

# Green infrastructure as a very important factor in creation of well human being conditions for inhabitants in urban areas



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# Green infrastructure - increasing the natural capital of Europe

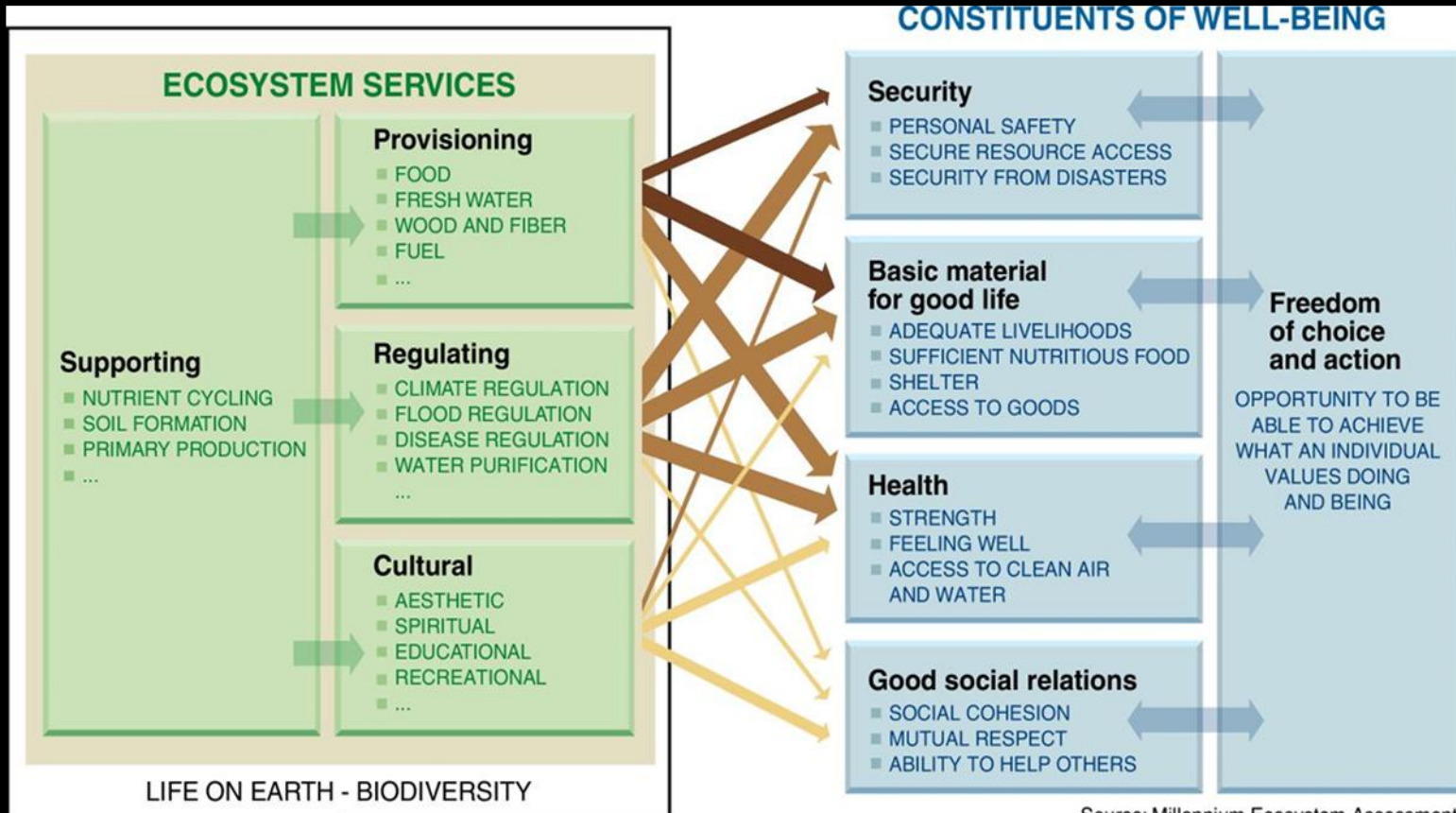


Human society is dependent on the benefits provided by nature, such as: food, mineral resources, clean water, clean air, climate regulation, flood control, pollination, recreation, etc.



# Ecosystem Services

the benefits humans derive from ecosystems



Source: Millennium Ecosystem Assessment

**ARROW'S COLOR**  
Potential for mediation by socioeconomic factors

- Low
- Medium
- High

**ARROW'S WIDTH**  
Intensity of linkages between ecosystem services and human well-being

- Weak
- Medium
- Strong

# Green infrastructure at urban area



Solutions for green infrastructure are particularly important in an urban environment in which lives more than 60% of the EU population as well as Poland too. Green infrastructure in the cities is a sources of health-related benefits such as clean air and a better quality of water.



# Aim of the presentation

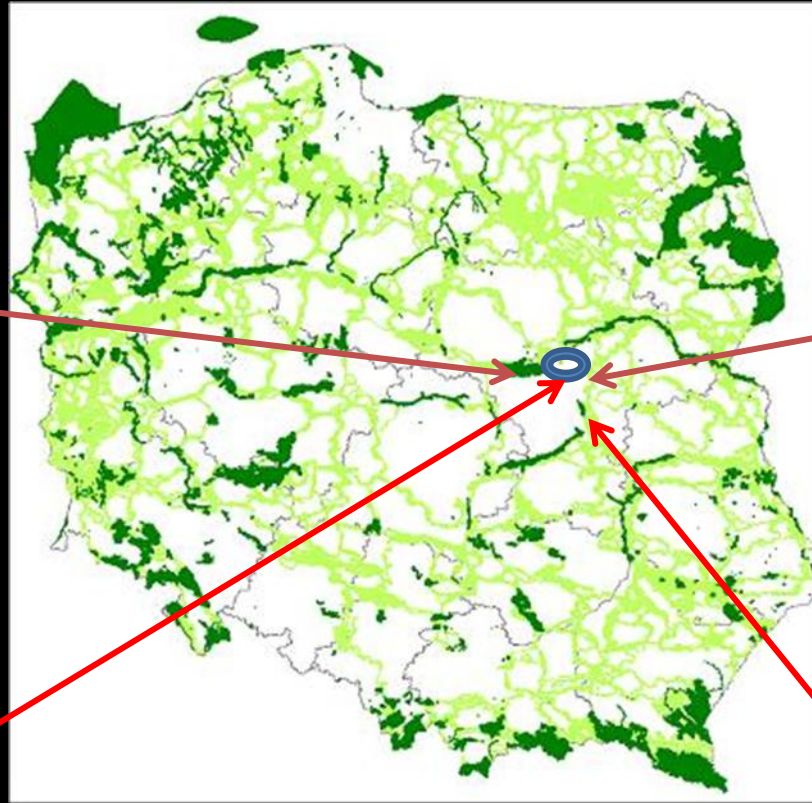


The aim of the presentation is to show the development of green infrastructure in Warsaw and prediction for the green development of the city for the next 50 years. Additionally, demographic and health hazards situation is done.

# Outline

- Location of Warsaw on the ecological background of Poland
- Spatial structure of land uses in Warsaw
- Green infrastructure in Warsaw
- Urban system resilience of Warsaw
- Demographic situation in Polish cities and health risk
- Green infrastructure – human health
- Green infrastruktura - water management

# Ecological connection of Warsaw



Kampinoski National Park

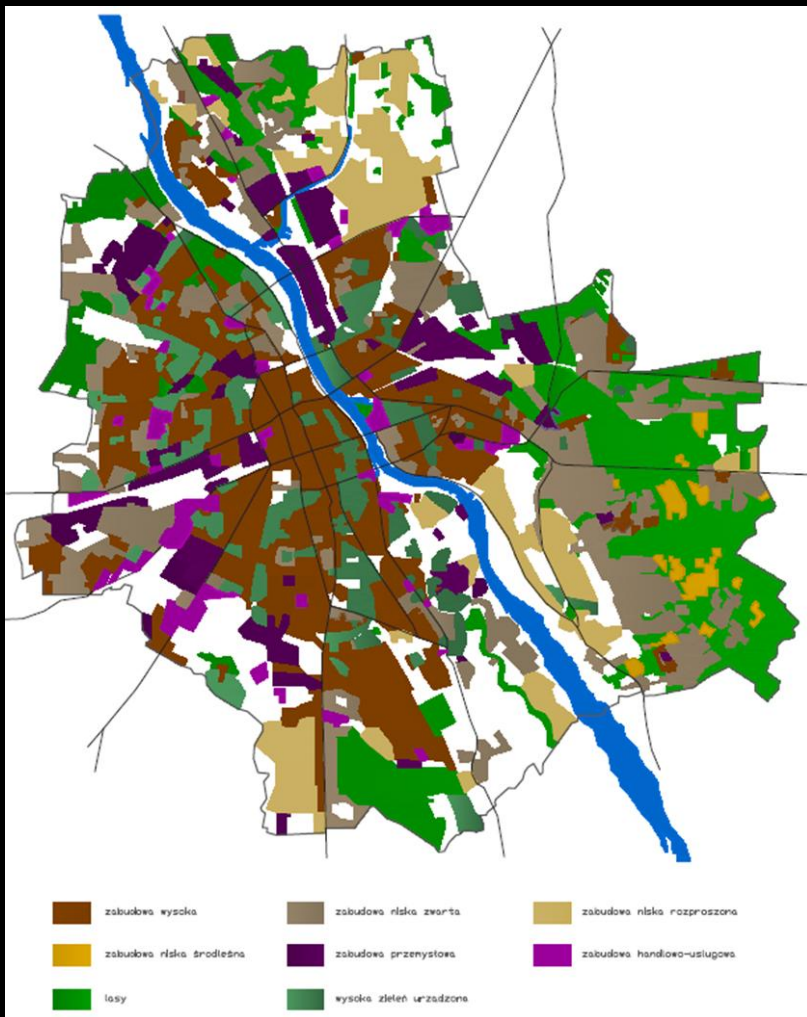


Vistula river

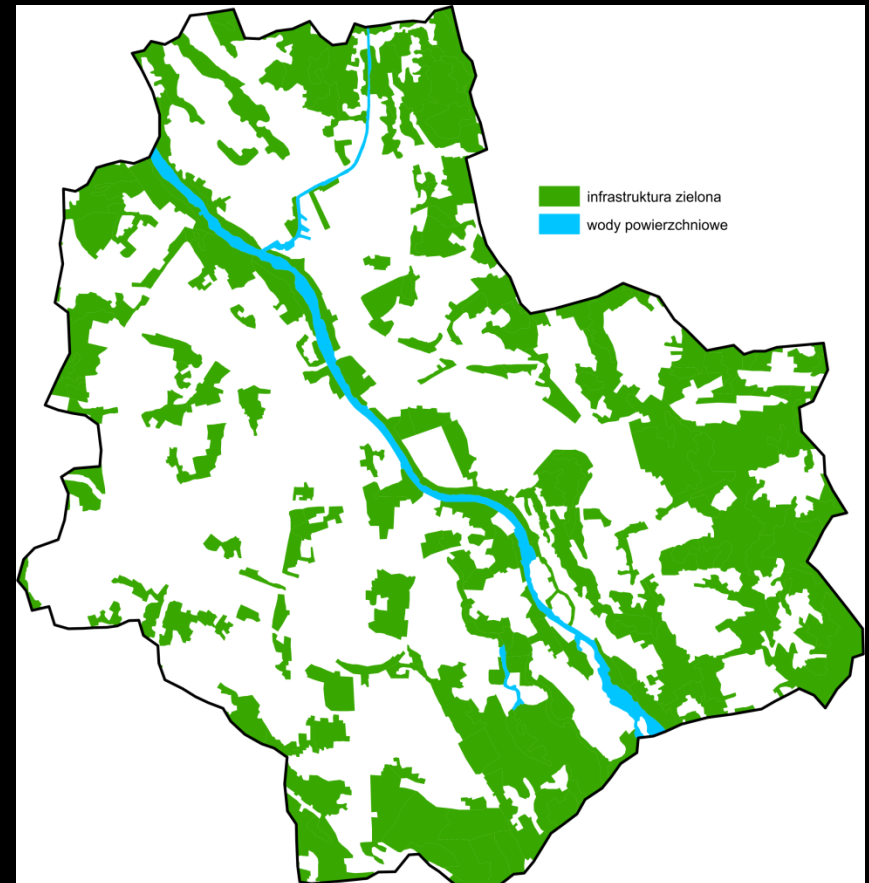




# The spatial structure of land uses in Warsaw



(according to: Studium uwarunkowań.....)



Green infrastructure of Warsaw  
(according to: Degórska i inni, 2013)

# Green infrastructure in Warsaw



It was mentioned, that thanks to appropriate planning activities at a local and city-wide scale, we can affect the intensity and spatial extent of these negative phenomena and the adaptation of inhabitants to climate changes. Performed studies showed that in order to limit the temperature increase in the city, share of biologically active areas should not be less than 45-50%.

# Green infrastructure in Warsaw (2)



Moreover, the overall share of green areas, including mainly parks (**62** in Warsaw), lawns, forests and riverside banks (excluding green areas with residential functions) in Warsaw should amount to **30-35%**. Additionally, green areas with high plants, must have a good accessibility, the best on foot, from the place of residence

# Climate change



Warsaw, like any big city requires adaptive action to climate changes, which are presented in global and regional climate scenarios.

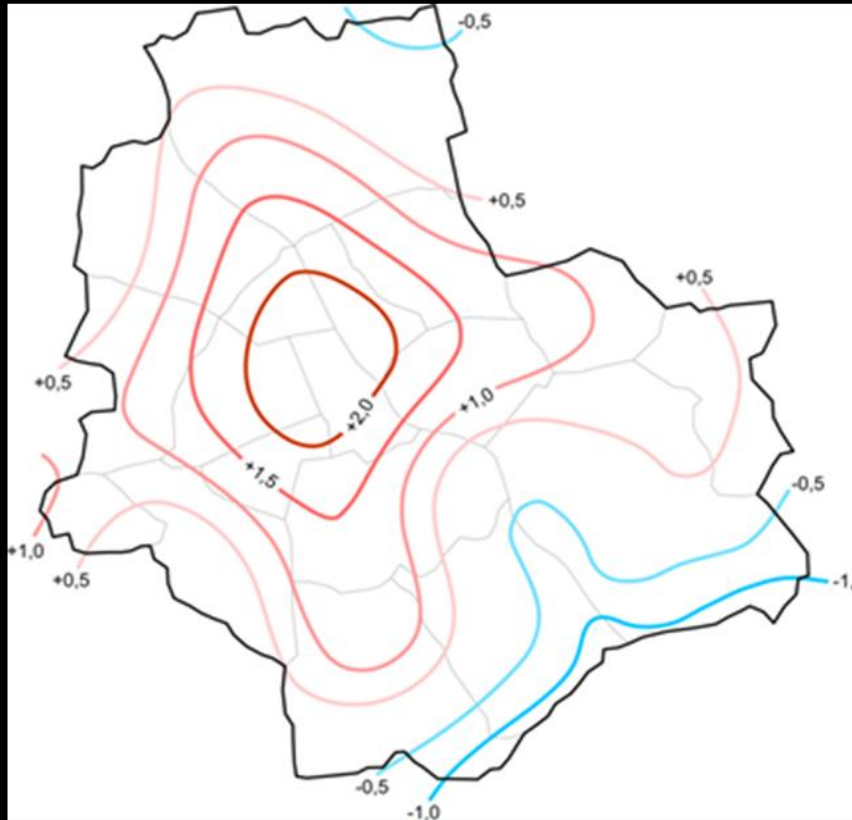


# Urban system resilience



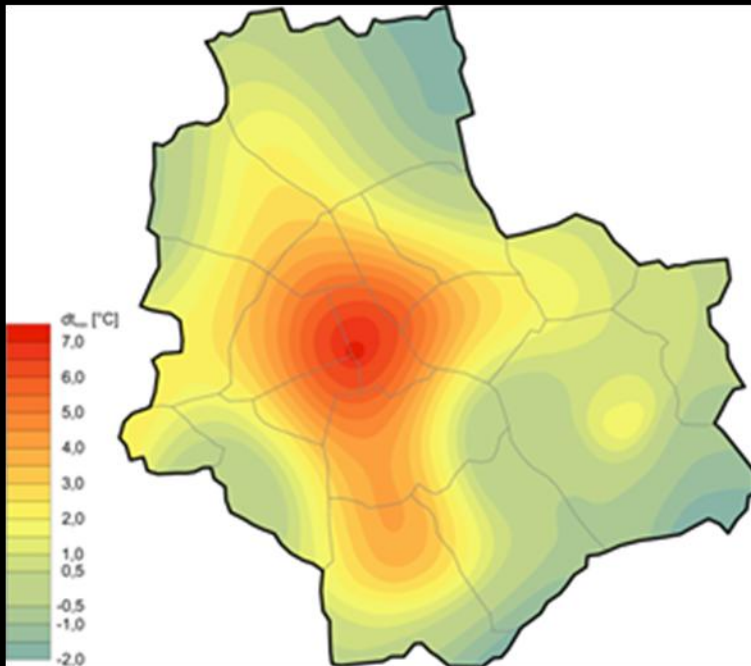
Every city system has own resilience for any impacts and green infrastructure is playing a significant role in this process.

# Distribution of average minimum air temperature deviations in the Warsaw area in relation to the station Warsaw-Okęcie 2011

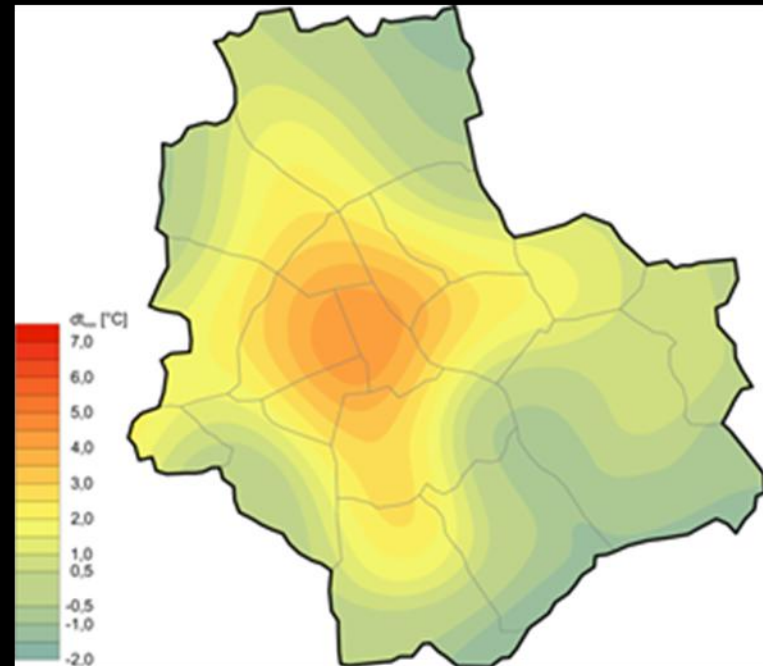


according: B. Degorska and others 2014

# Distribution of minimum air temperature deviations in the Warsaw area in relation to the station Warsaw-Okecie on 23.05.2011 and in the period 20-26.05.2011



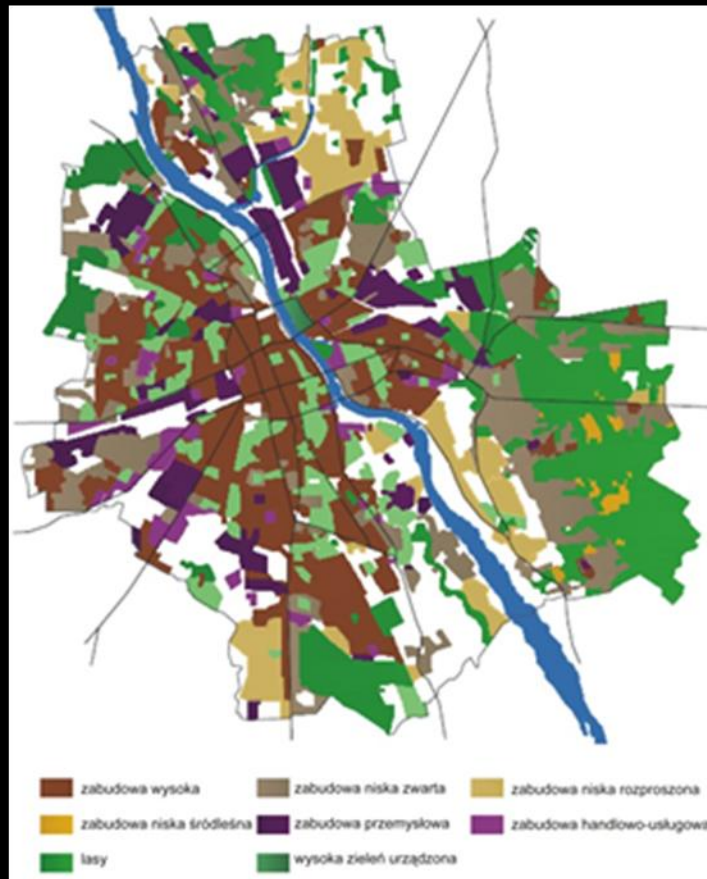
23.05.2011



20-26.05.2011

according: B. Degorska and others 2014

# Spatial distribution and extent of selected forms of land use, affecting the incidence of the urban heat island



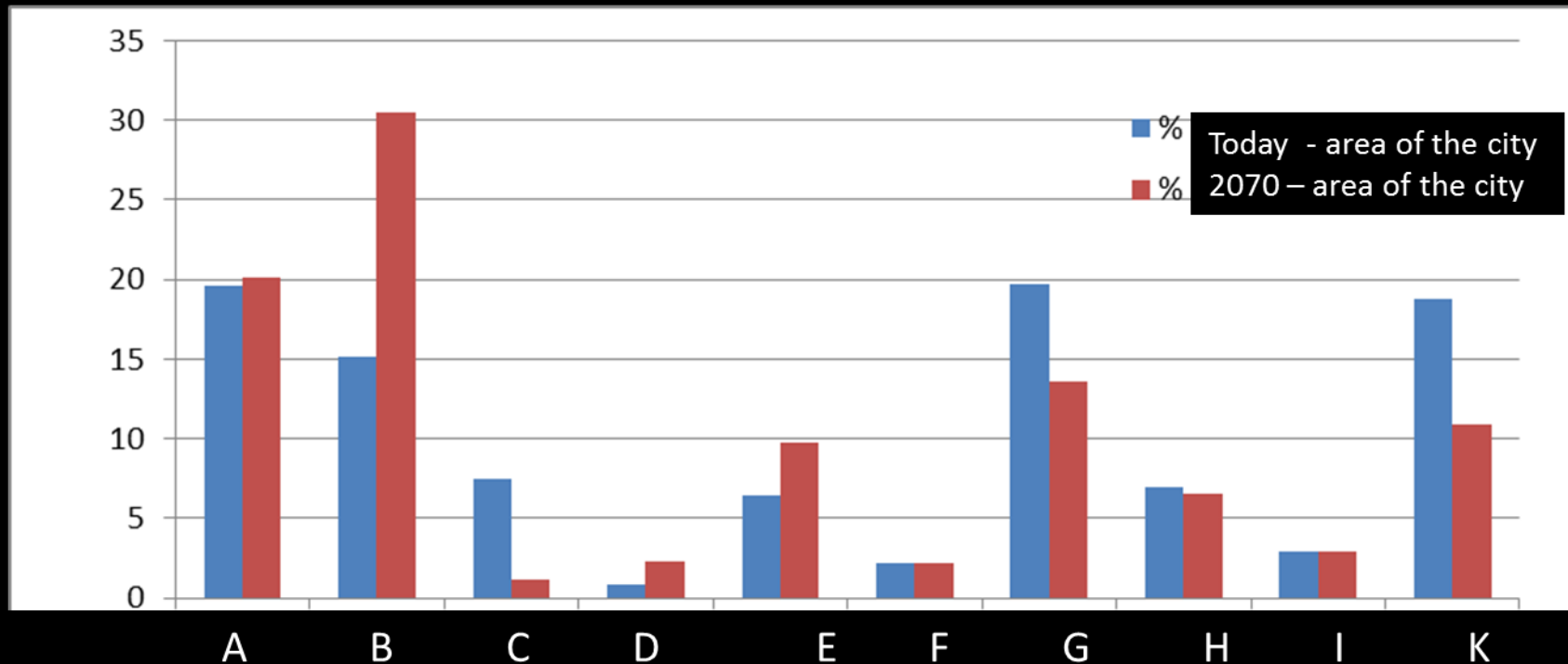
State for today (2015)



State of the forecast - the year 2070



# Forecast of land use in Warsaw to 2070



A - high buildings

B - compact low buildings

C - low buildings scattered

D - Buildings in the forest

E - industrial buildings

F - trade and service buildings

G - forests

H - high green infrastructure

I - Wisla river

K - open area

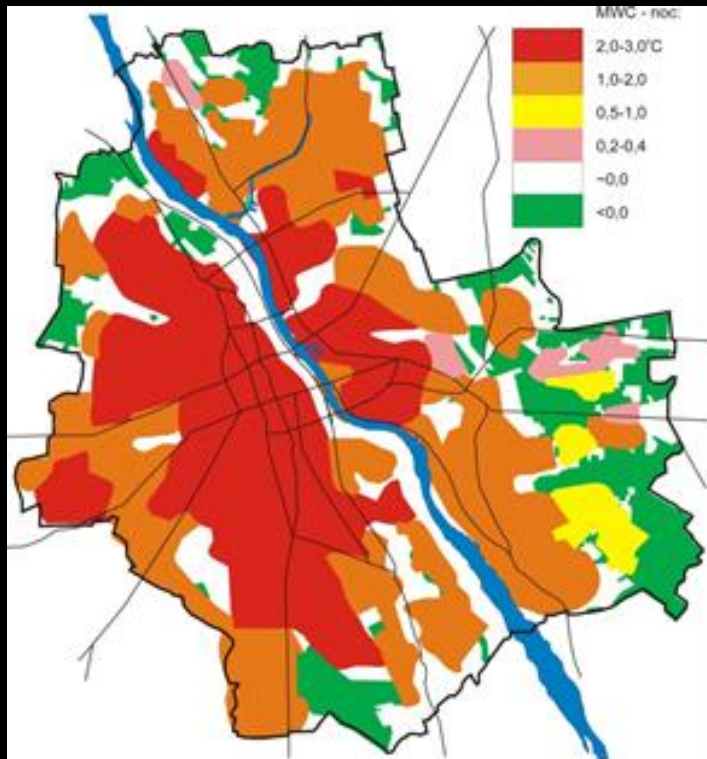


Urban heat island in Warsaw (today)

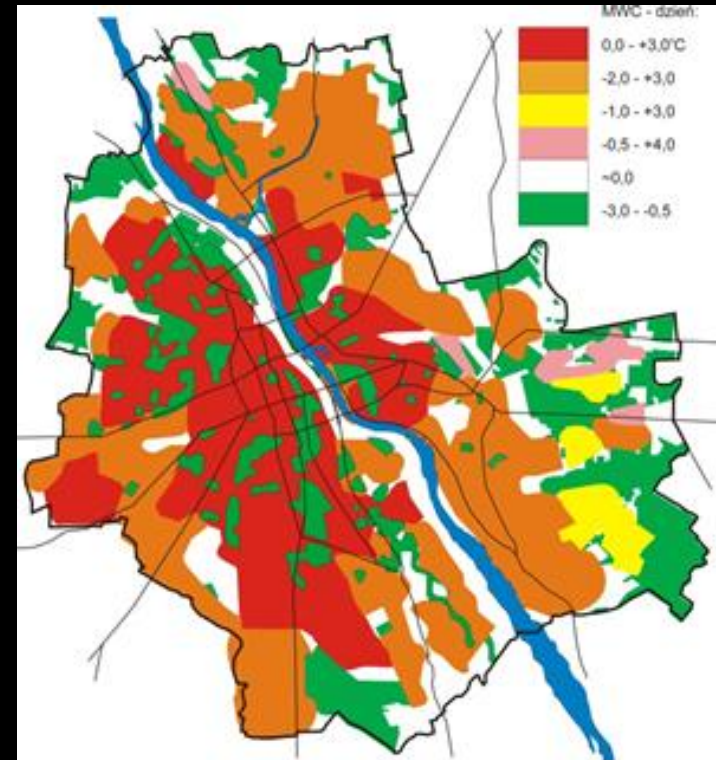
night

day

# Spatial distribution of different categories of urban heat island in Warsaw forecast for the year 2070 land use

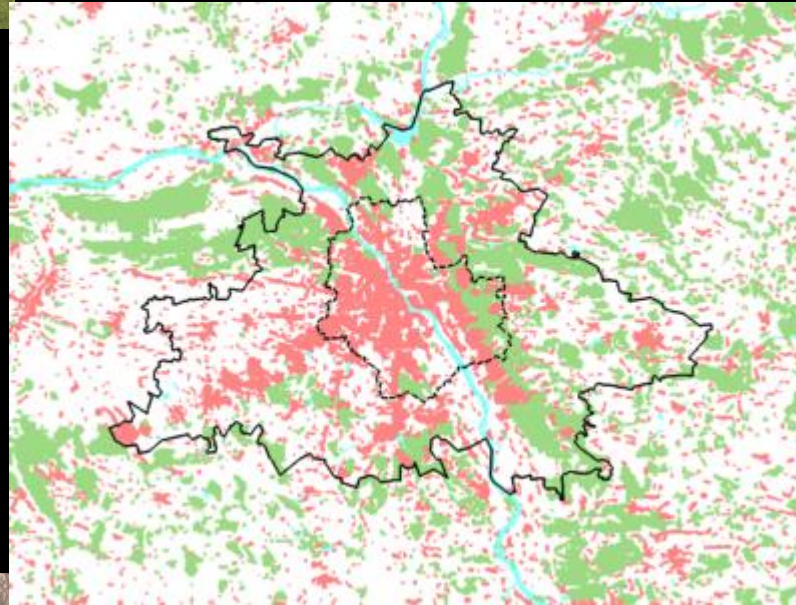


As projected (year 2070)  
night hours forecast

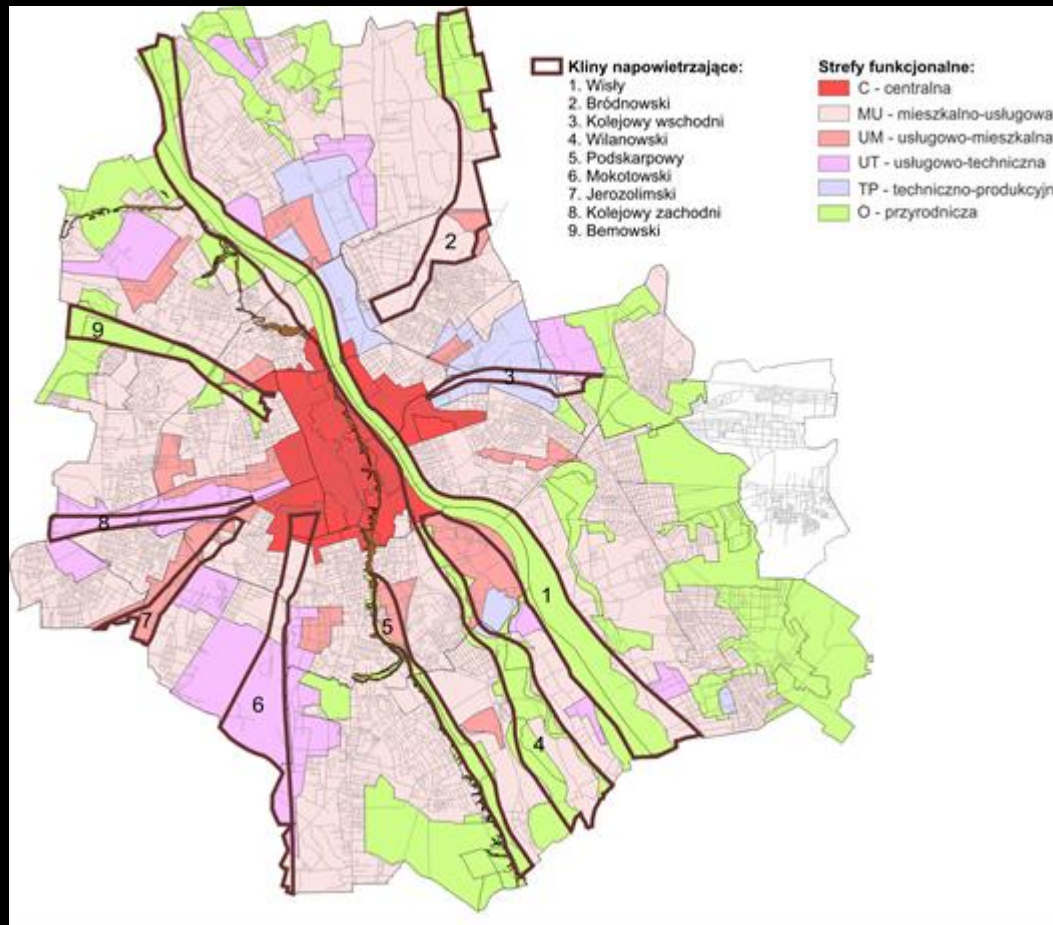


the daylight hours

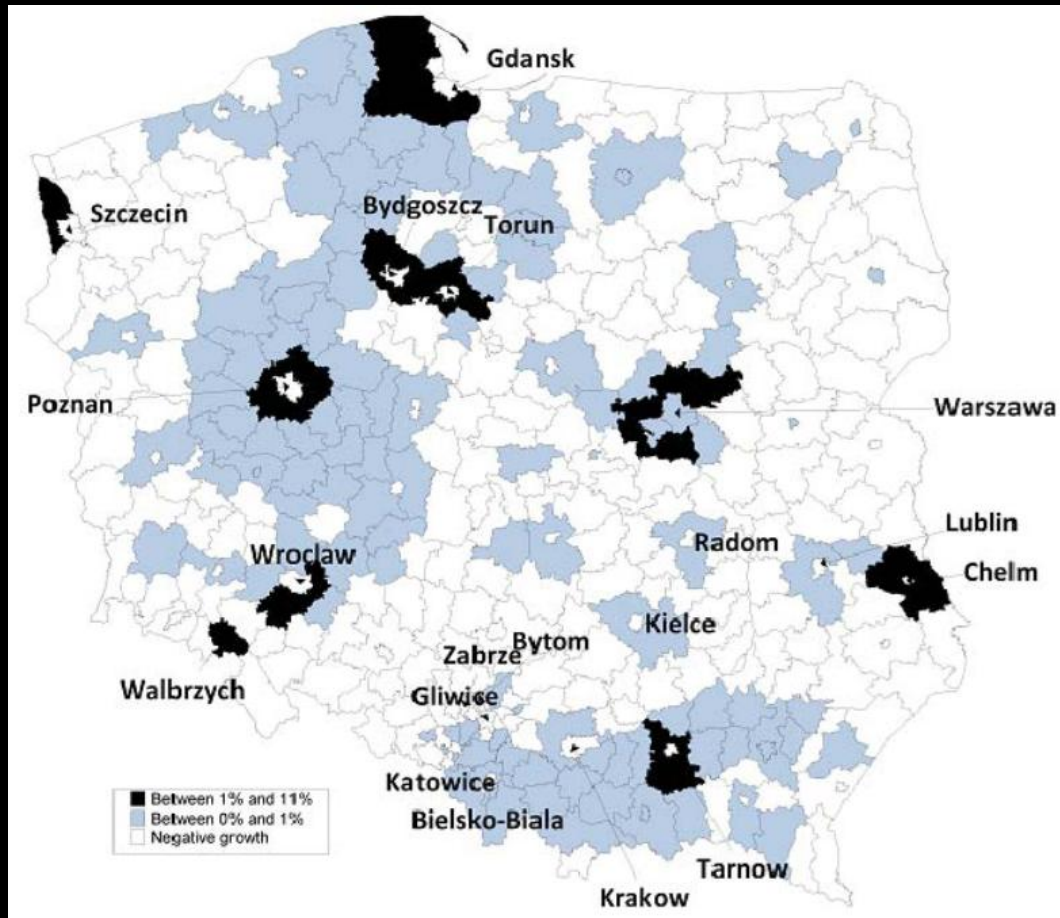
# Urban sprawl



# Green infrastructure function as an aerating wedges



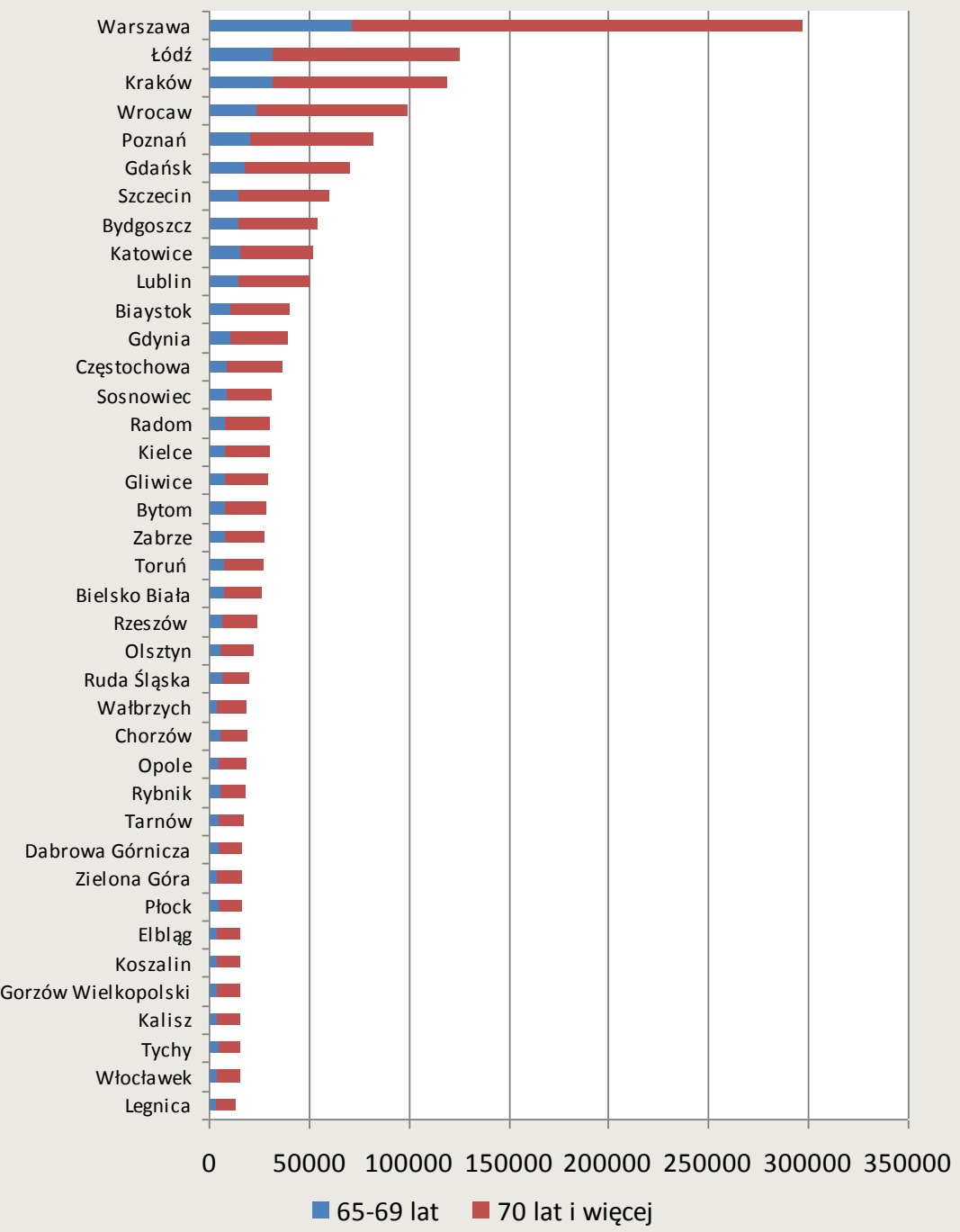
# Demographic situation



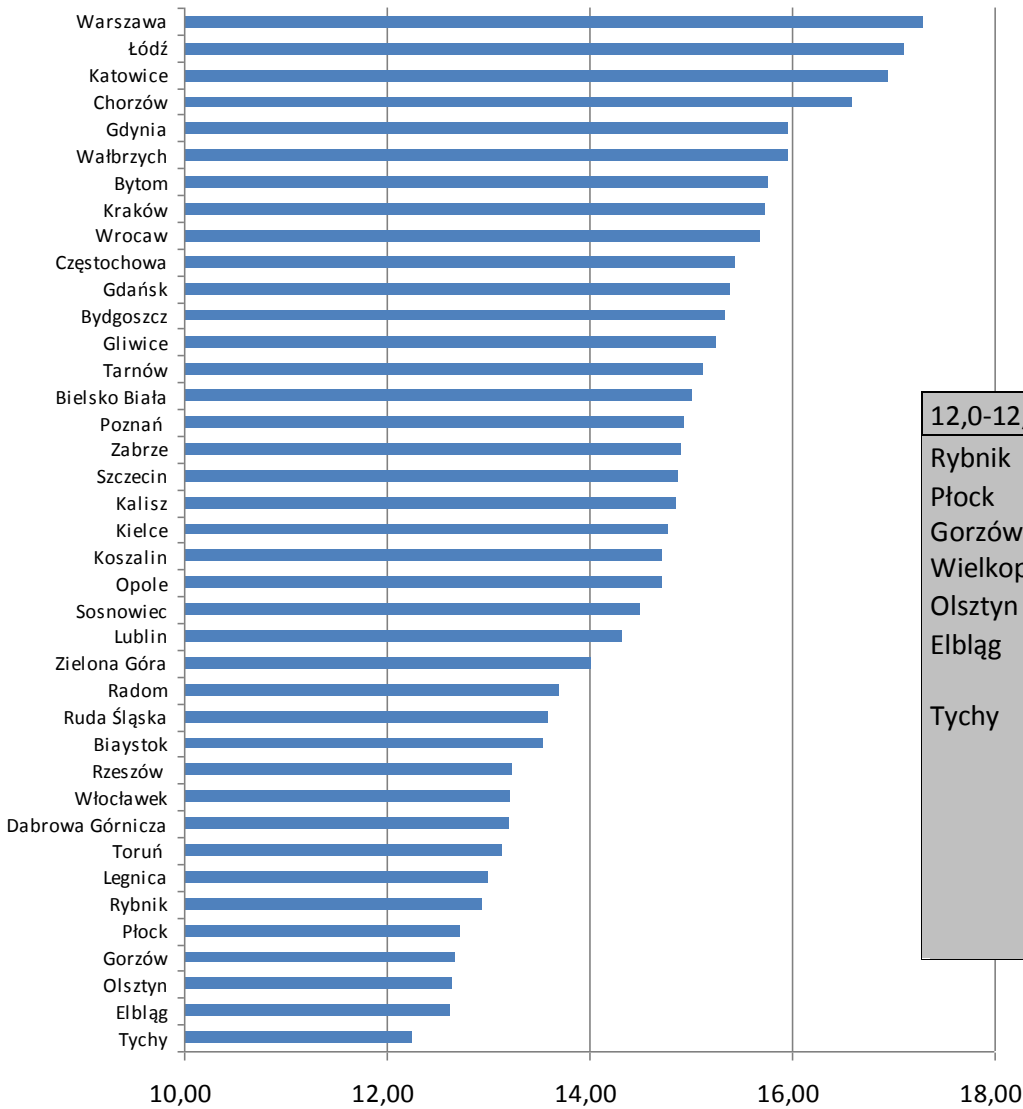
Changes in population at the urban areas in 1998–2008 -Black color indicates areas under strong urbanization .

# Absolute thermal risk in cities (ATR) - Number of people aged over 65 years in the Polish cities over 100 thousand residents

According to datsa GUS 2012



## Group of cities according to the percentage of population above 65 years old in relation to the total number of inhabitants



12,0-12,9%	13,0-13,9%	14,0-14,9%	15,0-15,9%	16-17,5%
Rybnik	Radom	Poznań	Gdynia	Warszawa
Płock	Ruda Śląska	Zabrze	Wałbrzych	Łódź
Gorzów	Białystok	Szczecin	Bytom	Katowice
Wielkopolski	Rzeszów	Kalisz	Kraków	Chorzów
Olsztyn	Włocławek	Kielce	Wrocław	
Elbląg	Dąbrowa			
Tychy	Górnicza	Koszalin	Częstochowa	
	Toruń	Opole	Gdańsk	
	Legnica	Sosnowiec	Bydgoszcz	
		Lublin	Gliwice	
		Zielona Góra	Tarnów	
			Bielsko Biała	

Percentage of people aged over 65 in the total population of cities over 100 thousand.  
According to: GUS 2013

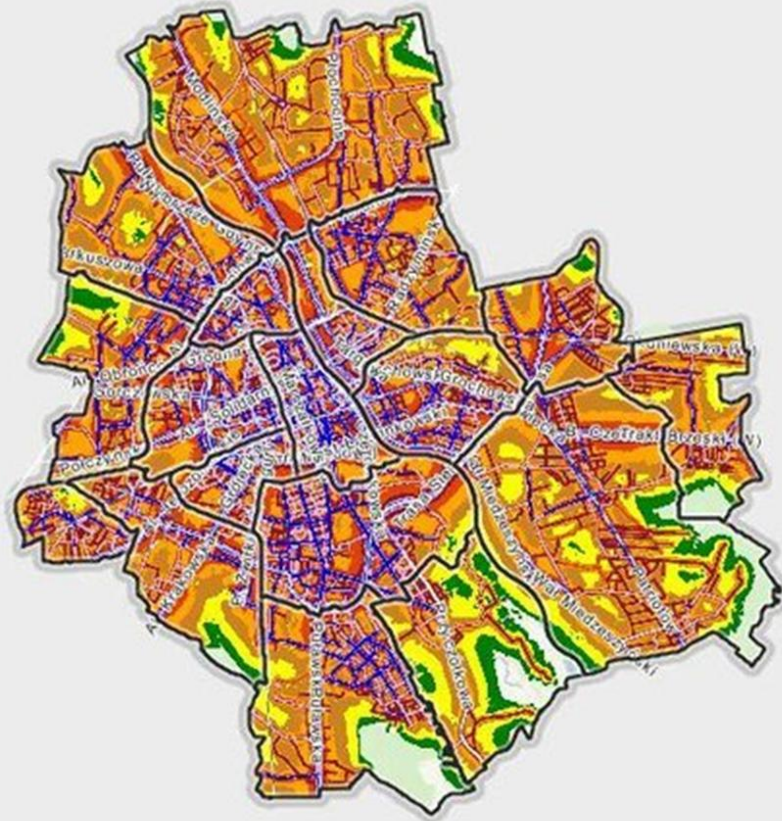


# Green infrastructure – human health



- increases the body's resistance to environmental threats (pollution, urban island, content of ozone, etc)
- sanity
- reducing the perceived noise by man
- increases satisfaction with life

# Noise map of Warsaw

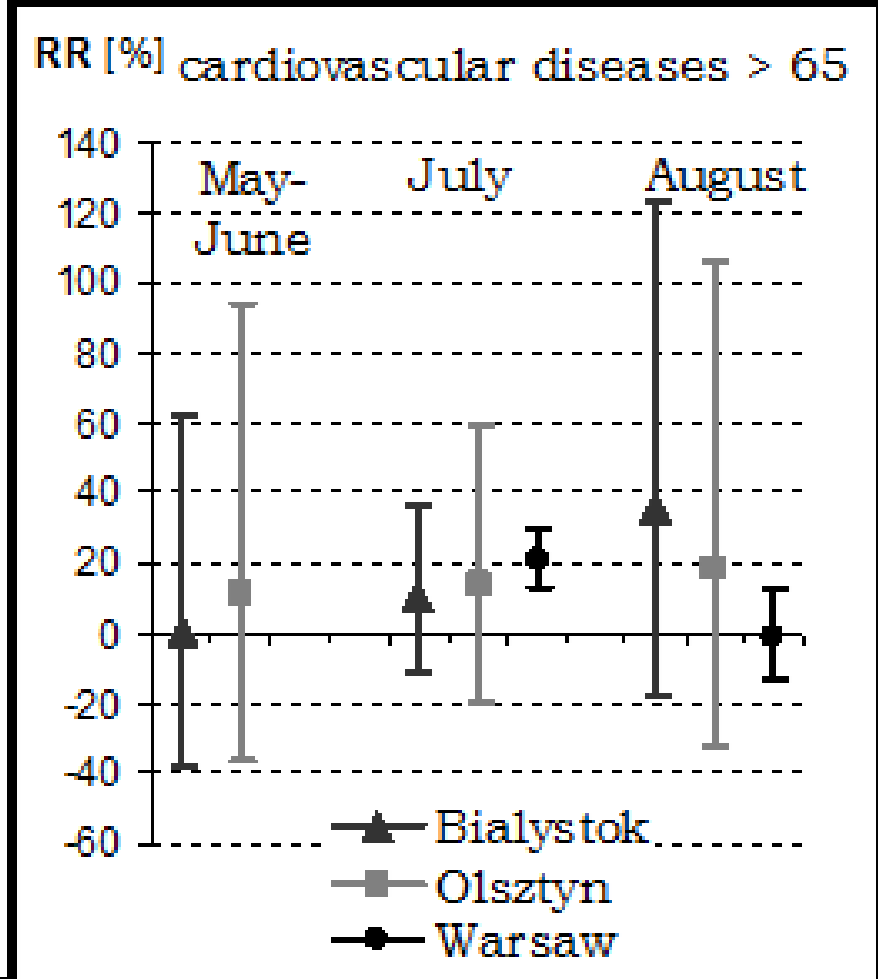
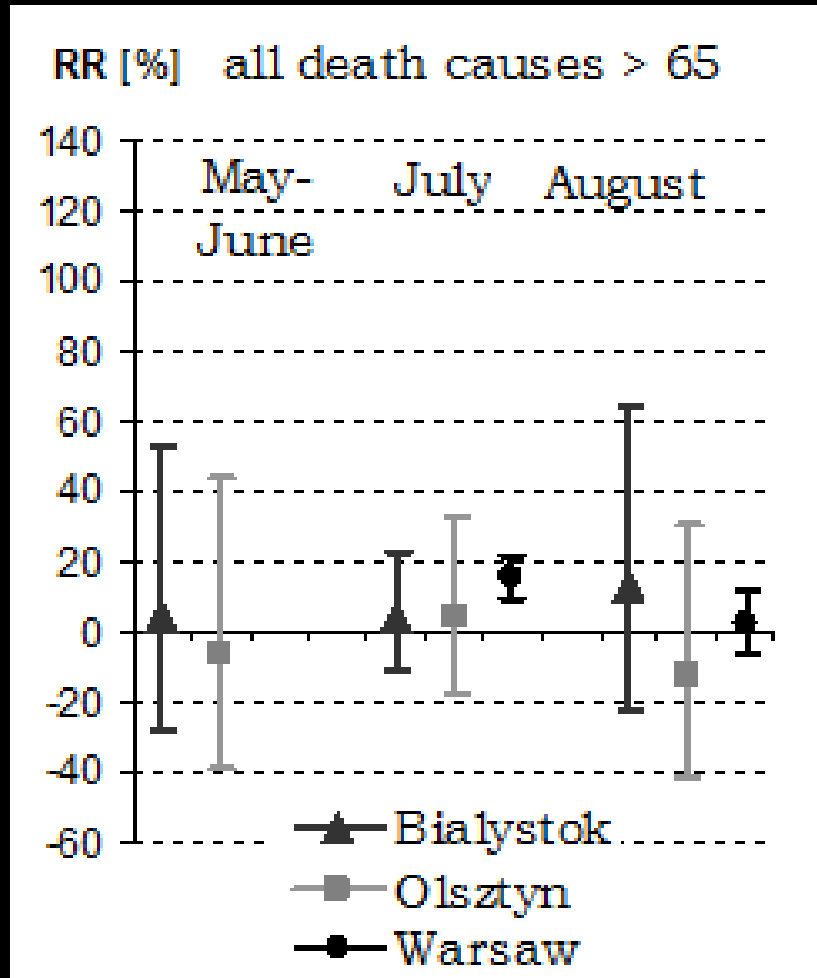


# Green infrastructure - urban heat island



Reduce nuisance of urban heat island (cooling center) can be achieved through integrated activities in many areas, mainly planning, infrastructural, technical, management, economic, raising knowledge and awareness of the inhabitants.

# Relative risk of death - RR [%] from all causes and from cardiovascular diseases among the elderly (aged 65 and over) during heat waves.

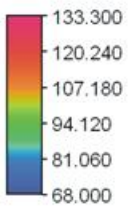
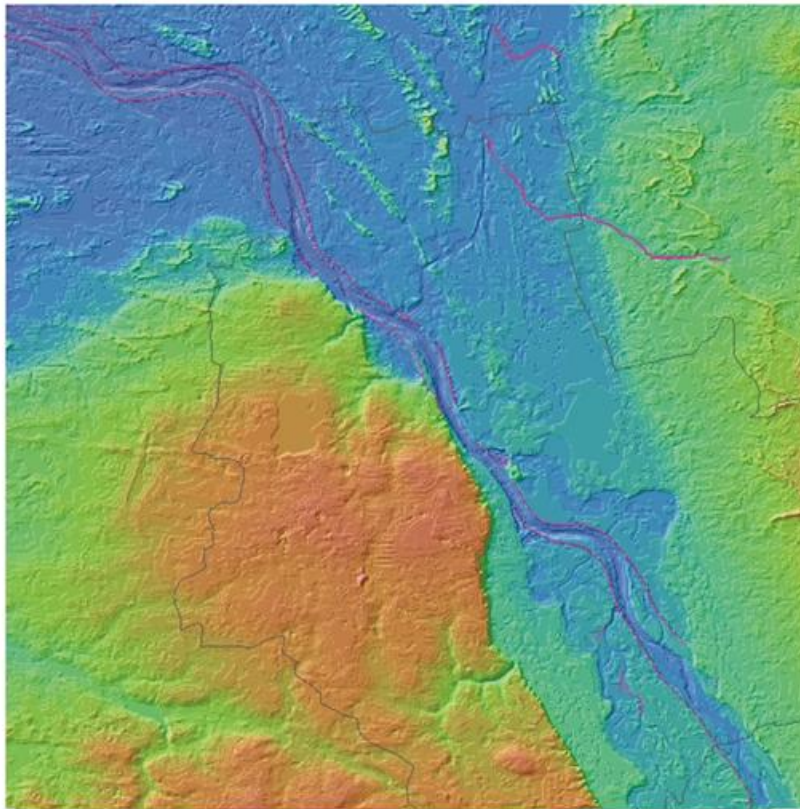


# Water management

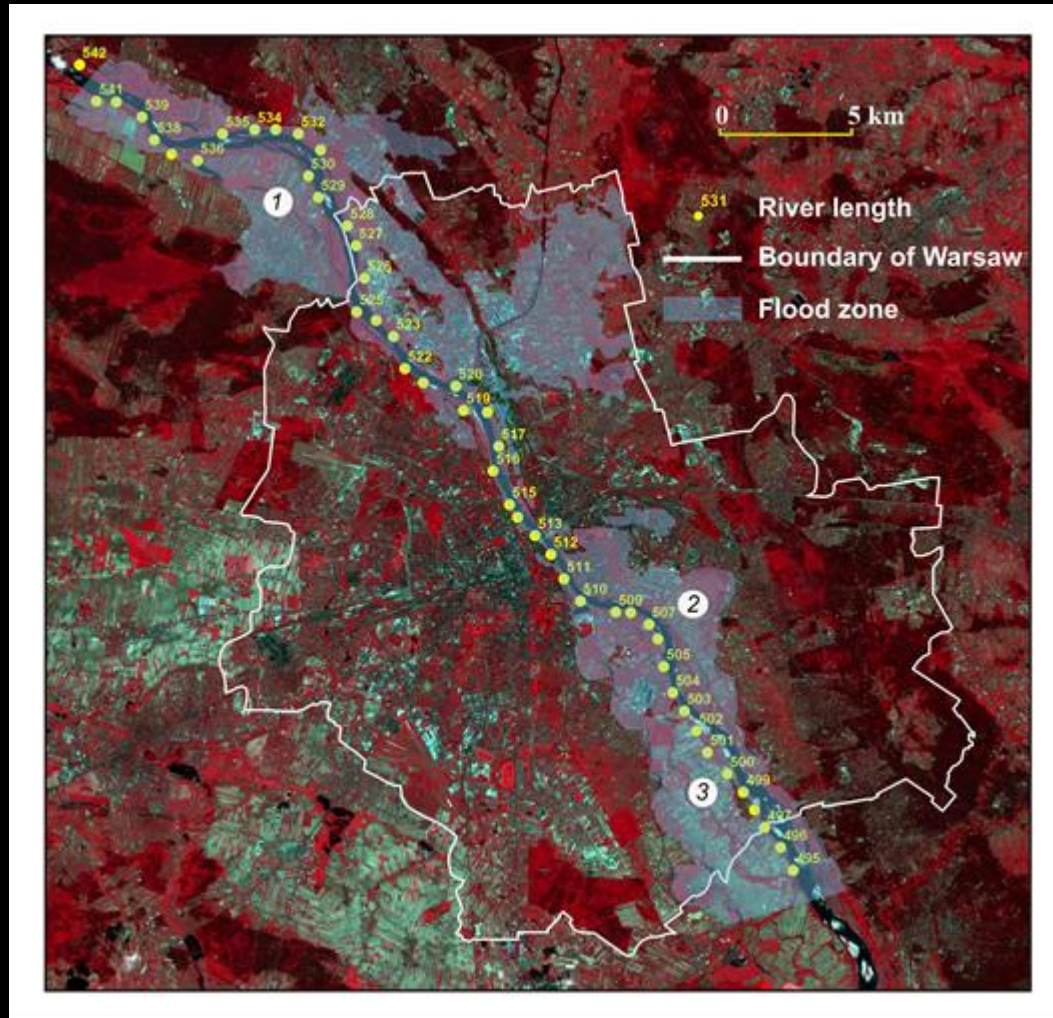


Another research question mentioned in this presentation is a water management in the city, in terms of both, protection of residents' needs and against floods. It will be presented that there is a need to optimize drainage of rainwater through the development of an efficient system of rainwater canalization, **greater use of green areas and tree plantings to create shields that will delay the runoff of water plus restoration and expansion of small retention system**

# Hypsometric factors of Warsaw



Potential flood zone Qp 1% in Warsaw calculated based on the digital terrain model and the model HEC-RAS; selected research areas Łomianki (1), Saska Kepa (2), Wilanów (3)



# Conclusion

- Green infrastructure is playing a big role for humankind, particularly it is very significant for the inhabitants of urban areas.
- Most vulnerable to disturbances in the normal functioning of the economic and socio-environmental areas are sensitive, which could include urban areas characterized by interdependency of many determiningf actors .
- The implementation of the sustainable development concept with good planning of green structure in urban areas is a guarantee of the quality of life their residents and the viscosity of the areas generating growth of their gravity.





Thanks for your attention