14th INTERNATIONAL MULTIDISCIPLINARY
SCIENTIFIC GEOCONFERENCE
S G E M 2 0 1 4

GeoConference on

INFORMATICS, GEOINFORMATICS AND REMOTE SENSING

CONFERENCE PROCEEDINGS
VOLUME III

- - - - - - - - - - - - - - - - - - - -

PHOTOGRAMMETRY AND REMOTE SENSING

CARTOGRAPHY AND GIS

- - - - - - - - - - - - - - - - - - - -

17-26, June, 2014
Albena, BULGARIA

DISCLAIMER

This book contains abstracts and complete papers approved by the Conference Review Committee. Authors are responsible for the content and accuracy.

Opinions expressed may not necessarily reflect the position of the International Scientific Council of SGEM.

Information in the SGEM 2014 Conference Proceedings is subject to change without notice. No part of this book may be reproduced or transmitted in any form or by any means, electronic or mechanical, for any purpose, without the express written permission of the International Scientific Council of SGEM.

Published by STEF92 Technology Ltd., 1 "Andrey Lyapchev" Blvd., 1797 Sofia, Bulgaria
Total print: 5000

ISBN 978-619-7105-12-4

ISSN 1314-2704

DOI: 10.5593/sgem2014B23

INTERNATIONAL MULTIDISCIPLINARY SCIENTIFIC GEOCONFERENCE SGEM
Secretariat Bureau

Phone: +359 2 975 3982
Fax: +359 2 874 1088

E-mails: **sgem@sgem.org** | **sgem@stef92.com**
URL: **www.sgem.org**

CONFERENCE ORGANIZERS

- BULGARIAN ACADEMY OF SCIENCES
- ACADEMY OF SCIENCES OF THE CZECH REPUBLIC
- LATVIAN ACADEMY OF SCIENCES
- POLISH ACADEMY OF SCIENCES
- RUSSIAN ACADEMY OF SCIENCES
- SERBIAN ACADEMY OF SCIENCES AND ARTS
- SLOVAK ACADEMY OF SCIENCES
- NATIONAL ACADEMY OF SCIENCES OF UKRAINE
- INSTITUTE OF WATER PROBLEM AND HYDROPOWER OF NAS KR
- NATIONAL ACADEMY OF SCIENCES OF ARMENIA
- SCIENCE COUNCIL OF JAPAN
- THE WORLD ACADEMY OF SCIENCES (TWAS)
- EUROPEAN ACADEMY OF SCIENCES, ARTS AND LETTERS
- ACADEMY OF SCIENCES OF MOLDOVA
- MONTENEGRIN ACADEMY OF SCIENCES AND ARTS
- CROATIAN ACADEMY OF SCIENCES AND ARTS, CROATIA
- GEORGIAN NATIONAL ACADEMY OF SCIENCES
- ACADEMY OF FINE ARTS AND DESIGN IN BRATISLAVA
- TURKISH ACADEMY OF SCIENCES
- BULGARIAN INDUSTRIAL ASSOCIATION
- BULGARIAN MINISTRY OF ENVIRONMENT AND WATER

HONORED ORGANIZER

BULGARIAN ACADEMY OF SCIENCES

EXCLUSIVE SUPPORTING PARTNER

INTERNATIONAL SCIENTIFIC COMMITTEE
Informatics, Geoinformatics and Remote Sensing

- PROF. ING. ALEŠ ČEPEK, CSC., CZECH REPUBLIC
- PROF. G. BARTHA, HUNGARY
- PROF. DR. DAMIR MEDAK, CROATIA
- PROF. PETER REINARTZ, GERMANY
- PROF. DR. JÓZSEF ÁDAM, HUNGARY
- PROF. RUI MIGUEL MARQUES MOURA, PORTUGAL
- PROF. DR. ISIK YILMAZ, TURKEY
- PROF. DR. ING. KAREL PAVELKA, CZECH REPUBLIC
- PROF. DR. MARCEL MOJZES, SLOVAKIA

Ass.Prof. Dorota Zawieska, Dr Eng. Michal Kowalczyk, Dr Rafal Zaplata, Warsaw University of Technology, Poland 391

50. VEGETATION CHANGE DETECTION IN LANDSAT TM TIME SERIES USING SINGULAR SPECTRUM ANALYSIS AND REGULAR FOREST INVENTORY DATA, Linda Gulbe, Assoc. Prof. Galina Hilkevica, Ventspils University College, Latvia 397

51. VISUALIZATION OF TRACKS USING DIGITAL TERRAIN MODEL AND IMAGE PROCESSING METHODS, Ing. Martina Faltynova, Ing. Eva Matouskova, Ing. Zdenek Svec, CTU in Prague, Czech Republic 405

CARTOGRAPHY AND GIS

52. A BUSINESS PROJECT APPROACH TO ASSESS SPATIAL DATA INFRASTRUCTURES, Dr. Agnieszka Zwirowicz-Rutkowska , University of Warmia and Mazury in Olsztyn , Poland 413

53. A MAP OF HISTORIC NAMES AS A FORM OF CULTURAL HERITAGE PROTECTION, M.Sc. Malgorzata Brzezinska-Klusek, Prof. DSc Janusz Golaski, Institute of Geodesy and Cartography, Poland 421

54. AIRBORNE LASER SCANNING AND GIS APPLICATION IN PROTECTION OF CULTURAL LANDSCAPE OF FORTIFICATIONS, Wojciech Ostrowski, Dorota Zawieska, Warsaw University of Technology, Poland 429

55. APPLICATION OF GIS AND AHP FOR LANDFILL SITE SELECTION, Ass. Prof. Svemir Gorin, Ass. Prof. Ivan Radevski, University of St. Cyril and Methodius, FYR of Macedonia 437

56. APPLICATION OF THE NATIONAL DATABASE OF TOPOGRAPHIC OBJECTS IN MONITORING CHANGES OF URBAN INDICATORS IN SELECTED POLISH CITIES, PhD, Eng. of Architecture Anna Majewska, PhD, Eng. of Architecture Malgorzata Denis, PhD, Joanna Jaroszewicz, Warsaw University of Technology, Poland 445

57. APPLICATION OF WIRELESS SENSOR NETWORK FOR TEMPERATURE AND AIR HUMIDITY MONITORING IN THE BOTANIC GARDEN, MSc. Vendula Hejlova, Palacky University in Olomouc, Czech Republic 453

58. APPLIED GEOINFORMATION SYSTEM OF SPACE MONITORING OF AGRICULTURAL RESOURCES, Dr Leonid Grekov, Anatoliy Kuzmin, Cand. Sc., Georgiy Veriuzhsky, Elena Medvedenko, Aleksey Petrov Cand. Sc., Viktor Skavronsky, NVP Agroresurssistemi TOV, Ukraine 461

59. APPLYING THE BASIC FUNCTIONS OF GIS TECHNOLOGIES ON THE ANALYSIS OF HAZARDOUS NATURAL CLIMATIC PROCESSES (ON THE EXAMPLE OF WEST SIBERIAN TAIGA ZONE), PhD Olga Nevidimova, PhD Elena Volkova, Institute of Monitoring of Climatic and Ecological Systems SB RAS, Russia 469

60. APPROACHES IN SPATIAL DATA GEOPORTALS IN ENVIRONMENTAL CONSERVATION - CASE STUDY: NATIONAL PARK IN ROMANIA, Assoc. Prof. Dr. Ana-Cornelia Badea, Lecturer Dr. Viorica David, Prof. Dr. Gheorghe Badea, Technical University of Civil Engineering of Bucharest, Romania 475

61. ASPECTS ABOUT THE IMPORTANCE OF OBLIQUE IMAGES IN URBAN MANAGEMENT, Lecturer Dr. Viorica David, Assoc. Prof. Dr. Ana-Cornelia Badea, Prof. Dr. Gheorghe Badea, Technical University of Civil Engineering of Bucharest, Romania 483

62. ASPECTS OF USING MODERN TECHNIQUES FOR ACHIEVING NETWORKS SUPPORT, PhD. Octavius Coltan, Prof. Valeria Ciolac, Assoc. Prof. Elena Pet, Assoc.Prof. Ioan Pet., Assoc.Prof. Eleonora Nistor, Lector Livia Barliba, Prof.PhD. Nilanchal Patel, Universitatea De Stiinte Agricole Si Medicina Veterinara A Banatului Regele Mihai I Al Romaniei Timisoara Statiunea Didactica Timisoara, Romania 491

63. ASSESSMENT OF FLOOD HAZARD AND RISK USING GIS AND HISTORICAL DATA. CASE-STUDY: THE NIRAJ RIVER BASIN (TRANSYLVANIA DEPRESSION, ROMANIA), PhD. Sanda Rosca, Prof. Phd. Danut Petrea, Lecturer Stefan Bilasco, Asoc.Prof. Ioan Rus, Prof. Ioan Irimus, Lecturer Ioan Fodorean, Lect. Iuliu Vescan, Babes-Bolyai University, Romania 497

64. CARTOGRAPHIC VISUALIZATION OF BOUNDARIES IN ACADEMIC ATLAS OF THE CZECH HISTORY, Ing. Pavel Seemann, CTU in Prague-Faculty of Civil Engineering, Czech Republic 505

65. CHATEAUX AND CASTLES IN THE CZECH REPUBLIC: OLD MAPS AND PLANS PROCESSING, Doc. Jiri Cajthaml, Ing. Jiri Krejci, CTU in Prague, Czech Republic 513

66. CONCEPT OF A GEOGRAPHIC INFORMATION SYSTEM FOR THE PURPOSES OF SPATIAL PLANNING OF DEGRADED AREAS, MSc. Agnieszka Turek, Dr. Eng. Joanna Jaroszewicz, Warsaw University of Technology - Faculty of Geodesy and Cartography, Poland 521

67. CONTRIBUTIONS REGARDING MODERN TECHNOLOGIES FOR THE OPTIMIZATION OF FARMLAND RECORDS, PhD. student Octavius Coltan, Prof. Valeria Ciolac, Assoc.Prof.Elena Pet, Assoc.Prof.Eleonora Nistor , Universitatea De Stiinte Agricole Si Medicina Veterinara A Banatului Regele Mihai I Al Romaniei Timisoara Statiunea Didactica Timisoara, Romania 529

68. CREATION OF THREE-DIMENSIONAL DIGITAL GIS–MODELS FOR ANALYSES OF CONSEQUENCES OF EMERGENCY FLOODS OF OIL ON THE OIL-PIPE LINE "EAST SIBERIA - PACIFIC OCEAN", Savvinova A.N., North-Eastern federal university named by M.K.Ammosov, Russia.....537

69. DRAFTING AND FINALIZING OF A PRIVATE PROPRIETY FORESTRY FUND IN SALCIUA NOUA VILLAGE, PhD Dragomir L, PhD Barliba Luminita Livia., PhD Barliba C., Assoc. Prof. PhD Eles G., Assoc. Prof. PhD Calinovici I., University of Agricultural Science and Veterinary Medicine of Banat Timisoara, Romania.....545

70. DRAWING A 3D TOPOGRAPHIC PLAN NECESSARY TO ACHIEVE A GRAPEVINE PROJECT ARRANGEMENT IN RECAS CITY, TIMIS COUNTY, ROMANIA, PhD Barliba Luminita Livia, PhD Dragomir L., PhD Barliba C., PhD Smuleac A., Banat University of Agronomical Sciences and Veterinary Medicine, Romania.....551

71. ENSURING INTEROPERABILITY OF GEOGRAPHIC INFORMATION IN LOCAL GOVERNMENT AND INSPIRE, Prof.Dr.-Ing. Hartmut Muller, Dipl.-Ing. Falk Wurriehausen, Institute for Spatial Information and Surveying Technology, Germany.....559

72. ESTABLISHMENT OF A METHODOLOGICAL BASIS OF ADAPTIVE-LANDSCAPE SYSTEM OF AGRICULTURE USING GIS - TECHNOLOGY (ON THE EXAMPLE OF THE NORTHERN SLOPE OF THE ILI ALATAU), PhD student Yerkin Kakimzhanov , al-Faraby Kazakh National University, Kazakhstan...567

73. FLOOD PREVENTION MAP ON BISTRITA RIVER, ROMANIA, Andreea Calugaru, Lecturer PhD. Doru Mihai, PhD. Assistant Bogdan Nedelcu, University of Agronomic Science and Veterinary Medicine - Bucharest, Romania.....575

74. FLOODPLAIN LANDSCAPE MANAGEMENT BASED ON GIS AND REMOTE SENSING DATA. CASE STUDY BUZAU RIVER, Lecturer Dr. Giuliano Tevi, Assist. Professor Dr. Mihaela Scradeanu, Professor Dr. Eng. Daniel Scradeanu, Ecological University of Bucharest - Faculty of Ecology and Environmental Protection, Romania.....581

75. FRAMEWORK FOR PROCESSING RIVER BANK POINT CLOUDS GENERATED BY TERRESTRIAL LASER SCANNING, Assistant Lecturer Mihai Niculita, Conferencer Dan Dumitriu, Alexandru Ioan Cuza University, Romania.....589

76. GEOANALYSES OF DATA ON FIRE OCCURENCE IN THE SLOVAK REPUBLIC – CASE STUDY, Stefan Galla, Peter Ivan, Nemec Jozef, Viktor Moravec, Andrea Majlingova, Fire Research Institute of the Ministry of Interior of the Slovak Republic, Slovakia.....595

77. GEOPOTENTIAL OF THE LANDSCAPE FOR URBANISATION EVALUATED IN GIS ENVIRONMENT (AT THE EXAMPLE OF

MICROREGION MINCOL, SLOVAKIA), Dr. Lucia Kunakova, Dr. Vladimir Cech, Dr. Juliana Krokusova, University of Presov in Presov, Slovakia.....603

78. GEOSPATIAL MODEL FOR VISUAL RECONSTRUCTION OF USERKAF'S PYRAMID AT SAQQARA, EGYPT, Prof. Valdis Seglins, Dr.Agnese Kukela, Dr.Maris Kalinka, University of Latvia, Latvia.....611

79. GEOSPATIAL TECHNOLOGIES FOR THE 3D RECONSTRUCTION OF CULTURAL LANDSCAPE – A CASE STUDY OF A VANISHED TOWN IN NORTHWESTERN BOHEMIA, Ing. Renata Duchnova, Ing. Ruzena Zimova, Ph.D., CTU in Prague-Faculty of Civil Engineering, Czech Republic.....619

80. GIS METHODS IN EVALUATION OF ARABLE SOILS' SPATIAL-TIME EROSION DYNAMICS ON THE TERRITORY OF THE RUSSIAN PLAIN, Alina Avvakumova, Prof. Oleg Yermolaev, Kazan (Volga Region) Federal University, Russia.....627

81. GIS-A TOOL FOR MONITORING AND MANAGEMENT OF EPIDEMICS, PhD Dragomir L, PhD Barliba C., PhD Barliba Luminita Livia., Assoc. Prof. PhD Calinovici I., Assoc. Prof. PhD Eles G., University of Agricultural Science and Veterinary Medicine of Banat Timisoara, Romania.....635

82. GREEN VERSUS RED: EYE-TRACKING EVALUATION OF SEQUENTIAL COLOUR SCHEMES, Alzbeta Brychtova, Alena Vondrakova, Palacky University in Olomouc, Czech Republic.....643

83. HIGH RESOLUTION IMPERVIOUS AND TREE COVER LAYERS AS AN ADDITIONAL SOURCE OF DATA ON LAND COVER STATUS IN POLAND, Anna Debowska, Milena Napiorkowska, PhD.Agata Hoscilo, Marta Gruziel, Institute of Geodesy and Cartography, Poland.....651

84. IDENTIFICATION AND MAPPING OF THE ETHNO-ECOLOGICAL-ECONOMIC CONFLICTS OF NATURE USE IN SOUTHERN YAKUTIA (NORTH-EAST RUSSIA) USING GIS, Savvinova A.N., Filippova V.V., North-Eastern federal university named by M.K.Ammosov, Russia.....659

85. IDENTIFICATION OF HOMOGENEOUS SPATIAL PLANNING ZONES WITH THE USE OF STATISTICAL CLUSTERING METHODS, Dr. Dominika Strumillo-Rembowska, Dr. Iwona Cieslak, Dr. Karol Szuniewicz, Dr. Michal Bednarczyk, University of Warmia and Mazury, Poland.....667

86. IMPLEMENTING INSPIRE COORDINATE TRANSFORMATION SERVICES - ROMANIAN INSPIRE GEOPORTAL, Vlad Teodor, Dr. Lucian Zavate, Dr. Cristian Vasile, Esri Romania, Romania.....675

87. INFORMATION SYSTEM FOR EASY ACCESS OF THE FIRST MILITARY SURVEY, Ing. Jan Pacina, Ph.D., Mgr. Eva Chodejovska, Ing. Jan Popelka, Ph.D., J. E. Purkyne University in Usti nad Labem, Czech Republic.....683

88. INTERPRETING RESULTS OF A GIS-BASED LANDSLIDE SUSCEPTIBILITY ASSESSMENT USING GEOTECHNICAL INVESTIGATIONS FOR A ROAD SECTOR IN NORTH-WESTERN ROMANIA, Prof. Ioan-Aurel Irimus, Dr. Flavia-Luana Marian (Magut), Dr. Sorin Zaharia , Babes-Bolyai University, Romania 691

89. INVESTIGATION OF DIFFERENT VISUALISATION METHODS FOR CRIME MAPPING, Ass. Prof. Andrea Podor, Sandor Soos, University of West Hungary, Hungary 699

90. LANDSCAPE CHANGES IN THE NORTH-WEST BOHEMIA AND THEIR VISUALIZATION, Doc. Jiri Cajthaml, Dr. Jan Pacina, CTU in Prague, Czech Republic.....707

91. LOGISTIC MODELLING TO HANDLE THE THREAT OF FLOODS – THE BODVA RIVER EXAMPLE, Prof. Ing. Miroslav Kelemen, PhD., Ing. Monika Blistanova,PhD., University of Security Management in Kosice, Slovakia 715

92. LOW COST VIDELOGGING AND GEOREFERENCING AS A COMPONENT OF THE ROAD MANAGEMENT SYSTEM, Arjol Lule MSc., Eduart Murati, Diana Bardhi, MSc., Polytechnic University of Tirana, Albania 723

93. MAPPING OF RISKS FOR NOT URBANIZED TERRITORIES, Natalya Trofimova, Olga Antamoshkina, Ph. D. Sergey Verkvovets, Ph. D. Natalya Koshurnikova, Siberian Federal University, Russia.....731

94. MEASURING INHABITANTS QUALITY OF LIFE USING GIS-BASED ACCESSIBILITY ANALYSIS,
Anna Fijalkowska, M.Sc., Warsaw University of Technology, Poland.....737

95. METHOD OF ERROR ASSESSMENT IN IMAGE CLASSIFICATION,
Assoc. Prof. Dalibor Bartonek, Ing. Jiri Bures, PhD., Ing. Irena Opatrilova, Ing. Alexej Vitula, Brno University of Technology, Czech Republic 745

96. MODELLING AS A PLATFORM FOR LANDSCAPE PLANNING,
Assoc. Prof. Dr. Eva Pauditsova, Ing. Barbora Slabeciusova, Comenius University Bratislava, Slovakia.....753

97. MONITORING VEGETATION AREAS THROUGH SATELLITE IMAGES. NDVI IN SOUTHERN PART OF OLTENIA PLAIN (LEU-ROTUNDA AND DABULENI AREAS), PhD student Florina Cristina Rosca, Prof. univ. Danut Petrea, Babes-Bolyai University, Romania 761

98. NEW GEOMETRIC SOLUTIONS FOR WEB MAP TOPONYM PLACEMENT, Assist. Prof. Robert Zupan, prof. Stanislav Franges, University of Zagreb, Faculty of Geodesy, Croatia.....769

99. POSSIBILITIES OF THE DEFINITION OF CITY BOUNDARIES IN GIS – THE CASE STUDY OF A MEDIUM-SIZED CITY, Dr. Jaroslav Burian, Msc. Vit Paszto, BSc. Barbora Langrova, Palacky University in Olomouc, Czech Republic.....777

100. PRAGUE URBAN FORM FEATURES AND THEIR IMPACT ON TRANSPORT SUSTAINABILITY, Vitalii Kostin, Assoc. prof. Lena Halounova, Vojtech Hron, CTU in Prague-Faculty of Civil Engineering, Czech Republic 785

101. QUALITY ASSESSMENT OF DIGITAL TERRAIN MODEL DERIVED FROM LIDAR, PhD Student Daniela Iordan, Lecturer Dr. Daniela Cristiana Docan, University of Agronomic Science and Veterinary Medicine - Bucharest, Romania.....793

102. REALIZATION OF OPENSTREETMAP PROJECT POSSIBILITIES: SPECIAL GIS SOFTWARE DESCRIBED BY USING CASE STUDY OF TRANSPORT INFRASTRUCTURE, Dr. Anton Pashkevich, Tallinn University of Technology, Esonia 799

103. RECOMMENDATIONS FOR ALTERNATIVE DESIGN OF MLBS APPLICATIONS, Assist. Prof. Robert Zupan and Prof. Stanislav Franges, University of Zagreb, Faculty of Geodesy, Croatia.....807

104. REQUIREMENTS FOR A WEBSITE SUPPORTING SOCIAL PARTICIPATION IN SPATIAL PLANNING AT THE COMMUNE LEVEL,
Dr. Joanna Jaroszewicz, Dr. Pawel Kowalski, Warsaw University of Technology, Poland.....815

105. SELECTED BASIC METEOROLOGICAL ELEMENTS AND THE POSSIBILITY OF THEIR CARTOGRAPHIC REPRESENTATION,
Ing. Viera Hurcikova, PhD., Ing. Sona Molcikova, PhD., Technical University of Kosice, Slovakia 823

106. SETTLING SELECTION PATTERNS IN THE SUBCARPATHIAN AREAS OF ROMANIA. SALT RESOURCES AS A DETERMINING FACTOR FOR PREHISTORIC OCCUPATION, PhD Andrei Asandulesei, PhD Marius-Tiberiu Alexianu, PhD Roxana-Gabriela Curca, MA Stefan Caliniuc, PhD candidate Mihaela Asandulesei, Alexandru Ioan Cuza University, Romania 829

107. SIMPLE METHOD FOR INCORPORATION OF TOPOGRAPHICAL FACTOR INTO GIS-SUPPORTED MULTI-VARIANT RAIL ROUTE SELECTION, Dr. Tomasz Pirowski, Dr. Wojciech Drzewiecki, Emilia Orzinska, AGH University of Science and Technology, Poland.....841

108. SOFTGIS AS TOOL SUPPORTING THE MANAGEMENT OF URBAN GREENERY, PhD Magdalena Nowak, PhD Sebastian Goraj, PhD Marta Gwiazdzinska-Goraj,, University of Warmia and Mazury, Poland.....853

It is good to keep in mind the scale and the associated degree of generalization newly emerging map at all points mentioned above.

CONCLUSION

The paper described the possibilities of boundaries representation in the new Academic Atlas of the Czech History and in historical maps generally. The emphasis was placed on the mutual cartographic distinction of current and historical boundaries and on the clear representation of boundaries in different types of surface. Shortly were mentioned also issues related to source data for the historic boundaries together with their possible solutions.

REFERENCES

[1] Semotanová E. & Cajthaml J. et al., Akademický atlas českých dějin (Academic Atlas of the Czech History; in Czech) Czech Republic, 2014.

[2] Janata T. & Seemann P. & Cajthaml J. & Zimová R., Designing Maps for a New Thematic Atlas of the Czech History. In 26th INTERNATIONAL CARTOGRAPHIC CONFERENCE PROCEEDINGS, Germany, 2013

[3] Slocum T. A. et al., Thematic Cartography and Geovisualization, USA, 2009.

[4] Brewer C. A., Design better Maps A Guide for GIS Users, USA, 2005.

[5] Hojovec V. et al.., Kartografie (Cartography; in Czech), Czech Republic, 1987.

[6] Kartografie PRAHA a. s., Školní atlas světa (School Atlas of the World; in Czech), Czech Republic, 2013.

[7] Cornelsen Verlag, Putzger Historischer Weltatlas (Putzger Historical World Atlas; in German), Germany, 2011.

[8] Wydawnictwo Szkolne PWN Sp. Z o.o., Atlas historyczny 1815-1939 – szkoła ponadgimnazjalna (Historical Atlas 1815-1939 - secondary school; in Polish), Poland, 2008.

[9] Marix Verlag GmbH, Dr. Walter Leisering (Hrsg.) Historischer Weltatlas (Dr. Walter Leisenring (ed.) Historical World Atlas; in German), Germany, 2011.

[10] Reader's Digest Výběr, spol. s. r. o., The Reader's Digest World Atlas (translated into Czech), Czech Republic, 2006.

[11] Times Books Group Ltd, The Times Comprehensive Atlas of the World Eleventh Edition, United Kingdom, 2005.

[12] Purš J. ed., Atlas československých dějin (Atlas of the Czechoslovak History; in Czech), Czech Republic, 1965.

CHATEAUX AND CASTLES IN THE CZECH REPUBLIC: OLD MAPS AND PLANS PROCESSING

Assoc. Prof. Ing. Jiri Cajthaml, Ph.D.

Ing. Jiri Krejci[1]

Czech Technical University in Prague, Faculty of Civil Engineering, **Czech Republic**

ABSTRACT

Chateaux and castles are an important part of cultural heritage in the Czech Republic. The main focus of our project is to put together all the historical maps and plans of chateaux and castles as well as their historical photographs within the web mapping application. The emphasis is put on the surroundings of the main objects. There are many interesting buildings, parks, sculptures and churches nearby. All these objects can be found on historical mappings or other plan materials.

The processing of old maps is performed during the first phase of the project funded by the Czech ministry of culture. Old maps are collected and georeferenced. After that is the vector data model being created and fulfilled. All these maps and created data are prepared to be used in geographical information systems. Besides map material, 3D models of castles and chateaux can be created. All outputs of the project (georeferenced maps, vector data models, 3D models of castles, buildings reconstruction) are easily accessible by the web mapping application.

Keywords: old maps, georeferencing, cultural heritage, web mapping

INTRODUCTION

The project itself is based on a cooperation of five public institutions and it is aimed mainly on the research of historical photographs particularly of aristocratic families and therefore also theirs chateaux, castles and manors. One of the project goals is to gather and online publish old maps and plans of these objects (castles, manors) and create complex web mapping application accessing not only these old maps, but also located historic photographs. Old maps, along with historic photographs, views, paintings and text documents can offer us new views into the history of castles, manors and aristocratic families. The project deals with 60 chateaux and castles formerly in property of noble families and at the present times under the administration of National Heritage Institute (*Národní památkový ústav - NPÚ*).

Various old maps and plans are being collected and processed to be usable for the web mapping application. Generally there are three groups of old maps related to the scale and map content. Floor and buildings plans are used to show chateaux interior. Cadastral and similar maps depict surroundings of castle and its closest economic background. Maps of Military Mapping Surveys and maps of domains compose last level representing the whole domain and wider economic and cultural background of the chateau. Much important information which are recorded only in text documents are

collected via archival survey. Subjects of interest are not only castle buildings, but also service yards (farmsteads), mills, sawmills, iron-mills, gamekeeper's houses, churches, chapels, important statues and so on. Selected important objects on maps as well as object recognized by archival survey are entered into the vector data model. Close surroundings of castles on these selected maps are vectorized fully allowing a comparison of land-use and castle area development.

These above mentioned maps, plans and vector data create a frame for localized historical photography. Publication of all the data in the web mapping application facilitates thorough the view of a chateau and the comparison of situation in different periods of time.

SOURCES OF MAPS AND PLANS

There are various sources of old documents (maps) related to castles and domains at several institutions dealing with old maps, plans, photos, documents, etc. The vast majority of collected sources belong to public institutions, few to the private sector. Most of these sources can be divided into following categories considering the administrating institution or owner as well as the availability for project and state of deposition. The most important maps will be mentioned more thoroughly.

First category includes maps which can be used for any objects. Generally it concerns well available national map series. Imperial Imprints of Stable Cadastre, other old cadastral maps, 1st, 2nd, 3rd Military Mapping Surveys, state derived map (*státní mapa odvozená – SMO5*), present cadastral maps, base maps (*základní mapa - ZM*), etc.

As one of the most important map source we use scans of Imperial Imprints of Stable Cadastre provided by Czech Office for Surveying, Mapping and Cadastre (*Český úřad zeměměřický a katastrální - ČÚZK*). These maps from the first half of 19th century in scale 1 : 2,880 cover almost the entire Czech republic, but even more the former Austria-Hungary. Due to theirs geometric precision and also graphic attractiveness the Stable cadastre maps are an excellent base layer for web application suitable also for vectorization.

Maps of three Military Mapping Surveys originated in between 2nd half of 18th century and end of 19th century in scale of 1 : 28,800 (or 1 : 25,000) are used as a base for overall depiction of aristocratic domains and their economic and cultural backgroud. Their accuracy is quite surprising [1].

SMO5 (state derived maps) in scale of 1 : 5,000 from early fifties of 20th century illustrate situation before significant changes later on. These maps are convenient pattern helpful for Stable cadastre georeferencing.

The following categories include maps which are not accessible for all these objects, so used maps are not the same for each object. Second category obtains sources which are under the administration of NPÚ, administrator of chateaux and castles selected for the project.

There are two main database system in NPÚ to manage old documents (maps, plans, views, photos). A CastIS is the information system to handle all the chattels on all the objects of NPÚ. There are various information about the item, usually including a preview photo. Unfortunately, not all the subjects are in the database. State of work

differs a lot castle to castle as it depends on the person in charge. Another database, MIS (Meta Information System) is related to GIS. Records thus should have been connected to the reference points. Unfortunately, neither this database can be considered as complete. State of work depends on district department of NPÚ. Despite of going through these databases, there are many more documents which can be found. Therefore the archival survey is essential part of the work and many maps, plans, views and photos can be found straight in the castle archives. Another important source in NPÚ are central map and plan archive and archive of photographs.

Different kinds of documents can be found there. Important are plans of structural-historical surveys, indicating development of castle buildings. There is also a great number of historic photographs to be found.

Another category are maps and plans deposited in public archives (State Regional Archives, State District Archives, municipal archives). There is a great number of historical documents, including maps and plans. Unfortunately, just a small part of archival documents has been already digitized. Even worse some of the funds haven't been inventorized yet, due to misbehave and many organizational changes in the past. Nevertheless, these archives are an exceptional source of interesting maps and plans.

All kind of maps and plans can be found in public archives. The important maps are of domains, castle surroundings, parks, gardens and forestry maps. These maps record economic and cultural background of the castle. Old buildings plans, floor plans along with plans of structural-historical surveys from previous category are essential to show the development and the use of castle buildings and interiors.

METHODS

Undoubtedly, the most used source on spatial information of castles or chateaux contains maps and plans. As the aim of the project is to prepare data to be visualized in web map application, spatial data should be stored in a common reference coordinate system. Our method of maps processing is based on three phases: digitizing (scanning), georeferencing and data preparation for internet publishing.

Old maps and plans are scanned with appropriate values of resolution (at least 300 dpi) and color depth (usually 24-bit). If scanning of analog media is not possible (e.g. maps attached on wall) the only possibility is to photograph them. During photographing is necessary to keep in mind drawbacks of this method (especially some types of distortion). Scanned data are stored in lossless graphic formats, such as TIFF.

The very actual problem is georeferencing of maps. This process is very complex and can bring many problems. There are some recommendations that can lead to quality georeferenced data. First, data should be georeferenced in the same (or much relative) reference coordinate system in which it was created. It is important mainly if provinces or states are depicted on the map and the scale of the map is quite small. Then the differences between cartographic projections can be obvious. Second, the ground control points should be distributed well within the area. It is advisable to collect more ground control points than needed. Then, after choosing the transformation type, data can be adjusted and statistically tested.

The core of georeferencing process is a geometric transformation. There are many types of transformation, either global (with unique transformation key) or local (usually based on interpolation methods). The global transformation methods can hold some geometric parameters of the image and can be used together with statistical testing during adjustment. In fact, ground control points have some residuals after transformation and thus don't fit any more. The local transformation methods can distort the image locally and ground control points fit precisely after the transformation. For much of the used material within our project, the global transformation methods were used.

There is one more problem with georeferencing maps. If we have map series with many map sheets, it is desirable to create a seamless map. Map sheets can be georeferenced individually but they don't fit together. The classic methods use second step transformations, where map sheets are fitted together. Cajthaml [2] proposes the new method where all the transformation parameters are adjusted together with conditions of identity of adjoining edges of map sheets. This method was used for maps of First Military Mapping Survey. Similar method uses Molnar in area of Hungary [3]. Cadastral maps (Stable cadastre) were georeferenced separately, but continuing drawing of adjacent sheets was monitored carefully.

After proper georeferencing, the data should be stored in usable format for an internet presentation. Color depth should stay at 24-bit, raster format can change due to large amount of data in TIFF format. Georeferencing information can be stored in the file header of graphic data or in separate file (world file). If more complex transformation has been used (local transformation or higher polynomials) usually the data must be resampled as there is no standard method how to store outputs of these georeferencing methods.

When having all scanned data in common reference coordinating system it is time to prepare vector data model. The vector data has many advantages and therefore, for specific layers it is better to convert raster data to vectors. Nowadays vector data are usually stored in geodatabases. The database can store geometric objects (points, lines, polygons) together with their relations and attributes. In our project it was important to create data model which can be used for many different objects. The focuses of the project are buildings nearby castles' or chateaux' main buildings or buildings and areas somehow connected with them. Main attributes created in the model are types of buildings, year of their creation and purpose of their usage.

Vector data can be used not only for buildings and areas information. If we vectorized whole surroundings of the castle in different time epochs, we can observe changes of land-use during time. These changes can be studied together with the history of main object. For this type of analysis it is essential to control objects' topology and attribute domains for data consistency.

Besides 2D vector data model covering surroundings of the main objects, it is possible to create 3D model of selected buildings. It is possible when the building plans or other plan documentation is available. Photographs or film material can provide textures of non-existing objects. 3D modeling is very popular in connection with Google Sketch-Up technology. 3D terrain can be reconstructed as well [4].

Historical photographs or paintings can be used as supporting material as well. These types of documents can be georeferenced by reference point (localized). There exist

many old photographs of castles and chateaux with their surroundings. All these photographs can be localized and can be used in the internet application.

The best way how to present georeferenced maps, vector data model or supporting image material could be web mapping application. This kind of application should be simple and clear to be used by wide public. There are several main internet technologies that can be used for such purpose. Google maps API is simple and clear framework for creating such applications. But, it is not designed for using own raster data in the background. Other coordinate reference systems can't be used as well. Better solutions are presented by map servers (either commercial or free) and their graphical user interface (GUI) usually based on JavaScript.

The top modern methods of web map applications are based on cloud technology. The application together with data is stored in cloud (network storage running on specific hardware and software of the provider). ArcGIS Online can be mentioned as one of these methods [5].

CASE STUDIES

Actual results of project can be shown on two testing objects – castle Konopiště and chateau Slatiňany. Different maps were collected from several sources. Maps of Stable cadastre create a base layer and were vectorized too. The comparison of maps of Stable catastre, vector model of cadastral maps from 1891 and present cadastral map can be seen on Figure 1a. Vector model of Stable cadastre overlaying present orthophoto is depicted on Figure 1b. Figure 1c shows vectorized floor plans with distinguished temporal origin (architectural style). Composition of 2nd Millitary mapping and map of domain with polygon delimitating domain is on Figure 1d.

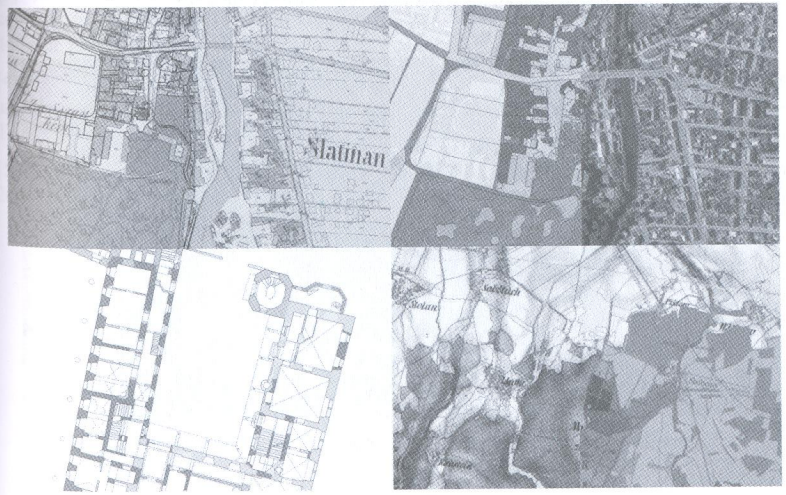

Figure 1 – Illustration of different processed maps – layers
(numbered from left to right a, b, c, d)

Georeferenced maps, vector data and localized photos are being published on the Internet. Two technologies were used so far. Figure 2 depicts web application based on ArcGis Online. Example of an application based on ArcGIS for Flex is on Figure 3. Meanwhile the processed data from all the objects can be seen online at http://gis.fsv.cvut.cz/zamky.

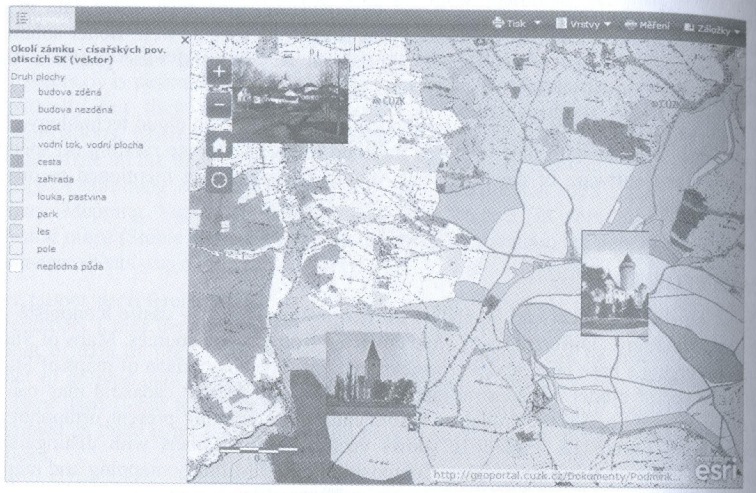

Figure 2 – Depiction of web mapping application using ArcGIS Online

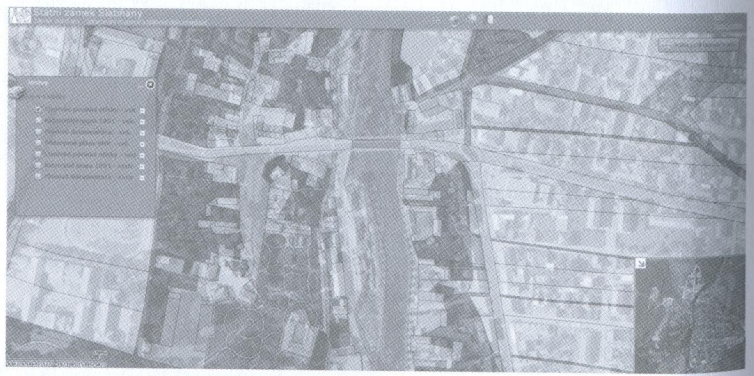

Figure 3 – Depiction of web mapping application using ArcGIS for Flex

CONCLUSIONS

The project makes accessible plenty interesting maps, plans, documents, views and last but not least also photographs to the general public interested in history, cartography, photography, castles and their aristocratic owners. The composition of different types of documents in the web mapping application makes available these documents not only as an isolated archival items but also in much wider sense showing deeper relations. It brings new ways in the presentation of cultural heritage – castles, maps, photographs, etc, to the large public.

This work was supported by the Czech ministry of culture by the NAKI programme "Historical photographical material: identification, documentation, interpretation, record keeping, presentation, application, care and protection in the context of basic types of commemorative institutions" no. DF13P01OVV007.

REFERENCES

[1] Zimová R., Pešťák J., Veverka B. Historical Military Mapping of Czech Lands - Positional Accuracy of Old Maps. GIM International - The Global Magazine for Geomatics, vol. 20, no. 10, pp. 21-23, 2006;

[2] Cajthaml J. Analysis of old maps in digital environment on the example of Müller's map of Bohemia and Moravia. Praha: Česká technika - nakladatelství ČVUT, 172 p., 2012. (in Czech);

[3] Molnar G. Making a georeferenced mosaic of historical map series using constrained polynomial fit, Acta Geodaetica et Geophysica Hungarica, Hungary, vol. 45/issue 1, pp. 24-30, 2010;

[4] Pacina J., Weiss L. Georelief reconstruction and analysis based on historical maps and aerial photographs. In Proceedings of Symposium GIS Ostrava 2011. VSB - Technical University of Ostrava, 2011;

[5] Havlíček J., Müller A., Janata T. Publishing Old Maps as Dynamic Map Services. In 26th International Cartographic Conference Proceedings. Dresden: International Cartographic Association, pp. 861-862, 2013.