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Multiple drivers for Earth system changes in the Baltic Sea region

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Changes of the Baltic Sea coastal urban region (with example of Klaipėda settlement)

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1. Introduction

Nowadays settlements location for people has not such a big meaning in distance from their living and working place due globalization and telecommunications advancements (Zhong et al. 2014 (a); Shatu et al. 2014; Neuman 2005; Žaromskis 2001), as well as one of the main residence dispersion factors in place, its landscape and as well as the distinction of climate comfort. Climate change in the future may be affected by urbanization tendencies. Therefore, it is necessary to research on climate impacts on human life, in social trends.

Peri-urbanization sets settlements location behind the city and at the moment they are facing with poor social and technical infrastructure, there have been seen negative impact on landscape and CO₂ emission (Wang et al. 2014; Newman et al. 2014; Poom et al. 2014; Brand et al. 2009; Neuman 2005; Europos Sąjungos regioninė politika 2007). In 2004, European Commission has described importance of sustainable urban development and it is important to ensure efficient land use as non-renewable resource (European Journal of Spatial Development, 2012; Zaleckis 2010; Poom et al., 2014).

The process of urban sprawl in Klaipėda and surrounding areas has negative meaning as population moving to new suburbs because of search for better living conditions and cheaper housing (Cirtautas 2013). Besides urban sprawl negative meaning, Kavaliauskas had adopted a new term – anthroecosystem. He notes that population always will form, work, rest and live in places which are the most suitable and comfort for them, does not matter how far away it will be from working and living places (Kavaliauskas 1984).

The goal of this study is to analyse the impact of urban sprawl on landscape around Klaipėda city settlements, Lithuania (Fig. 1). The main aims are: (I) find differences in location of settlements during period since 2005 to 2013; (II) predict possible settlements expansion till 2020; (III) evaluate possible urban sprawl impact on Klaipėda city and suburbs.

2. Study area and method

Klaipėda is the largest town at the western Lithuania, with the number of population 158 541 (2013 Census data) and it is third largest city in terms of population in Lithuania. Here is located one of the major harbours at the south-eastern of Baltic Sea. In Klaipėda surrounding settlements is located several tourist attraction points, and summer resorts, such as well-known Palanga and Nida, Marine museum with the only one dolphinarium in all Baltic countries. At the same time almost 0,5% of Klaipėda city territory and 48% of Klaipėda district territory belongs to the National park area and Natura 2000 or other prohibited area (State Cadastre of Protected Areas, 2014).

In order to make prognosis of future urban sprawl, to predict change of land use and ecological and social problems, it is important to do spatial modelling, which nowadays is more precise when mathematical calculations (Cheng, Masser, et.al. 2003; Gadal 2011 (b)) what was done in this research.

In order to get the most accurate data on suburbanization processes, was gathered several methods: GIS, using orthophoto and georeferential GDB10LT databases and also mathematical – statistical method in comparison with received visual results. GIS methods were used to identify changes in the land cover change in Klaipėda and its surroundings. Both – macro (city level) and micro level (suburbs) changes were investigated during research.

In this study, was used year 2005 and 2013 layers of Lithuanian territory M 1:10 000 georeferential database year 2005 and 2013 and the 2005 and 2010 Lithuanian territory digital orthophoto M 1:10 000 map ORT10LT (Fig.1). Orthophoto's map layers were used to make geometrical correction of georeferential GDB10LT database layers in order to look for settlements territorial change during analysed period.

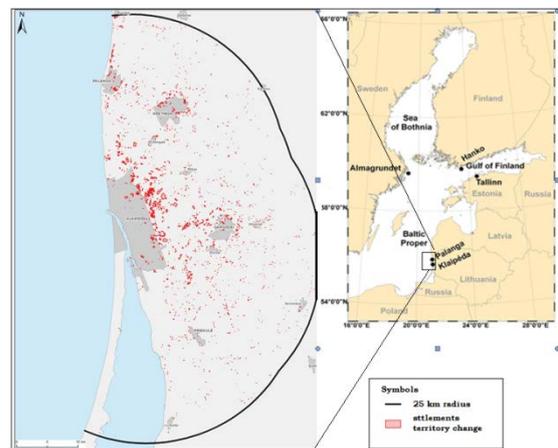


Figure 1. Territorial change of settlements during 2005-2013, ha.

3. Results

Study shows, what the biggest suburbanization processes in Klaipėda have been spotted in 5-10 km eastwards and not significantly in south – east and northern direction from the city (Fig. 1). Territory in 5 km distance from Klaipėda city centre have increased by 632,65 ha, as well as in all studied area enlarged by 1090,94 ha. The most significant suburbanization processes have been in settlements of Klaipėda district: Slengiai, Triušėliai,

Budrikai, Mazuriškiai. Here was recorded by 56,63% of all changes in Klaipėda district.

One of the best indicator, showing urban sprawl and change of physical landscape is the change of number of population in city and suburban areas (Cirtautas 2015, Newman et al. 2014; Europos Sąjungos regioninė politika 2007). Correlation shows, what population number in Klaipėda city is decreasing but in Klaipėda district increases exponentially ($r=-0.92806$).

According georeferential data analysis, settlements territory of Klaipėda city suburbs expanded by 1090.94 ha during by 2005-2013. Mostly, suburbs have expanded eastwards and northern in 5 km distance from Klaipėda city (632.65 ha) that is directions parallel to the highway Klaipėda-Vilnius, and on the way to Palanga resort.

If territorial growth of settlements around Klaipėda city will be the same as during 2005-2013 period, settlements around Klaipėda city in 5 km radius, would expand up to 1245,77 ha till year 2020. Future urban sprawl direction should remain the same – eastwards and northern from Klaipėda city.

4. Discussion and conclusions

Graphical and statistical analysis of study area showed strong evidence of urban sprawl in Klaipėda suburban areas, especially in 25 km distance. As found Bouwman et al. (2005) in their study, urbanization has a clear effect on human mobility. In this case it changes everything, as Klaipėda city and its suburban municipality governments should rethink transportation system and infrastructure in order to make urban-rural continuum, which describes Bouwman, greener, more suitable for living and more ecological, as the right city design can enhance the use of car alternatives (Zhong et al. 2014 (b), Poom et al. 2014; Jansen et al. 2011). It is very important to think about car alternatives while communication between Klaipėda city and suburbs at the moment is quite weak. Wang et al. (2014) has empirically proven that sub-urbanization have a significant impact on commuting CO₂ emission increase.

Study results shows, that Klaipėda region is not exception in the Europe. We are facing fast urban sprawl which has negative impact on regions' landscape and ergonomics', social, economic and psychological human being in newly inhabited territories (Kavaliauskas 1984; Europos Sąjungos regioninė politika 2007). Instead of green and recreation zones concentration in suburban areas (Jansen et al. 2011), population moving to live there, leaving cities emptier.

Knowing urban sprawl directions will let us predict future scenarios of land use and will help for urban planners to meet populations' daily needs in order to avoid mistakes which were made some centuries ago (Zhong et al. 2014 (a); Kavaliauskas 1984; Žaromskis 2001). Canada already taking action in drawing borders, there urban sprawl is not possible, in order to protect the land from residential use and let spread farming.

The analysis of this research showed what no proper action has been taken in order to avoid urban sprawl and Klaipėda's city emptiness. Also climate change projections and adaptations should play important role in future planning documents of Klaipėda city and its district settlements.

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