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Using of GIS tools for analysis of organic waste management in Slovenia region Pomurje

Miran Lakota^{a*}, Denis Stajniko^a

^a *Department of Biosystems Engineering, Faculty of Agriculture and Life Sciences, University of Maribor, Slovenia*

Abstract

This paper introduces the possibility of using publicly available geographic spatial data for the study of biogenic waste management. A number of spatial data is publicly accessible in digital form on web portals or in a form of data layers, generated within various European initiatives and/or projects. Many data is accessible in a tabular form in municipal records. This paper systematically processes publicly available digital cartographic data on biogenic waste in Slovenia and data on collected waste in the Pomurje municipalities in 2011. These are collected to show the possible use of existing data sources for further analysis collection, determination of potential and optimization of material flow. A Geographic Information System (GIS) has been developed from the available data, which forms a good device for further analyses of such issues in combination with other publicly accessible digital geographical data layers. Practical examples show the collected data for the municipalities in Pomurje, and describe how to save the issue of managing biogenic waste and contribute to the increased use of alternative energy sources, using these tools.

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Keywords: Publicly available data; GIS; Biogenic waste; Pomurje; Alternative energy sources.

1. Introduction

Precision agriculture has been described as a continuous cyclical process of data collection, followed by interpretation and evaluation of the information acquired and implementation of management decisions in response

* Corresponding author.

E-mail address: miran.lakota@um.si

to it [1]. Due to the large amounts of organic and other municipal waste, we are faced with the problems what to do with waste and how to recycle, remake or even reused it [3]. Now days when the prices of mineral fuels drastically raise almost every day the production of biogas from biogenic waste seems like optimal solution. The waste is collected in municipalities and the process itself is regulated by municipal concessions. Slovenia has, this area regulated by a new regulation on waste, with effect from 31december 2011, the main point of this regulation is recycle and disposal of waste. Waste must be collected separately by source of origin. Each waste group has its own entry, after which it is classified. Mixing of different types of waste is strictly prohibited. For energy productions in biogas plants are of particular interest biogenic waste, such as kitchen waste, rotten food products, vegetable and fruit waste, green waste, etc. [4]. Data on collected quantities are usually published in local publications and reports. To complete whole study of biogenic waste management, need for the geographic information system (GIS) has shown. Where we could collect data in one place. And then it will be possible to make the study of complex potentials and logistic analysis. The purpose of this paper is to show how publicly available digital cartographic data on biogenic waste in Slovenia and data on collected waste in the Pomurje municipalities in 2011 are systematically processed.

2. Materials and Methods

2.1 QGIS

Quantum GIS (QGIS) is a user friendly Open Source Geographic Information System (GIS) licensed under the GNU General Public License. QGIS is an official project of the Open Source Geospatial Foundation (OSGeo). It runs on Linux, Unix, Mac OSX, Windows and Android and supports numerous vector, raster, and database formats and functionalities (www.qgis.org).

For building of digital maps the program Quantum GIS (Qgis) version 1.8.0-Lisboa was used. About window of program is shown on Fig. 1.

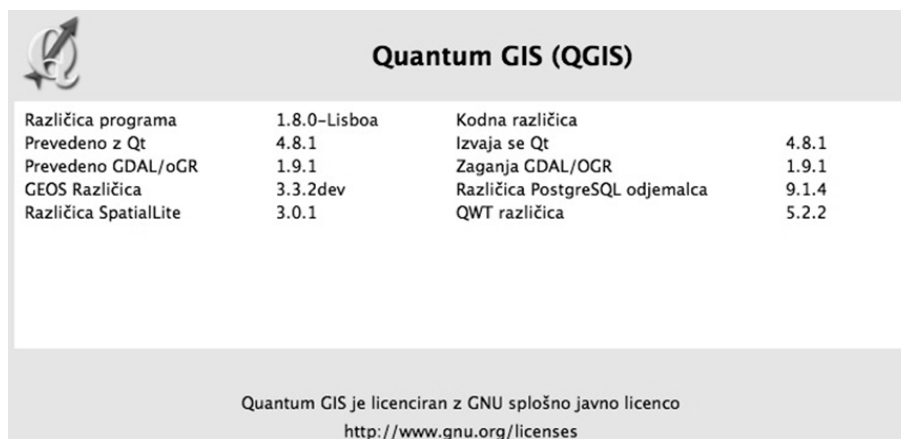


Figure 1: About Program window of Quantum GIS

2.2 SLOVENIAN REGION POMURJE

The study covered Mura region with the municipalities Apače, Beltinci Cankova, Gornja Radgona, Gornji Petrovci, Grad, Hodoš, Križevci, Kuzma, Ljutomer, Moravske Toplice, Municipality of Murska Sobota, Puconci Radenci Razkrižje, Rogaševci, Sveti Jurij ob Ščavnici, Lšovci, Silence, Veržej Črenšovci, Dobrovnik, Kobilje, Lendava, Odranci, Turnišče, Velika Polana (Figure 2).

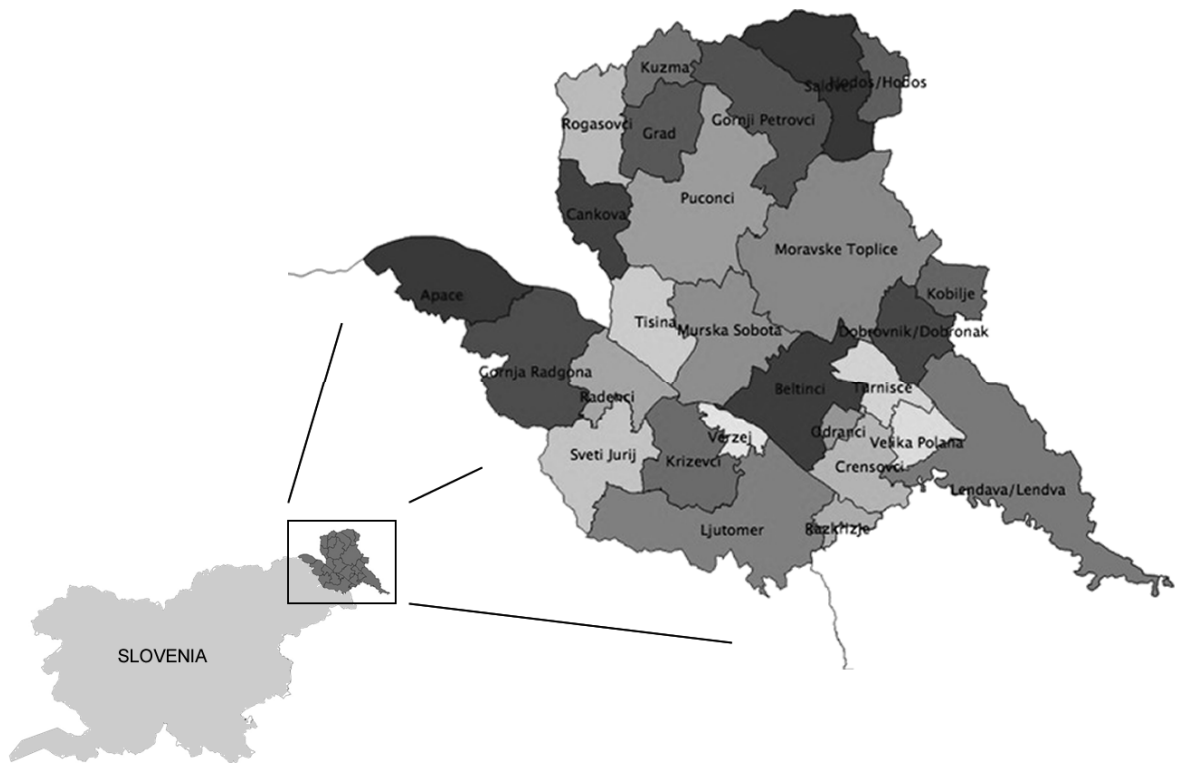


Figure 2: Pomurje region in Slovenia with municipalities

We got data from the municipality Ljutomer on the quantity of collected waste; volumes separated fractions in kilos, the proportion of adoption in percent and the estimated value of the collected material quantities of separated fractions taken by municipalities in 2011 [2].

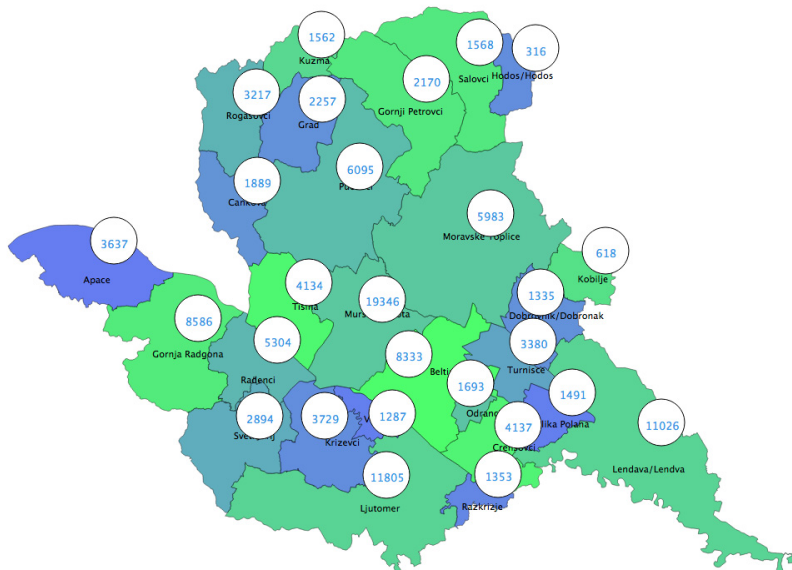


Figure 3: Number of population by municipalities

Furthermore, we obtained information on the deferred amount of waste in the municipality in kilos. Furthermore, from the statistics we have obtained data on the population by municipalities (Figure 3). As municipalities vary in size and population, it makes sense to normalize the quantities in terms of population, which gives us a much clearer picture of the quantities of waste [5].

3. Results

Data on population is important for the subsequent analysis of specific indicators in terms of population (Figure 3).

The Map on Figure 4 shows the amount of separately collected fractions in kilos by municipalities in 2011 per capita. The total volume of the collected fractions was divided in the representative classes, each of which was painted with a different color, as shown in the legend to figure 4.

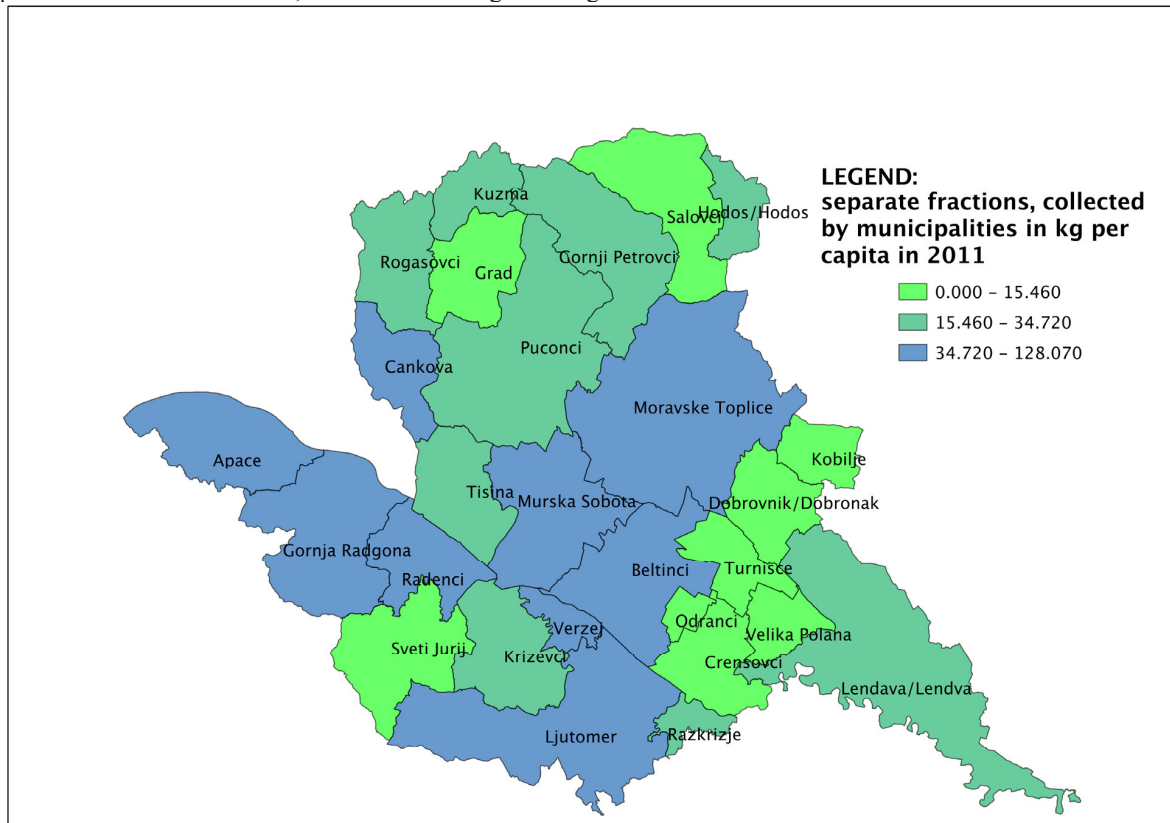


Figure 4: Quantity separate fractions, collected by municipalities in kg per capita in 2011 (GIS)

4. Conclusion

In this article a digital maps within geographic information system were created, which provides the basis for making further studies on waste management, especially biogenic waste. For the base were used vector layer Slovenian municipalities, which we linked with the file, attribute information. Attributive data file was created from documents obtained in the municipality of Ljutomer. Data from the printed tables were transferred into a geographic information system and linked to the vector layer of Slovenian municipalities. Digital maps were created for accepted amounts of separated fractions in the regional municipalities of Pomurje region in 2011. In the county are covered by Apače, Beltinci Cankova, Gornja Radgona, Gornji Petrovci, Grad, Hodoš, Križevci, Kuzma, Ljutomer,

Moravske toplice, Municipality of Murska Sobota, Puconci Radenci Razkrižje, Rogaševci, Sveti Jurij ob Ščavnici, Šalovci, Tišina, Veržej Črenšovci, Dobrovnik, Kobilje, Lendava, Odranci, Turnišče, Velika Polana. A digital map of adopted separate fractions per capita in the present municipalities was made. Furthermore, a digital map of the deposited quantities of municipal waste per capita in the municipality and kilos in 2011 were constructed using the same methodology.

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References

- [1] Cook, S.E; Bramley, R.G.V. Precision agriculture - Opportunities, benefits and pitfalls. *Australian Journal of Experimental Agriculture* 1998;38:753-763.
- [2] Klemen D., Lebarič Z. Poročilo o izvajanju gospodarskih javnih služb zbiranja komunalnih odpadkov in prevoza komunalnih odpadkov na območju občine Ljutomer, 2011.
- [3] Mihelič R., Andoljšek L., Leskošek M., Lobnik F.. Uporaba biogenih odpadkov v kmetijstvu: stanje v Sloveniji in perspektive. *Gospod. odpad.*, 10, 2001;vol 38: p. 8-14.
- [4] Novakovits P. Aufkommen, Zusammensetzung und Entsorgung/Verwertung von fester Biomasse aus Gärten, öffentlichen Anlagen und von Straßenbegleitgrün in ländlichen Gemeinden, 2012.
- [5] Sagadin L. Public accesible GIS tools for analysis of organic waste management, Diploma work, Faculty of Agriculture and Life Sciences, University of Maribor, 2012.