

THE “HISTORICAL GIS GERMANY”

- A TIME ENABLED INFORMATION SYSTEM FOR GERMANY AND CENTRAL EUROPE, 1820-1914

L. Dietze¹, A. Kunz², A. Zipf¹

¹i3mainz, University of Applied Sciences, Mainz, ²Institute of European History (IEG), Mainz
dietze@geoinform.fh-mainz.de, kunz@ieg-mainz.de, zipf@geoinform.fh-mainz.de

Summary

The national GIS-based historical information system “HGIS Germany” is a joint research project conducted by the Institute of European History (IEG) and the Institute for Spatial Information and Surveying Technology (i3mainz). It researches the development of the German states between 1820 and 1914 down to the governmental district level, and combines this with a wealth of statistical data and information on the ruling dynasties and their mutual relationships. All this information is researched and managed in a spatially and temporally referenced information system. This information can be viewed via interactive web maps at <http://www.hgis-germany.de>.

1 Introduction

Regarding national unification, Germany is still quite young. In fact Germany had not been founded until 1871, and at this time consisted of 28 states. Before this, in 1820, a total of 41 states made up the German Confederation. Unfortunately historical information about geographical and political boundaries is scattered amongst various sources such as atlases or books. Hence, the main goal of HGIS Germany is to collect historical spatio-temporal data within an information system and to make this data available to historians and other interested users. In order to display the spatio-temporal development of Germany from 1820 on, a political map of Central Europe from 1820 was integrated as a base map (BÖHLER & KUNZ 2005, KUNZ 2007). This map demonstrates the political reorganization of Central Europe as decided by the Congress of Vienna in 1815, and it includes state- and administrative boundaries of upper and middling administrative entities.

2 Web Access to HGIS Germany for Everyone

To us, it was important to make historical information about Germany accessible and available to the general public and not only to historically minded GIS experts with special GIS software. This was realized by providing a web-based access to the data in the database.

Various queries resulting in a wide variety of maps can be generated easily through the web-based user interface. Thus the user does not need an expert systems such as ArcGIS.

2.1. WebGIS: a technical background

The base geometries have been investigated by the IEG, prepared or transferred into ArcGIS by i3mainz and stored temporarily in an ESRI geo-database. From there, the data was copied into a PostgreSQL database using the PostGIS extension. In order to be able to provide maps on the internet, a map server is necessary which is able to readout the geometries from the database and is then able to display them on a map. For this project the open source map server of the University of Minnesota (UMN MapServer) was used. The UMN MapServer is able to access the database and to administer the different temporal geometries. In order to stay flexible with respect to the map server, standardized parameter of the Open Geospatial Consortium (OGC: <http://www.opengeospatial.org>) „Web Map Service“ (WMS) and “Styled Layer Descriptor” (SLD) specification have been applied. This way, other map servers can be used, if they are more powerful or more adequate for the task. The OGC WMS specification is supported by most map servers, whereas the SLD specification is still less supported (WEISER & ZIPF 2005). SLD allows the expression of visualization rules for map display and symbols. A map server only has the ability to generate maps; however, the end user needs also a user interface in order to query the data and to be able to navigate within the map. For this we used Mapbender which provides modules for administering maps, users and map interaction. It has been customized and extended for HGIS Germany to allow the access and administration of the diverse attribute information and the time dependent geometries.

2.2 Possibilities of automated map generation in WebGIS

Within the main user interface there are two ways to generate a map (see Fig. 1).

The figure shows two side-by-side screenshots of a webGIS user interface. The left screenshot is titled 'States' and has three selection steps: 1) 'Select a state' with a dropdown menu showing 'Sachsen'; 2) 'Select a year' with a range selector showing '1895'; 3) 'Administrative structure' with a dropdown menu showing 'Administrative district'. A 'Generate map' button is at the bottom. The right screenshot is titled 'World of States' and has three selection steps: 1) 'Select a state world' with a dropdown menu showing 'Deutsches Reich (1871-1914)'; 2) 'Select a year' with a range selector showing '1900'; 3) 'Organisation' with a list of options: 'Entire area', 'Membership by rank', 'Political map', 'Administrative structures', and 'Topographic map'. The 'Entire area' option is selected and highlighted in blue.

Fig. 1: Selection for “states” and “world of states”

The main difference for the user is the decision between a selection of "states" or of "world of states". If the user chooses to search for "states", he or she will be able to access information about approximately 50 states within the German Confederation, the North German Confederation and the German Empire - all political unions of German states which existed from between 1820 and 1914. For structures pertaining to more than one state the term "worlds of states" has been coined to denote unions of states etc. Here, information for example about the German Confederation, the North German Confederation, the German Empire, the German Customs Union or the many German trade alliances formed in this period can be accessed. The following maps can be generated according to specified dates, when choosing "states": a.) individual state b.) provincial structures of the state, if existing and c.) district structures of a state, if existing. On the other hand the subsequent maps can be generated dynamically for each year if the user chooses "worlds of state": a.) complete area of the union for the time period (including enclaves and exclaves etc.); b.) type of membership in the selected "worlds of states"; c.) political map and d.) structure of the upper and middling administrative units for some states. In addition to these base maps, it is possible to derive a range of further overview- and thematic maps from the variety of attributes that have been researched and are thus accessible in the spatial database for each year:

- „Who married whom?“ for each state dynastic nuptial relationships for each year
- Map of the individual dynastic families, as single lines or joint lines that participated in each state union for each year
- Choropleth map of the population density of all governmental districts for each year
- Thematic map on the number and regional distribution of machine spinning in Prussia (selected years between 1837 and 1849)
- Thematic map on the output of brown coal, hard coal and iron ore since 1850
- Thematic maps on the production of pig iron and steel since 1850

The population density map and the maps showing the amount of mineral extraction are described later. Further data layers or overlays can also be displayed to ease orientation.

3. Online-Prototype of the HGIS Germany WebGIS

Fig. 2 shows the entry page of the English prototype of the WebGIS user interface, released in spring 2007. On the lower left hand side there are four buttons: (i), text/photo, crown, pie chart. These can be used to obtain more detailed information on the selected area. From left to

right, the following information is available: a introduction to the state or world of states, multimedia descriptions for all states and provinces along with the selectable state unions.

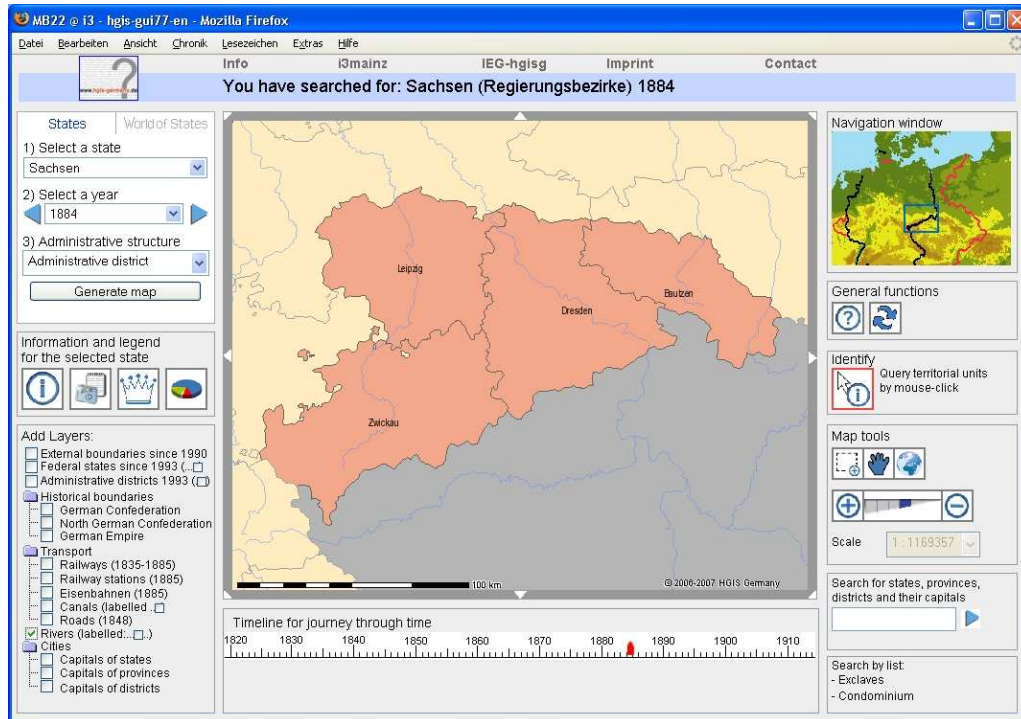


Fig. 2: 3rd Prototype of HGIS Germany WebGIS: administrative districts of Saxony in 1884

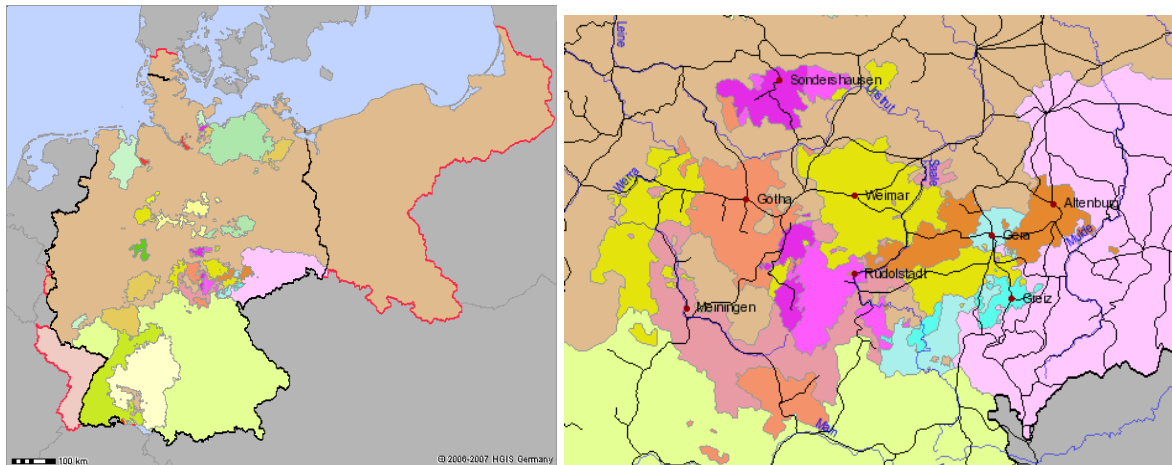
The 3rd button generates dynastic information, and the 4th one statistical information about the selected state. Maps can be made with the information given by clicking on the third and fourth button. There are many possibilities for navigating within the map (tools on the right hand side) and for adding theme-dependent layers (lower left hand side). Information about even smaller areas, such as exclaves, can be obtained by using the *Identify* button.

3.1 Information on “States”

The interested user is able to view all states of the former German Confederation and to activate overlays. By default, only the unlabeled state area is displayed. But, it is possible to load a large number of additional labels. If a state has administrative units, these structures can be viewed in combination with their capitals. However, it should be kept in mind that the types of administrative units have been standardized over time: Before 1823 the Kingdom of Hannover was comprised of so called “royal governmental provinces” („Königliche Provinzialregierungen“). As of 1823 so called “drosties” (“Landdrosteien”) were created, which had the same competences as governmental districts. Within HGIS Germany these

correspond to the government district level and are therefore labeled as such. The bordering country of Austria plays a minor role within the project: Information on Austria is only shown until 1865, from the end of the German Confederation until the beginning of the North German Federation. Special emphasis is laid on the queries for smaller units such as exclaves and condominiums. These can be selected and detailed information will be made available.

3.2 Information on "Worlds of states" (political unions etc.)



*Fig. 3a: Political map of the German Empire in 1885 with today's German border (1993)-
3b: Political map of the Thuringian states in 1885 (with railway lines, rivers, cities)*

In addition to querying for "states" the user has also the option to querying for "worlds of states". As already mentioned, this information is about alliances and interactions between states, which have formed some types of unions, such as the German Confederation or the German Customs Union, also including the State Union of Mecklenburg or other condominiums. Fig. 3 shows a result: A political map of the German Empire in the year 1885 and today's border of Germany existent since 1993. This demonstrates how territories existed then and now. HGIS Germany allows the user to pan around and to zoom in to the map. This is especially important because states and world of states differ greatly in size. Also capitals of the former states and railway lines are displayed. A fourth query is only available for the German Confederation, the North German Federation and the German Empire. The administrative structures can be mapped. For this, the smallest existent middling administrative entity is displayed. Smaller states do not usually have a sub structure but can be categorized as normal governmental districts.

4 Thematic Maps on Statistics and Dynasties using WebGIS

In addition to the main maps on “States” and “Worlds of States” and their attribute queries, diverse thematic maps can be rendered from the versatile data. At present, dynasty relations and historical statistics of a certain area can be linked to geographic information and can then be visualized. The following sub chapters describe some possible map queries.

4.1 Dynasty maps

A large range of relevant dynasty data for all states has been added to the database (KUNZ & MARBURG 2005). Users can query this data and visualize the interactions between the existing states. On a yearly basis, the following information is available for every state: closely related family members of the sovereign (if existent), the monarch’s wife, the wife of the heir to the throne and the husband of the first married daughter of the monarch. This data can also be received in text form. If the line of the monarch for the selected year also reigned in more than one state, a map of marital links can be generated for the respective monarch. Even the inexperienced user can see which areas, big or small, had been linked in that fashion.

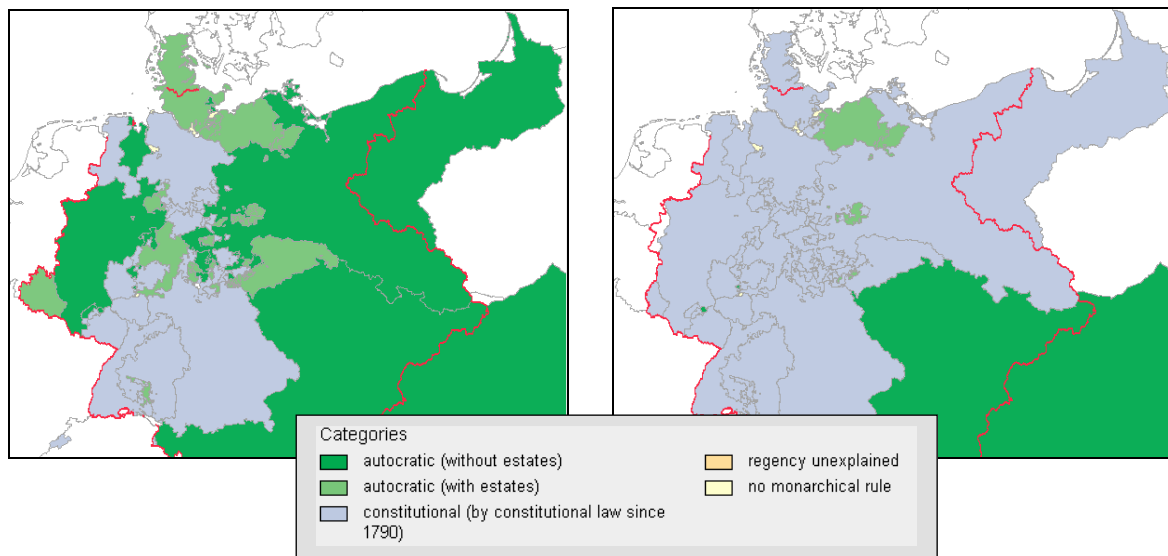


Fig. 4: Comparison of the constitutional conditions in the German Confederation in the year 1820 (left) and 1855 (right)

Fig. 4 shows a comparison of the constitutional condition of reign in the German Confederation. It can clearly be seen, that there were some changes between 1820 and the year 1855. Some countries switched from autocratic to constitutional rule. It is also possible to examine which of the reigning monarchs’ houses were parts of the German Confederation or of the German Empire.

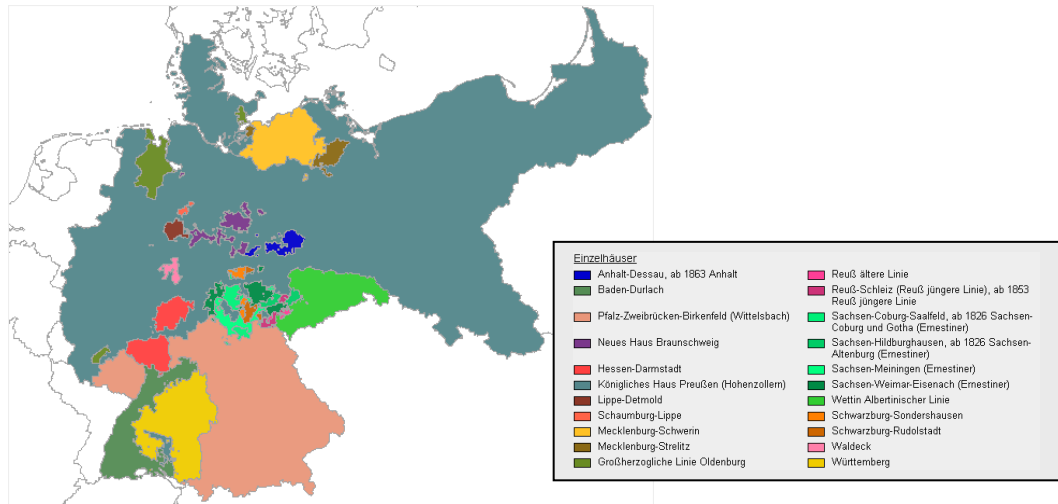


Fig. 5: Lines of the ruling monarchs in the German Empire, 1875

To display this, a map with an overview of all areas can be generated by year. All states within a house have the same color code. To enable a division between the separate houses, a map of the separate lines can also be displayed (Fig. 5). These lines are color coded in a shade of the main color of the house. This way the dynastic links between states becomes visible.

4.2 Maps on historical statistics

From the wealth of statistical data in the geo-database, a wide range of thematic maps can be dynamically created by using HGIS Germany's WebGIS-interface. For example, from 1820 until 1914 this is possible at the government district level in Prussia for the population density. In the years following 1850 there are further thematic maps showing the mineral extraction of hard or brown coal and iron ore.

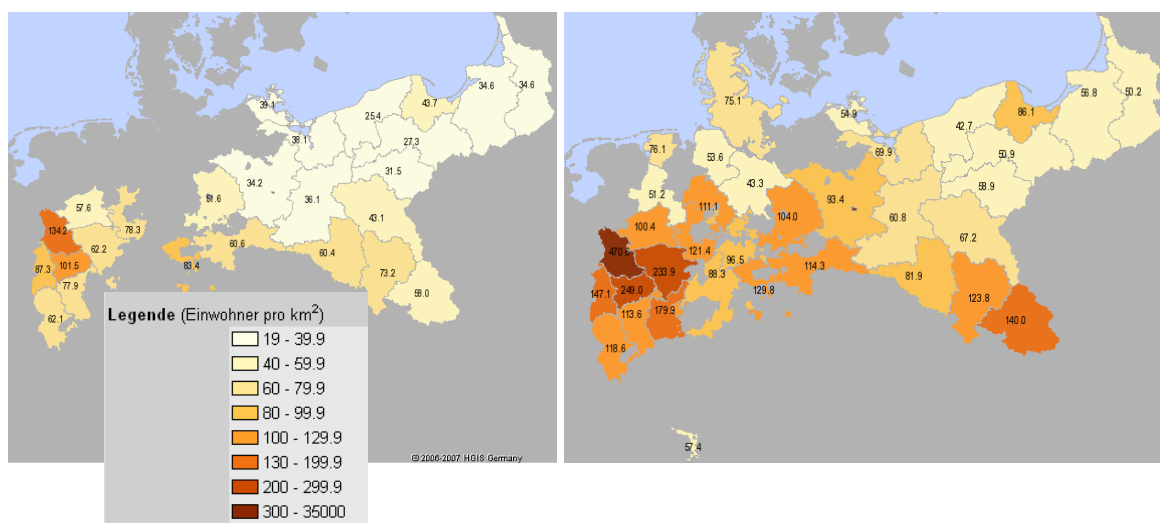


Fig. 6: Population density in Prussia between 1835 and 1900

The population density can be mapped as a choropleth map for every year, on a governmental district level. Fig. 6 shows the population density in Prussia from 1835 and from 1900. Within these 65 years, the population density and the area of Prussia experienced a large growth. In contrast to the map shown above, a more unified classification of the colours was chosen in order to visualize the change. When classifying the thematic data we needed to consider, that these classes need to be comparable over the whole time periods, therefore we have chosen an equidistant classification. Attention should be paid to the class with the highest values, here Berlin. It cannot be seen in the map at this scale, but this territory has experienced a broad range of population density within these 50 years, with values over 30'000 and under 10'000. Fig. 7 illustrates the amount of mineral extraction of hard and brown coal in Prussia in the year 1900. These figures are also available for all other states and all years since 1850. In the future we plan to make more statistical data available to the general public, in form of thematic maps, via the HGIS Germany WebGIS.

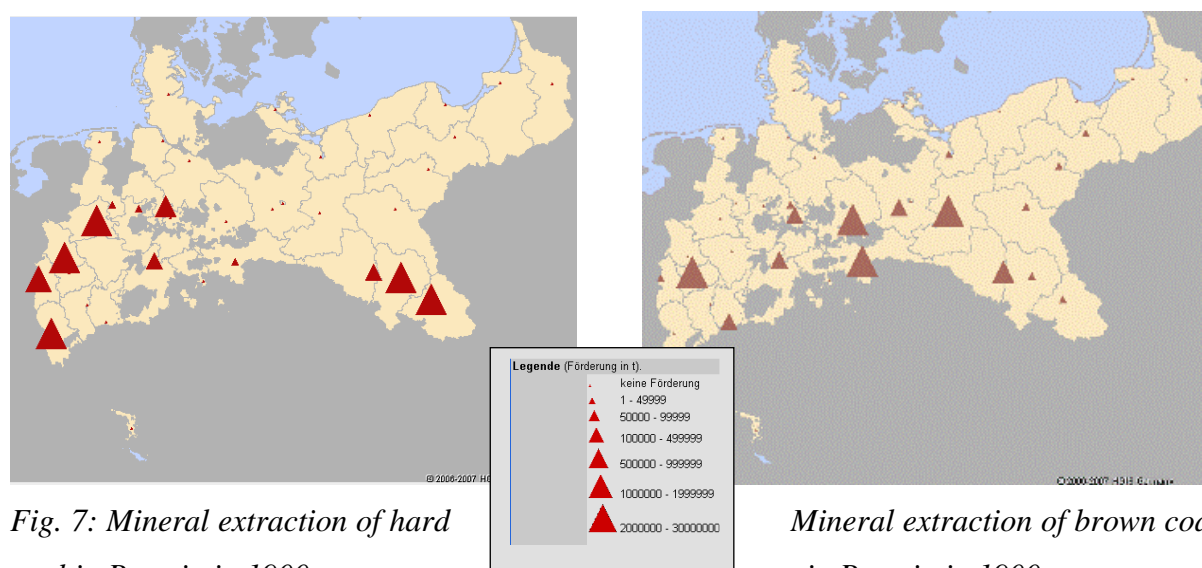


Fig. 7: Mineral extraction of hard coal in Prussia in 1900

Mineral extraction of brown coal in Prussia in 1900

6. Summary and Outlook

In the future we will provide even more functions, for example date dependent thematic maps based on historical statistics. We then want to focus on the temporal component by offering so called time travels or change maps. First examples of time travels have already been generated on the basis of the maps shown in Fig. 8 (population density maps). For this, the maps are created and displayed automatically, one after the other. Further, we may add elevation data of Central Europe. The 2nd draft of a time comparison map for the HGIS Germany WebGIS can be seen in fig. 8.

It shows the changes of the governmental district Dresden in the years 1854 to 1855. This type of map will also be available in form of thematic maps, within HGIS Germany online. It is obvious, that GIS play a vital role in historical research (cp. KNOWLES 2005). In the HGIS Germany project new historic knowledge has been researched and made available within a digital information service for the public and interested users. The data can also be analyzed by experts using the full power of GIS if needed (DIETZE et al. 2005). But even non experts without much technical knowledge can access the information easily. Also the project underlines the importance of interdisciplinary cooperation between historians and scientists working in the field of geoinformatics because for both sides the results and methodologies lead to important insights. The web based information system also provides a good opportunity for the general public to view the fascinating development of the German states and world of states through space and time.

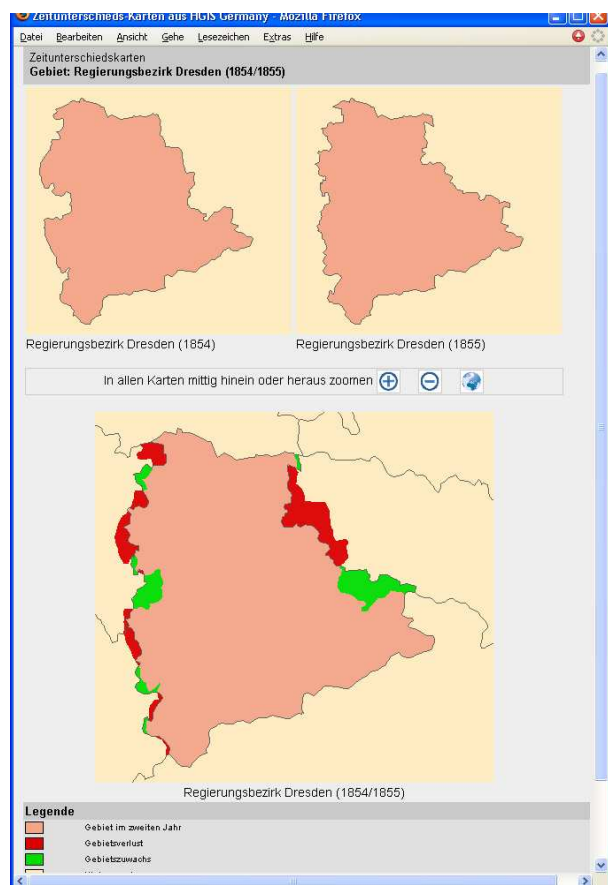


Fig. 8: Draft of a time comparison map in the WebGIS: District of Dresden 1854-1855

In March 2007 the latest version of the system has been made available for use at <http://www.hgis-germany.de>. For the first time ever, newly researched historical data about the development of the German worlds of states, between 1820 and 1914, is collected in one information system and the opportunity for exciting geo-temporal analyses is provided. Further, the HGIS Germany project shows the successful cooperation between two disciplines. The data can already be used by multiple different research teams. Many extension possibilities can be added if sponsors are found. HGIS Germany is an innovative way to present historical base data to a broad public audience. Other countries such Belgium, the Netherlands, Great Britain, Ireland and Portugal are also developing national HGIS systems. The possibility to link these systems in order to create a European HGIS is currently under discussion. For example China, Korea, Japan and the USA also have national HGIS projects

under way. Of course there is also a wide range of regional HGIS projects, but we focus here on the ones covering whole nations or states. Some links to other initiatives are available from www.hgis-germany.de.

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7 References

- BLUME, D., B. JOHNEN, A. KUNZ, S. MARBURG (2005): HGIS Germany - Ein raumbezogenes historisches Informationssystem der deutschen Staatenwelt im 19. Jahrhundert (1815/20 - 1914). In: BOOCHS, F. u. H. MÜLLER (Ed.): Entwicklungen auf dem Gebiet der Informations- und Messtechnik. Vol 6, Aachen, pp.168-179.
- BÖHLER W., A. KUNZ (2005): HGIS-Germany: An Information System on German States and Territories from 1820 to 1914. In: KNOWLES, A.K.(Ed.): Emerging Trends in Historical GIS. Historical Geography, Vol 33, Baton Rouge, pp.145-147.
- DIETZE, L., C. WACHTENDORF, A. ZIPF (2005): GIS-Funktionen und WebMapping im Historischen GIS Germany. In: BOOCHS, F. u. H. MÜLLER (Hrsg.): Entwicklungen auf dem Gebiet der Informations- und Messtechnik. Vol 6, Aachen, pp.147-167.
- KNOWLES, A. K. (Ed.)(2005): Emerging Trends in Historical GIS. In Historical Geography Vol 33. Baton Rouge, LA: Geoscience Publications.
- KUNZ, A: Exploring 'Worlds of States' Through Time and Space – Some Notes on the Online Information System 'HGIS Germany. In: Historisches Forum, 10 (2007), vol. II, pp. 289-301. (http://edoc.hu-berlin.de/e_histfor/10_II/)
- KUNZ A., S. MARBURG (2005): GIS and the Visualization of Dynastic Rule. The German Experience in the 19th Century. In: Ecai Shanghai Conference, Berkeley (USA), p.28.
- Weiser, A., A. Zipf (2005): A visual editor for OGC SLD files for automating the configuration of WMS and mobile map applications. In: 3rd Symposium on Location Based Services and TeleCartography. Vienna. Austria. 2005. Springer.
- Belgian Historical GIS: <http://www.flwi.ugent.be/hisgis/>
 - China Historical GIS: <http://www.fas.harvard.edu/~chgis/>
 - Great Britain Historical GIS: <http://www.port.ac.uk/research/gbhgis/>
 - National Historical Geographic Information System, United States, www.nhgis.org