boundaries within Kosova's GM data (Hyseni, 2009)

3.3.4. Mathematical elements of Global Map vector data of Kosova

The reference coordinate system of Global Map is ITRF94, and its longitudes and latitudes are defined in GRS80 ellipsoid. Since the difference between ITRF94+GRS80 and WGS84 is negligible in spatial resolution of Global Map, WGS84 can be adopted also. Due to fact that ellipsoid GRS is a part of state coordinate system of Kosova, all Kosova's GM data have been transformed from the state coordinate system "KOSOVAREF01" in to ITRF94 with GRS80, where the data was stored in decimal degrees to a three decimal points as geographic coordinates (longitudes and latitudes). The positional mean accuracy of Kosova's GM data is $\pm 190\text{m}$, calculated from the composite errors from three sources: the positional accuracy of source material, errors due to conversion processes, and errors due to the manipulation processes.

GM data is in use of GEOREF tiling naming system, which does not allow overlaps or gaps between the tiles, with the the reference for their southwest corner. It uses two pairs of letters. The first pair of letters represents the coarsest, 15° by 15° standard GEOREF division, and represents the first coordinate pair identifying the tile name. The second pair of letters represents the 1° by 1° standard GEOREF divisions, and represents the second coordinate pair of the tile name (Kishimoto, 2005). According to this tiling scheme, the territory of the Republic of Kosova is within the area defined with the reference PJDL (figure 11).

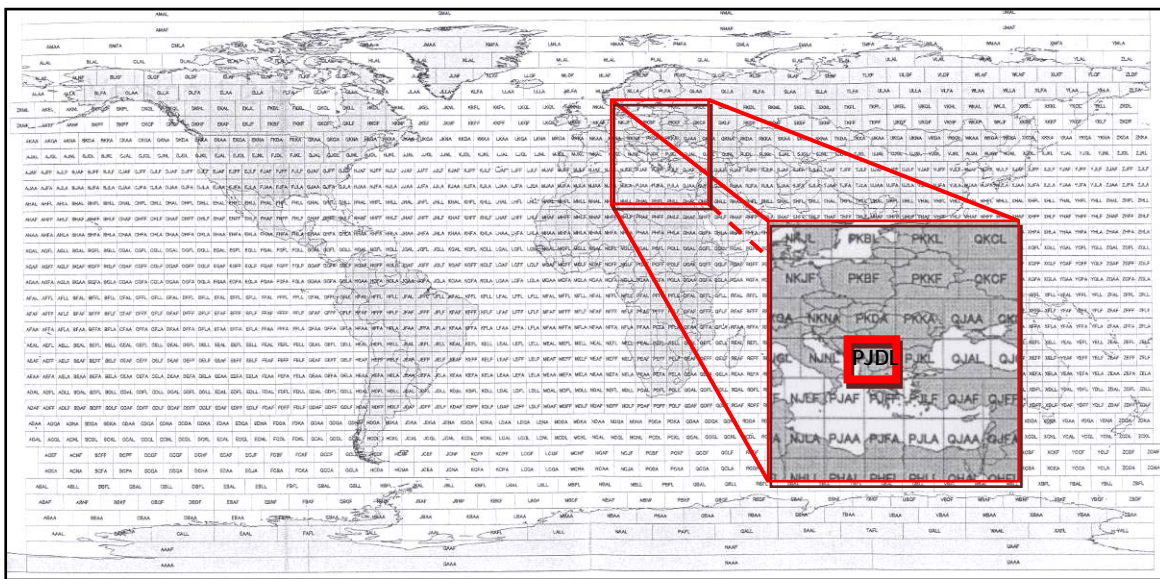


Figure 11. GEOREF tiling system and the tile of the Republic of Kosova "PJDL"

3.3.5. Metadata of Global Map vector data of Kosova

Metadata is data about the contents, quality, condition and other characteristics of the data, which also describes the lineage, process and accuracy of the data set. A metadata file accompanies each layer of the data set separately, developed in ASCII file, named after the relevant theme and have the extension "*.met". The contents of metadata follow the ISO standard of metadata (ISO 15046) at conformance level 1: Title; Edition; Issue identification; Initiative identification information; Initiative identification name; Reference date; Responsible party information; Responsible party organization name; Responsible party role code; Postal address; City; Administrative Area; Postal Code; Country; On-line resource linkage; Responsible party organization name; Responsible party role code; City; Administrative Area; Postal Code; Country; On-line resource linkage; Dataset extent; Geographic extent coordinates; West bounding coordinate; East bounding coordinate; North bounding coordinate; South bounding coordinate; Temporal date/time; Resolution level code; Language of dataset code; Abstract; Purpose; Category; Theme code; Access constraints; Use constraints; Spatial representation type code; Spatial reference system type code; Distribution format name; Distribution media; Distribution resource url; Level of conformance code; Language of metadata code; & Metadata date. In the following tables, are shown the necessary contents of the GM metadata for vector and raster layers, as well as the example of one layer of Kosova's GM dataset, i.e. metadata of boundary layer named as "bnd.met" (Hyseni, 2009).

	For vector layers	For Raster layers
Cataloguing metadata information		
* Title	x	x
* Edition	x	x
* Issue identification	x	x
Initiative identification information		
* Initiative identification name	x	x
* Reference date (Publication Date/Time)	x	x
Responsible party information		
* Responsible party organisation name	x	x
* Responsible party role code	x	x
* Postal Address	x	x
* City	x	x
* Administrative Area	x	x
* Postal Code	x	x
* Country	x	x
* On-line resource linkage	x	x
Dataset Extant		
* Geographic extent coordinates		
** West Bounding Coordinate	x	x
** East Bounding Coordinate	x	x
** North Bounding Coordinate	x	x
** South Bounding Coordinate	x	x
* Temporal extent (Content) Date/Time	x	x
* Resolution level code	x	x
Language of data set code	x	x
Dataset character code set	x	x
Abstract	x	x
Purpose	x	x
Category		
* Thema code	x	x
Access Constrains	x	x
Use Constrains	x	x
Spatial representation type code	x	x
Spatial reference system type code	x	x
* Distribution identifier	x	x
* Distribution format name	x	x
* Level of conformance of metadata	x	x
* Language of metadata code	x	x
* Metadata date	x	x

Cataloguing metadata information:	
Title	>Global Map Kosova - Boundaries layer
Edition	>1
Issue identification	>1.0
Initiative identification information:	
Initiative identification name	>Global Map
Reference date	>20080805
Responsible party information:	
Responsible party organization name	> Kosova Cadastral Agency (KCA)
Responsible party role code	>5
Postal address	> Kosova archive building, 2nd floor
City	>Pristine
Administrative area	>Pristine
Postal code	> 038
Country	>KOS
Online resource linkage	> http://www.kca-ks.org
Responsible party organization name >Secretariat of the International Steering Committee for Global Mapping	
Responsible party role code	>2
Postal address	>Geographical Survey Institute, Kitasato 1
City	>Tsukuba
Administrative area	>Ibaraki
Postal code	>305-0811
Country	>JPN
Online resource linkage	>http://www.iscgm.org/
Dataset extent: Geographic extent coordinates:	
West bounding coordinate	>18.0
East bounding coordinate	>24.0
North bounding coordinate	>45.0
South bounding coordinate	>40.0
Temporal date / time	>unknown
Resolution level code	>0
Language of dataset code	>en
Abstract >The Global Map Kosova - Boundaries layer was developed by Prof.Dr. Bashkim Idrizi (bashkim.idrizi@yahoo.com, bashkim.idrizi@unite.edu.mk) and Demir Hyseni(demir.hyseni@gmail.com).	
Purpose >The Global Map is a basic framework database designed to support Geographic Information Systems applications, especially for examination of global environmental issues.	
Category:	
Theme code	>10
Access constraints	>none
Use constraints	>non-commercial
Spatial representation type code	>2
Spatial reference system type code	>2
Distribution format name	>Vector Product Format
Distribution media	>online
Distribution resource uri	>http://www.iscgm.org/
Conformance level code	>001
Language of metadata code	>en
Metadata date	>20090530

Figure 12. Metadata of GM dataset and metadata of Boundary layer of Global Map Kosova - "bnd.met"

4. EXPECTED UTILIZATION OF KOSOVA'S GLOBAL MAP DATASET

Environmental issues are closely interlinked one leading to another. A local environmental problem may grow into regional or even global environmental problem, and a global environmental degradation may create a new environmental problem in various other parts of the globe hitherto unaffected by it or it may aggravate the existing local problems. This is precisely because a global outlook is essential to understand the environmental problems affecting the local-national surroundings and to provide a holistic solution towards the same. Advanced capabilities of researching based on Global Map data set are (Idrizi B., 2005):

- all data of Globe is in one place,
- with the same attributes,
- in the same format,
- in the same coordinate system
- in the same scale/spatial resolution, and
- with similar accuracy.

Global Map data set with its consistent quality and data standards is a handy tool to monitor the environmental status at regional and global scale. With the Global Map dataset being in digital form, it lends itself to various data manipulation and for modelling real life situations. Global Map dataset may have limited uses at national and local scales. However, Global Map dataset is needed to address global, regional, trans-boundary and in many cases national concerns. The following are some of the potential applications of Global Map datasets in general:

- Global Environmental Assessments (Ozone, Global Climate Models etc.)
- Global/Regional/National perspective and contextual information
- Developing ecosystem, drainage basins framework for environmental assessment
- Quantifying transboundary issues
- Rapid Response capability / Early warning (Success in predicting El Nino, forest fire)
- Environmental priority setting, analytical studies over large areas (question: where to invest?)

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6. BIOGRAPHICAL NOTES OF THE AUTHOR



Mr. Bashkim IDRIZI, was born on 14.07.1974 in Skopje, Macedonia. He graduated in geodesy department of the Polytechnic University of Tirana-Albania in 1999 year. In 2004, he got the degree of master of sciences (MSc) in Ss. Cyril and Methodius University-Skopje. In 2005 he had a specialization for Global Mapping in Geographical-Survey Institute (GSI) of Japan in Tsukuba-Japan. On year 2007, he held the degree of Doctor of sciences (PhD) in Geodesy department of Ss. Cyril and Methodius University-Skopje. He worked in State Authority for Geodetic Works from May 1999 until January 2008. During those period, in 2004 he appointed for head of cartography department, i.e. geodetic works. From October 2003 up to January 2008, he worked as a outsourcing lecturer in State University of Tetova. From February 2008, he works as a cartography and GIS Professor at the State University of Tetova-Tetova. He continues working as outsourcing lecturer in geodesy department of the University of Prishtina-Kosova. He is the author of three cartography university books, and more than 50 papers published and presented in national and international scientific conferences related to geodesy, cartography, GIS and remote sensing.



Mr. Pal NIKOLLI. Graduated at the Geodesy branch of Engineering Faculty, Tirana University. In 1987 has been nominated lecturer in the Geodesy Department of Tirana University. In 1994 has been graduated Doctor of Sciences in cartography field. During this period, he has taught the following subjects: “Cartography” (for Geodesy and Geography students) and “Geodesy” (for Civil engineering & Geology students). Actually he is lecturer and tutor of the following subjects: “Elements of Cartography” (for Geography students), GIS (for Geography students, diploma of first and second degree) “Interpretation of Aerial Photographs” (for Geography students, diploma of first degree), “Satellite Images” (for geography students, diploma of second degree) “Thematic Cartography” (for Geography students, diploma of second degree) and “Topography-GIS (for the Geophysics students, diploma of second degree). Mr. Nikolli is the author and co-author 8 textbooks (Elements of Cartography and Topography, Elements of Cartography, Geographic Information Systems, Processing of satellite images, Cartography, etc), 3 monographs (History of Albanian Cartography, Mirdita on Geo-Cartographic view, etc), more than 40 scientific papers inside and outside of the country, more 40 scientific & popular papers, etc. Has participated in several post graduation courses of cartography and GIS outside of the country (1994, 2000 - Italy), etc.



Mr. Demir HYSENI, was born on 18.10.1985 in Vushtri-Kosova. He is graduated in geodesy department of the University of Prishtina – Faculty for Civil engineering and Architecture, on July 2009. His diploma thesis was “The data in vector form of the Republic of Kosova within Global World Map in scale 1:1.000.000”. For a few months on years 2005 and 2006 he worked voluntarily in municipality cadastral office of Vushtri. From September 2006 to September 2007, he worked in the private sector. Also he worked in Municipal Assembly – Mitrovica, department of planning, urbanism, Cadastre and Properties, November 2007 until November 2009. From November 2009 and ongoing, he works in Kosova Cadastral Agency - Prishtina. He owns good knowledge of production data and managing with the data in ArcGIS software.