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Technological innovations for the 2020 census round

Use of Geoinformation Technologies in the Preparation and Conduct of Population Census

Note by the National Statistics Committee, Republic of Belarus

Abstract

The use of geoinformation technologies is a new tool in the statistical practice of the Republic of Belarus for collecting and distributing up-to-date and objective data on the people of the country.

The paper provides information on the objectives and phases of the creation of the Population Census GIS, and describes the structure of the geodatabase. It also outlines main uses of geoinformation technologies in official statistics.

Considering user attention to the 2009 census data the NSC is continuing improving the Population Census GIS to use it in the preparation and conduct of the 2020 population census.

I. Introduction

1. The use of geoinformation systems (GIS) is a new tool for disseminating population census data in the Belorussian statistics; it has enabled better capturing of main demographic, social and economic estimates and identifying local specifics in their distribution.
2. In 2010, Belarus created the Population Census Geoinformation System (GIS) for disseminating final 2009 census data. The system was based on the paper mapping materials that were used for field operations during the 2009 population census.
3. As part of the preparations and conduct of the 2009 Population Census the State Property Committee's enterprises produced map materials for 205 cities and towns, 118 administrative regions, 30 large villages with a population over 3,000.
4. For cities, towns and villages they produced reference plans at a scale of 1 in 10,000 and site plans at a scale of 1 in 2,000; for administrative districts– site plans at a scale of 1 in 25,000 or 1 in 50,000 depending on the location of settlements.

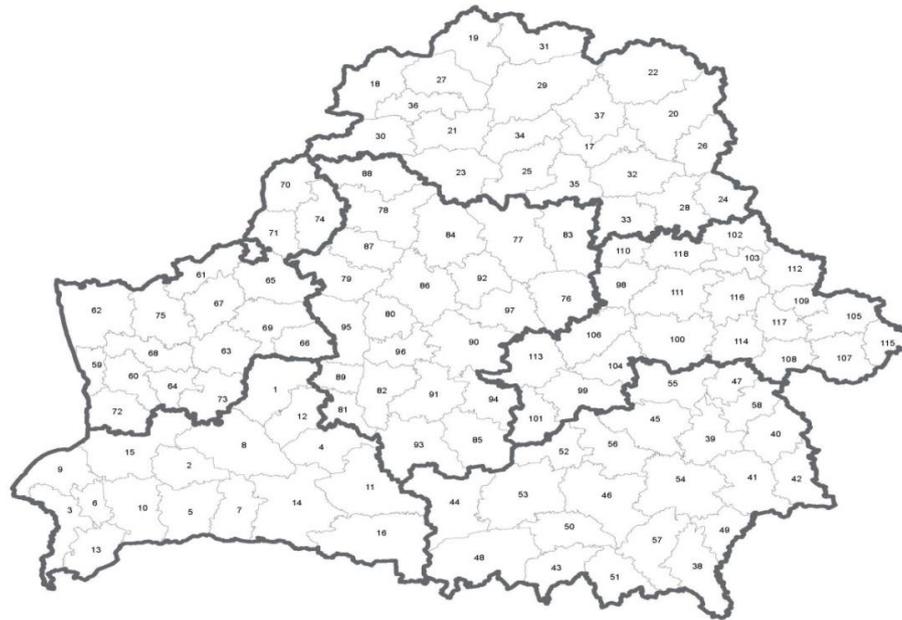
II. Objectives of the Population Census GIS

5. The objectives of the Population Census GIS included:
 - to create a database of spatial and attributive data of the Population Census GIS in ArcGIS format;
 - to link final 2009 Belorussian census data with relevant geographic areas of the baseline map;
 - to automate spatial analysis and to produce mapping and graphic (by business graphics means) presentations of final census data with standard ArcGIS means;
 - to provide users with mapping and graphics information, including in digital format for dissemination through the Internet.

III. Phases of the Population Census GIS

6. The core of the created geoinformation system is a single geodatabase the access to which users have through a local area network.
7. The geodatabase contains spatial classes or layers of the national, provincial and local borders. The objects in the layers have attributive data enabling their identification and matching with relevant locations.

Figure 1: National, provincial and local borders



Brest region	Vitebsk region	Gomel region	Grodno region	Minsk region	Mogilev region
<i>districts</i>	<i>districts</i>	<i>districts</i>	<i>districts</i>	<i>districts</i>	<i>districts</i>
1. Baranovichy	17. Beshenkovichy	38. Bragin	59. Berestovitsa	76. Berezino	98. Belynichy
2. Berezinsk	18. Braslav	39. Buda-Koshelyovo	60. Volkovysk	77. Borisov	99. Bobruysk
3. Brest	19. Verkhnedvinsk	40. Velika	61. Voronovo	78. Vileyka	100. Bykchov
4. Gantsevichy	20. Vitebsk	41. Gomel	62. Grodno	79. Volozhin	101. Glusk
5. Drogichin	21. Glubokoye	42. Dobrush	63. Dyatlovo	80. Dzerzhinsk	102. Gor'ki
6. Zhabinka	22. Gorodok	43. Vetsik	64. Zelva	81. Kletsk	103. Dribin
7. Ivanovo	23. Dokshitsy	44. Zhitkovichy	65. Iyve	82. Kopyl	104. Kirovsk
8. Ivatsevichy	24. Dubrovno	45. Zhiobin	66. Korelichy	83. Krupki	105. Klimovichy
9. Kamenets	25. Lepel	46. Kalinkovichy	67. Lida	84. Logoyak	106. Klichev
10. Kobrin	26. Liozno	47. Korma	68. Mosty	85. Lyuban	107. Kostyukovichy
11. Luninets	27. Micyr	48. Lelchitsy	69. Novogrudok	86. Minsk	108. Krasnopolye
12. Lyakhovichy	28. Orsha	49. Loyev	70. Ostrovets	87. Molodechno	109. Kirchev
13. Malorita	29. Polotsk	50. Mozyr	71. Oshmyany	88. Myadel	110. Krugloye
14. Pinsk	30. Postavy	51. Narovya	72. Svisloch	89. Nesvizh	111. Mogilev
15. Pruzhany	31. Rossony	52. Orlyanskiy	73. Slonim	90. Pukhovichy	112. Mestislavl
16. Stolin	32. Senno	53. Petrikov	74. Smorgan	91. Slutsk	113. Ospovichy
	33. Tolochin	54. Rechitsa	75. Shchuchin	92. Smolevichy	114. Slavgorod
	34. Ushachy	55. Rogachev		93. Soligorsk	115. Khotimsk
	35. Chashniki	56. Svetlogorsk		94. Starye Dorogi	116. Chaussy
	36. Sharkovshchina	57. Khoyniki		95. Stalbitsy	117. Cherkov
	37. Shumilino	58. Chechersk		96. Uzda	118. Shklov
				97. Cherven	

8. The spatial data in the GIS database are overlaid across the country in the WGS-84 coordinate system and have at least the same accuracy of the mapping materials prepared for the 2009 Population Census in Belarus.

9. The Belstat continued the activities for further development of the Population Census GIS in the course of the preparations to the 2020 population census. In 2015, it updated the existing layers and created a new layer of address data linked to addresses of the raster base material with structure outlines in all settlements (satellite images, open source maps).

Figure 2: Example of an address layer



10. The attributive table of the address data layer contains the following data:
 - name of a settlement;
 - name of a street, square, avenue, etc.;
 - house number;
 - geographic coordinates.
11. The software consists of general and customized software. The Population Census GIS uses MS Windows Server 2008 as general software. For the customized software it relies on server ArcGIS and ArcGIS ArcInfo 10.2, as well as Microsoft SQL Server. ArcGIS works in the local area network controlled by a licence managing application which controls the number of simultaneously operating modules.
12. Tablets are planned to be used during the preparations to and in the conduct of the 2020 census. The use of address data layer will help to produce mapping materials and upload such data electronically into tablets and to use at all stages of the future population census:
 - verification of a household;
 - carrying out enumeration zoning;
 - estimation of a enumerators' work load;
 - monitoring of progress and dissemination of results.
13. Use of electronic maps will help to reduce costs due to the lower costs for paper maps.
14. The development of the Population Census GIS is still ongoing. Currently the Belstat is working on developing an automated construction of statistical areas based on the data from administrative sources for surveys and censuses. Currently, the Population Register of the Interior Ministry is considered as an administrative source of data.
15. The development of automated construction of statistical areas should be compatible with the Population Census geodatabase, use its resources and provide for:
 - aggregation of data from administrative sources, on address information, i.e. count records on those living in the same house;
 - information interlinks between objects of address layer in the Population Census GIS and aggregated data on the number of people based on the address data;

- identification of the area and borders of statistical areas as per established criterion on the resident population;
- division of the country and its parts into statistical areas. Thus, each user has to be able to indicate a province, region and settlement for which the division is to be made;
- colouring of statistical area borders;
- numbering of statistical areas within a region, district, provincial city that is not divided into regions;
- a possibility to manually adjust borders of statistical areas; and
- uploading statistical areas as separate shape files.

16. The activities for automated construction of statistical areas are intended to be completed later this year to be then tested during a census test.

IV. Uses of geoinformation technologies

17. In 2011, when Belstat completed the Population Census GIS, it issued a statistical collection ‘Spatial Presentation of the 2009 Population Census Results’ (Vol. 8). The publication contains 207 maps produced on the basis of census data on administrative units and major demographic, social and economic characteristics. The electronic copy of the publication is placed in the Internet at the web site of the National Statistics Committee of Belarus at www.belstat.gov.by.

18. Today the uses of the Population Census GIS are not limited to the population census only. There has been growing interest to the use of geoinformation systems as user-friendly and easy-to-see means to present official statistics.

19. The software solutions in the Population Census GIS enable linking any statistical data with mapping data and show how an indicator is distributed across the country, in a province, administrative district or a settlement.

20. The uses of the Population Census GIS for visual presentation of official statistics in various statistics areas can be found in statistical compilations issued by the National Statistics Committee and placed at its website. For example, Social Situation and Standards of Living, Environmental Protection, Science and Innovative Activities, SMEs, etc.

Figure 3: Example of a map showing emissions of pollutants into the air from stationary pollution sources, by districts



21. The available address layer allows using mapping materials for preparing and conducting sample surveys. The mapping materials created in the Population Census GIS are used for sampling in household living standards surveys and surveys for measuring employment.

22. Thus, the success of GIS as a separate area is based on the huge potential of geospatial information for issue solving and making informed decisions. The use of geospatial technologies is an integral part of census improvement efforts, first and foremost for producing detailed geographic data at a good scale as well as for obtaining better results and analysis.