

CONCEPT OF A SPATIO-TEMPORAL GEOINFORMATION SYSTEM OF THE BIBLE EVENTS - DATABASE APPROACH

A.J. Linsenbarth
Institute of Geodesy and Cartography, Warsaw, Poland – (adam.linsenbarth@igik.edu.pl)

ICWG IV/VII

KEY WORDS: History, Cultural Heritage, Bible, Cartography, GIS, Satellite, DTM

ABSTRACT:

The paper presents the concept of a spatio-temporal geoinformation system of the Bible events. In 2006 in the Institute of Geodesy and Cartography in Warsaw, the research project dealing with the concept of a complex time related spatial information system was undertaken. The main goal of this project was to create a spatio-temporal system, which allows to connect the Bible contents, namely the geographical objects indicated in the Bible with the geospace, presented on various geographic and Bible thematic maps. The proposed spatio-temporal system consists of three databases: the reference maps database, the geographic objects database and the thematic database. The reference maps database consists of DTM and vector maps in three scales: 1:20 000 000, 1:1 000 000 and 1:200 000 depending on the extent of the mapped territory. The most up-to-date topographical maps in various scales, as well as, the satellite images and the digital terrain models (DTM) were used for compilation of reference maps. In the geographic object database the list of all geographical objects occurring in the Bible is located. For all objects the status of the degree of their identification in the geospace is given. The changes of names of the geographical objects within the various periods of history are introduced to the database. Also a brief description of each object is added. In the geographic object database the list of all geographical objects occurring in the Bible is located. For each one geographic name its appearance in the Bible text is indicated. Also the brief description of each object is added. In the thematic database, the Bible events are listed in chronological order and described in accordance with the Bible texts and non Bible sources. Due to the interaction of the information incorporated in these databases, the reader of the Bible, has a connection with the proper maps and location of the geographic object and has an access to the additional information regarding accuracy of identification, appearance of the name of this object in all chapters in the Bible and description of this object in the various periods of history.

INTRODUCTION

The Bible cartography constitutes a very specific category of the historical cartography. This specific character is determined mainly by the following factors: a very long time of the Bible history and a very huge area on which the events described in the Bible occurred. In this long historical time which stretches over 4 000 years a lot of changes occurred on this territory such as the changes of the country boundaries, the changes in locations of settlements and towns as well as the changes in land cover.

The Bible cartography is represented by the two basic forms: Bible atlases and Bible maps. The Bible atlases appear in an analogue form and in a digital-computerized form. Also maps appear in these two forms.

There are several Bible atlases which represent various content and various approaches to the cartographic presentation of the Bible events and to the territory on which these events occurred. The performed analysis of the content of the Bible atlases indicated that they can be divided into three groups according to relation between the history of the Bible events, the universal history and the geography of the Bible territory. There are various proportions in these relations. Furthermore sometimes the atlases consist only of maps but, on the other hand, there are atlases which present a combination of cartographic maps with text books and can be treated as monographs of the Bible history illustrated with maps.

The extent of the Bible territory presented in these atlases sometimes covers the total area of the Bible history described both in the Old and the New Testament but in some atlases it is limited to the territory of the events which occurred only in the New Testament. Also the extent of the historical period is various. In some cases it is strictly related to the history of the

Bible events, sometimes it is not covering the full time of these events, but in several cases it is extended beyond this period; from the beginning of the Bible events up to the period after the Bible events.

EVALUATION OF THE CONTEMPORARY BIBLE CARTOGRAPHY

The evaluation of the contemporary Bible cartography, performed in the last years by the Institute of Geodesy and Cartography in Warsaw, indicated that most of the Bible atlases, present different quality of maps, both geographic and thematic, incorporated in these atlases (Linsenbarth, Wrochna, 2007).

The main disadvantage of Bible atlases is a lack of general reference map which should be used for the elaboration and edition of the thematic Bible maps. Hence the thematic maps are not homogeneous and very often, the same geographical features have various location on individual thematic maps. In the process of compilation and edition of the thematic maps, sometimes a large group of branch oriented specialists is involved hence the maps are prepared in various manners and in accordance to various schools of cartography. There are the Bible atlases which consist of maps prepared by more than 150 specialists and scientists (Linsenbarth, 2009). In many cases in the same atlas several projections are applied, hence it is very difficult to compare the maps and the same territory looks completely different. In many atlases there is a lack of the geographic grid on maps.

Very seldom general geographic maps giving better impression of a geography of the Bible territory are included. The orography is often very poorly presented. In some cases this presentation is done by the hypsometric method and only in few

cases it is presented by the digital terrain model enhanced by shadows. It is necessary to underline, that the terrain relief, in many cases has very strong influence on the occurrence of the Bible events. Hence the proper presentation of the terrain relief is the most important problem in the Bible cartography.

A very difficult problem, in the process of preparation of the Bible maps and atlases, is the presentation of the time changes which occurred during the history of the Bible events. During this very long period which covers ca 4000 years, several changes have taken place in the terrain geomorphology. Some lakes disappeared, water level changed, rivers were converted into wadies etc. Also changes caused by the human activity occurred in this period. There were many changes of the state boundaries, changes in the settlements and towns – some of them disappeared, some new were erected. The same geographic objects changed their names.

The performed analysis of the Bible atlases indicated various proportion of the thematic maps referring to the individual periods of the Bible events. In some atlases the same period is characterized by one map, while in the other atlases by several maps. Of course this depends on the appropriate idea of the atlas authors and on the final users to which the atlases are addressed. The number of maps in the atlases varied from 10 maps up to more than 100. Also the formats of atlases are various (Linsenbarth, 2009).

The performed analysis of the contemporary Bible cartography indicated that the improvement and modernization of the cartographic presentation of the Bible events, with the application of the up-to-date technology is very important (Linsenbarth, Mościcka, 2007).

GENERAL ASSUMPTION OF THE DATABASE APPROACH

The concept of the database approach is based on very strong connection of the Bible context with the modern cartographic techniques and technologies. Such solution can be only fulfilled on the basis of very close cooperation of the Biblicalists and cartographers. The exchange of the ideas between both sides created the background for the concept based on database approach of the spatio-temporal geoinformation system of the Bible events. The proposed system can be treated as the spatio-temporal information system related to the Bible events (Brzezinska, M, Moscicka A, Wrochna A., 2007)

The concept of the proposed system is based on the idea that the reader of the Bible should have the possibility to locate the geographical objects indicated in the Bible text on the proper map of the system. For each geographic object which has its name the information regarding the location as well as the accuracy of identification will be given. Furthermore the history of this object will be added. In the case of the Bible events, there will be a list of all Bible events on which the references to the proper Bible chapters and verses will be given. Additionally, the others non Bible sources which are referring to these events will be added. Further more the photographs of geographic objects will be included. In the case of dynamic events the flight over the terrain of the routes can be demonstrated (Brzezinska, Moscicka, Wrochna. 2007).

CORE DATA BASES OF THE PROPOSED CONCEPT

The proposed system consists of the three core databases:

- the reference maps database,
- the geographic objects database,
- the thematic maps database.

The reference maps database

The database of the reference maps constitutes the core component of the system. Due to very huge territory of the Bible events, which stretches in the East-West direction from the ancient Mesopotamia and Babylon to Italy, and in the North-South direction from Turkey to Egypt, it was decided to create three levels of the reference maps. For the full territory the scale 1:20 000 000 was applied, for the countries in the vicinity of the biblical Palestine the scale 1:1 000 000 was taken and for the territory of the Bible Palestine the scale 1:200 000 was chosen.

As a basic material for preparation of the reference maps various materials were collected and applied. The most up-to-date topographical maps in various scales were used as well as geomorphologic maps, geologic maps, archeological maps and climatic maps. Furthermore the satellite images covering the Bible territory as well as the digital terrain models (DTM) with various precision were used for elaboration of reference maps. Such reference maps present the actual state of the terrain. Of course in the long Bible history several geographical objects were changed. As the most stable element of the terrain topography the relief can be taken, but in some cases it was also changed by human activity or as a result of natural events. Of course in the long geological history, counted in millions of years, there were some changes in the terrain relief, mainly due to the Earth tectonic plates movements and geological faults appearing in this region. There is a huge shift of the Arabian Plate and African Plate causing the displacement of the Arabic Plate of ca 107 km to the north within the last 35 millions of years. It is necessary to draw attention that on the territory of biblical Palestine the great rift passing along the Jordan valley appears. Along this rift, the world biggest depression occurs (The Dead Sea - 418 m b.s.l. and Lake Gennesaret – 212 m b.s.l.), (Linsenbarth, 2008). Within the period of the Bible events there were changes of the water level of the Dead Sea and the Persian Gulf. Due to the changes of climate conditions the changes of the river water courses appeared. As a result of human activity some of the lakes disappeared like Lake Hule in the northern part of the course of Jordan River. The above mentioned changes have to be depicted on the maps referring to the individual periods of the Bible history (Linsenbarth, 2007). The proposed system allows to apply various forms of presentation of the reference maps such as simple digital terrain model, satellite images of the territory, satellite images together with the main geographic objects and other combinations according to the required purposes.

The geographic objects database

The geographic objects database constitutes the most important part of the system. In this database there is an index of the names of all geographical objects mentioned in the Bible text. Each object has its own specific identification. To each object, the precision level of its identification on the map is indicated. There are four categories of precision level identification: definite identification, approximate identification, uncertain identification and unknown identification. In the Old Testament there are several geographic objects of the unknown identification and many of them can only be very approximately located.

The names of geographic objects create a serious problem in cases when the same name is connected with different geographic objects, hence a very detailed analysis of the Bible text is necessary. Sometimes the same name is used in the Bible for the settlement and for the mountains (e.g. Samaria, Carmel). In other cases the same name is used for different geographical

objects, such as settlements with various locations (e.g. Gilgal). Another case appears when this same Bible object has different locations according to the individual archeological or cartographical sources. There are cases when the same name is used for separate parts of the city which were constructed in different historical periods. For example in Jericho, the remnants of settlements or forts, which were built in various periods of time are located very near each other and have the same name. The same names of geographic objects were used in different periods of history for various geographic objects. For example the name Araba in the Bible period was used for the valley between Lake Gennesaret and the Dead Sea. Presently the name Araba is used for the valley between the Dead Sea and the Gulf of Aqaba.

In the Bible there is a lot of geographic objects which changed their names in various historical periods. Let us present some examples. In the Old Testament, Dan was the northernmost town in biblical Palestine; hence the saying “from Dan to Beersheba”. Previously it was Phoenician trading post of Laish. When Laish was taken by Danites, they changed the name into Dan. The Greeks worshiped Pan, hence they called this city Paneas, which was later on changed into Baniyas. Philip, the son of Herod, built a city here and named it Caesarea after Augustus or Caesarea Philippi. Agrippa II changed the name to Neronias in honor of Nero. In the Crusaders' time the name of the city was Belinas. Presently the name Dan is used. Another example is Beit Shean, the town occupied by Thutmose III. During the Hellenistic period it was known as Scythopolis. Under the Arabs, Beit Shean returned back to its old name Beisan (Linsenbarth, 2008). The capital of Jordan Amman is another example of the name changes. The old name was Rabba cited by Jozue. During the Hellenistic period the name of the town was changed into Philadelphia.

There are also geographic objects which have various names in the same period of the Bible history and objects with different names used in the same chapter of the Bible. For example the Sea of Galilee appears under various names in the Gospel. St. Luke applied the name Gennesaret, St. Mathews and St. Mark used the name Sea of Galilee, but St. John used the name Sea of Tiberias.

In the database of geographical objects there is also separate index of all the names of geographical objects which appear in the Bible. On this list to each name the appearance of this name in all places in the Bible is indicated by its position in the proper chapter and verse. To each location of the geographic name in the Bible the citation from the proper verse in the Bible is given. This is some kind of so called concordance of the Bible geographic names. Such an index allows to evaluate and to analyze various cases of geographic names in the context of individual chapters and verses.

The thematic database

The thematic database is mainly dedicated to the description of the events presented in the Bible which are connected with the geographic objects. This module consists of the list of the individual Bible events described in one or more chapters. To each event, the position in the Bible, where this event occurs, is indicated. Furthermore, the citations of the verses, in which these events are described, are added. In the case when these same events are described in the two or more chapters, all these places in the Bible are referenced. In the case when there are also other historical sources referring to such events a short description of these events is added. Such solution allows to compare various, sometimes different descriptions of the same event.

All the geographic names which were used in the description of each event have a link to the index of geographic names incorporated within the database of geographic names and another link to the thematic map. In this index, beside the appearance of the name in different parts of the Bible, there is attached a description of the geographic object. In case of natural geographic objects like mountains, rivers, valleys etc., a short characteristic of the object is given. In case of countries, settlements or towns a description of the object is given with special attention paid to the occurrence of it in the Bible history as well as in the general history. On the thematic map referring to the countries or regions of individual historical period, the boundaries of these countries are presented as well as the other geographic objects taking part in the Bible events of this period. Also selected photographs presenting such object can be attached.

If the events described in the Bible have the dynamic character, such as the routes of patriarchs or routes of the armies, these routes can be presented on individual thematic maps referred to these events and furthermore they can be presented in a dynamic form. Additionally, for selected parts of the Bible territory *the flights* over terrain can be demonstrated. Such solution makes better perception of the territory described in the Bible. Very impressive are the flights over the Jordan Valley or along the other valleys like Arnon or Jarmuk.

CONCLUSIONS

The main goal of the presented concept of the database approach to the Bible cartography was the direct connection of the Bible text with the geographic space of the Bible territory. The readers of the Bible or the Bible scientists can have the direct connection with the maps presenting the respective parts of this territory with indication of geographical objects described in the individual parts of the Bible. The system allows to connect the respective Bible text, referred to the certain historical period, with the proper maps on which the geographic objects are depicted. Furthermore, from the index of the geographical objects the information of all locations of each geographic object in the Bible text as well as short description of each object can be extracted.

The presented concept of the database approach to the Bible cartography resulted from the research studies on the spatio-temporal GIS performed in the Institute of Geodesy and Cartography in Warsaw.

References

- Brzezińska, M, Moscicka A, Wrochna A., 2007. System informacji przestrzennej o wydarzeniach biblijnych jako narzędzie dokumentowania światowego dziedzictwa kulturowego (Spatial information system of the Bible events as a tool for documentation of World Cultural Heritage). Warsaw, *Geomatic Annals*. Vol 8, No 8, pp. 207-216.
- Linsenbarth, A., 2007. Geoprzestrzeń wydarzeń biblijnych (Geospace of the Bible events). Warsaw, *Geomatic Annals*. Vol.8, No 8, pp. 57-66.
- Linsenbarth, A., 2008. Dolina Dolnego Jordanu (The Lower Jordan Valley). Warsaw. *Przegląd Geodezyjny*. Year LXXX, No. 5, pp. 17-24)
- Linsenbarth, A., 2009. Critical remarks regarding the contemporary Bible Atlases. CD with papers presented on the 23rd Cartographic Conference, Santiago di Chile, 15-21 November 2009

Linsenbarth, A., Drachal, J., 2009. New Approach to the Bible Cartography. CD with papers presented on the Cartographic Conference at the Technical University in Vienna – 16-15 February, 2009

Linsenbarth A, Moscicka, A., 2007. Geoinformacyjne aspekty przedstawiania wydarzeń biblijnych (Geoinformation aspects of

the presentation of Bible events). 2007. Warsaw, *Przegląd Geodezyjny*. Year LXXIX, 3, pp. 8-12.

Linsenbarth, A, Wrochna A., 2007. Współczesne kierunki w kartografii biblijnej (Contemporary trends in the Bible cartography). *Kartografia No. 1*. Lublin, pp. 109-123.