

Lecture 1: Introduction to general issues related to climate change and their impact on the functioning of the city and the people living there. (1.5 h)

Slides:

(Slide 2)

Introduction to the lecture.

The 21st century can be called the era of cities which results from their dynamic development, that we have been observing since the second half of the 19th century. One of the reasons for this phenomenon will be the dynamic growth of the world's population. Currently, more and more people live in cities and not in rural areas - it is estimated that 55% of the world's population lives in cities, while by 2050 it is expected to increase up to 68%. The largest population growth in cities will be observed in Asia and Africa.¹ This brings specific social, environmental and economic impacts, affecting both the urban environment and that located at a distance from the cities.²

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Discussion of the dynamics of city development on the example of the video attached on YouTube. Presentation of how the natural increase influences the development of individual cities in the world.

¹www.un.org https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html

²Belanger P., 2017, Landscape infrastructure, Nowy Jork, Routledge

https://www.youtube.com/watch?v=PUwmA3Q0_OE

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Discussion of spatial changes that took place in cities with the development of industry (19th century). Construction of industrial plants and their accompanying infrastructure.

In the nineteenth century, there was a significant civilization progress - the creation of the steam engine contributed to the development of various forms of industry located mainly in urban spaces. In cities, in addition to the traditional urban infrastructure, factories and accompanying infrastructure in the form of warehouses, storage yards, etc. began to emerge. Transport was also developing, not only goods, but also passenger transport - which increased the mobility of people who abandoned their life in rural areas to work in industry emerging in cities. The development of rail transport, and later road transport, resulted in the emergence of infrastructure necessary for their functioning within cities, which had an impact on the later directions of agglomeration development. At that time, the first housing estates for the new social class - workers and their families were also built. An additional town-forming factor was the development of schooling and education.³

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Spatial changes triggered by the expansion of the infrastructure: for wheeled and rail transport.

³Nietyszka M., 1986, Rozwój miast i aglomeracji miejsko – przemysłowych w Królestwie Polskim 1865 – 1914, Warszawa, PWN

Rail transport developed in the 1820s and 1830s. Its functioning was and still is dependent on the appropriate infrastructure in the form of: railway tracks, building structures (stations, stops, locomotive depots) and engineering structures (bridges, viaducts), as well as earth structures needed to mark the track. Railway areas also constitute additional infrastructure in the form of technical facilities necessary for the proper functioning of the railway, as well as housing estates intended for railway workers and their families.⁴ With the development of other means of transport, the decline of industry, and a fall below the break-even point of some rail links, these sites have been abandoned. Their long-term non-use, as well as the specific environmental conditions of these areas, influenced the formation of specific ecosystems (as a result of the succession process) today used to shape park areas in cities.

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Discussion of changes related to the mass influx of rural population to urban areas. The impact of these migrations on spatial changes, the lack of a sufficient number of housing facilities, construction of workers' housing estates.

The development of industry, both in the nineteenth century and after World War I and II, contributed to a large migration of people from the country to the cities. This contributed to a reduction in the number of flats for people working in the then developing industry. It is estimated that, on average, about 1025 people per 1 ha lived in historic urban districts⁵. There was also a lack of properly adjusted sewage and water supply infrastructure.⁶ An image of the 19th-century industrial city of Łódź: https://www.youtube.com/watch?v=v65U-WTi-OI

⁴www.nid.pl https://www.nid.pl/upload/iblock/26c/26cef751938458c8810f7a26d6219867.pdf

⁵Sas- Bojarska A., 2017, Idea miasta - ogrodu w rozwoju nowoczesnej urbanistyki, [w:] Majda T., Mironowicz I., (red.), Manifesty urbanistyczne - w poszukiwaniu współczesnego modelu miasta, Warszawa, TUP ⁶Burno F., 2018, Negatywna urbanizacja". Relacje urbanistyka - natura we włoskiej debacie architektonicznej lat 20. i 30. XX wieku, [w:] Łbik L., Strauss K., Wysocka A., (red.), Zieleń w krajobrazie miasta xix i xx wieku, Bydgoszcz, Kujawsko-Pomorskie Centrum Kultury w Bydgoszczy

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Discussion of the impact of industrial development on human life and the natural environment. Deteriorating health of working-class families, deteriorating condition of the natural environment.

Rapid urbanization went hand in hand with deteriorating sanitation in cities, a situation that was most felt among the poorest sections of society. This contributed to mass cases of infectious diseases such as smallpox, cholera, typhoid and tuberculosis. There was also no free access to clean water. The accumulation of large amounts of waste, dirt and rubbish was also a big problem. Infant mortality was high.⁷ These factors contributed to the low life expectancy of the then inhabitants of the city. There was a visible relationship between the number of deaths and the high population density of specific areas.⁸

Taking London as an example: one of the root causes of premature mortality of the urban population was air pollution (formation of toxic mists) in the nineteenth century caused by - burning of fossil coal (due to the dynamic economic development, the development of the coal distribution network, thanks to the development of railway and water networks). A noticeable decrease in the concentration of dusts resulting from the combustion of fossil coal occurred with the gradual movement of the population to the suburbs, and thus a decrease in the concentration of the population in the central parts of the city. Appropriate legal regulations were also introduced to punish those enterprises that caused excessive production of pollutants. Another factor contributing to the reduction of dust concentration in London was the gradual switch to another source of heating and cooking - gas.⁹

⁷The Future of Public Health., 1988, Institute of Medicine (US) Committee for the Study of the Future of Public Health., Washington, National Academies Press

⁸Leon D., 2008, Cities, urbanization and health, International Journal of Epidemiology, 37(1), p. 4–8

⁹www.ourworlindata.org https://ourworldindata.org/london-air-pollution

More information at the link:

https://www.museumoflondon.org.uk/discover/londons-past-air

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The first observations on the increase in the amount of carbon dioxide in the atmosphere.

As early as the beginning of the 19th century, the first studies on the effects of carbon dioxide concentration in the atmosphere were conducted (Fourier - stated that the earth was now warmer than in past centuries). In the mid-nineteenth century, it was shown that CO₂, water vapor and other gases have the ability to absorb infrared radiation, which contributes to the warming of the earth's surface.¹⁰ Callendar noted that the development of industry may affect the formation of a warmer climate on earth.¹¹ It was not believed then that these changes would have a negative impact on the functioning of the earth and its inhabitants. The slow heating of the earth was not seen as a problematic phenomenon but as a benefit of some kind. Accumulation of carbon dioxide in the atmosphere, according to contemporary researchers of the phenomenon, was interpreted as a possibility of climate stabilization and its warming, especially in colder regions, which could have contributed to an increase in agricultural yields¹².

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Models of utopian cities.

The new models of city formation were influenced by many factors, the first of which was the

¹⁰www.envchemgroup.com https://www.envchemgroup.com/anthropogenic-co2-and-climate-change-ndash-a-historical-perspective.html

¹¹www.history.aip.org https://history.aip.org/climate/co2.htm

¹²www.daily.jstor.org https://daily.jstor.org/how-19th-century-scientists-predicted-global-warming/

French Revolution, where it was postulated that all citizens should be equal - before the law and themselves. At that time, the industry was also developing dynamically, in which a new social class appears - workers. Hence the emergence of a number of concepts aimed at improving the well-being of people living in cities, was precisely aimed at this social class.

The new models of cities were to be based on the community of residents, spaces for living and working were to be shaped in such a way as to create decent and healthy living conditions¹³ and bring people closer to nature.

Examples of concepts of utopian cities:

- Robert Owen – Village of Unity

- Charles Fourier – Phalanstery

- Jean Baptiste Andre Godin – Familistère

- Tony Garnier - City Industrial

-Le Corbusier – Cite Radieuse

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The idea of the garden cities.

E. Howard in 1902 published in his book the ideas of shaping the so-called "garden cities", where he called for a change in the model of creating cities and moving the urban population to the suburbs. Satellite cities located around a large city were to be self-sufficient, and residents were to have the access to the natural environment and work guaranteed. Cities were also to create a kind of community thanks to the creation of a large number of public spaces in "garden cities". They were to be built from scratch, "in cruda radice", where the plots were to be bought on the free market. An important element of the cities was to be a large share of greenery and free spaces, the central component of the cities was to be the city park. In

¹³Tölle A., 2011, Rozrastanie się miasta w krajobrazie. Dawne i współczesne utopijne koncepcje, Rozwój Regionalny i Polityka Regionalna, 15, p. 9-21

addition, there were to be green streets planted with trees, and each house (single-family houses were intended for working-class families) was to have an individual garden. In addition, the entire city was to be surrounded by a 3-mile-long green avenue - this space was to act as a barrier and protect residents from pollution emitted by industrial works located on the outskirts of the city. (The city of La Plata was shaped very similarly and ideologically, but here we see a clear chess division of space, not a radial arrangement, as is the case with the garden cities).¹⁴ After all, city gardens were not self-sufficient units, nor were they spaces for integration of various social strata. Their construction contributed to the fashion of living outside the city.

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Modernist cities. Athens Charter.

The Athens Charter was adopted in 1933, its demands were to contribute to the improvement of the urban environment and the well-being of the people living there. Cities at that time were densely inhabited (even overpopulated), had an outdated infrastructure that was not adapted to the early twentieth century. Its postulates were about: in what spaces to locate housing estates (in spaces with high environmental values, adequately lit) to make the buildings taller, which would allow them to be freely located among greenery; public utility facilities were also to have their own green areas, in addition, each district, according to its assumptions, should have had a public city park - with appropriate sports infrastructure. When there was not enough land to build such a park, it was recommended to demolish the obsolete buildings.¹⁵

Currently, modernism is criticized for contributing to the unification of space, many inhabitants of modernist housing estates do not identify with them. The scale of these housing estates and the free spaces within them was / is too large, not adapted to the "human scale"

¹⁴Burno F., 2018, Negatywna urbanizacja". Relacje urbanistyka - natura we włoskiej debacie architektonicznej lat 20. i 30. XX wieku, [w:] Łbik L., Strauss K., Wysocka A., (red.), Zieleń w krajobrazie miasta xix i xx wieku, Bydgoszcz, Kujawsko-Pomorskie Centrum Kultury w Bydgoszczy

¹⁵Sas- Bojarska A., 2017, Idea miasta - ogrodu w rozwoju nowoczesnej urbanistyki, [w:] Majda T., Mironowicz I., (red.), Manifesty urbanistyczne - w poszukiwaniu współczesnego modelu miasta, Warszawa, TUP

(the green areas located there are neglected and they lack proper development). In addition, modernist cities were crossed by wide communication arteries.¹⁶ An extreme example of the decline of modernist city-shaping thought is the Pruitt-Igoe estate in Louisiana.

More: history of the estate: https://www.youtube.com/watch?v=8CAfACI7LBY

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Development of cities after World War II.

After the Second World War, there was a dynamic development of the economy which was followed by related social changes. A modern industry (metallurgical, petrochemical, chemical, machine or electrotechnical) was being then created. Trade and services were developing.¹⁷ In the 1960s, we also observe a rapid increase in the world's population (with a simultaneous extension of the life span of city dwellers).¹⁸ These factors were also conducive to the dynamics of urbanization (the development of old cities and the emergence of new cities).¹⁹ It was then that the intensified phenomenon of migration of the better-earned population to the suburbs began to be observed, which contributed to the initiation of the process of urban sprawl (suburbanization) with the simultaneous degradation of the central parts of the cities. Cities with a high concentration of industry and communication arteries were also exposed to high concentrations of pollution.²⁰ In the 1970s, an important document was created: "Limits to Growth", published in 1972 by the Club of Rome. This report showed that the uninterrupted development observed in those years might lead to the total consumption of resources and the collapse of the world known at that time. It included the thesis that: *"the current development trends in the field of population, industrialization,*

¹⁶Sas- Bojarska A., 2017, Idea miasta - ogrodu w rozwoju nowoczesnej urbanistyki, [w:] Majda T., Mironowicz I., (red.), Manifesty urbanistyczne - w poszukiwaniu współczesnego modelu miasta, Warszawa, TUP

¹⁷Mydel R., 2020, Kryzys amerykańskich miast - pasa rdzy, Kraków

¹⁸Ciążela H., 2018, Statek kosmiczny ziemia. "Maltuzjanizm" oraz "Neomaltuzjanizm" lat 60 i 70 XX wieku i ich krytycy - niezakończona debata, Zeszyty Naukowe Politechniki Śląskiej, Organizacja i Zarządzanie, 123, p. 89 - 101

¹⁹Mydel R., 2020, Kryzys amerykańskich miast - pasa rdzy, Kraków

²⁰Szymańska D., Zjawisko urbanizacji i jej konsekwencje,

https://repozytorium.umk.pl/bitstream/handle/item/1201/zjawisko%20urbanizacji.pdf?sequence=1

environmental pollution, food production and depletion of natural resources will not change, then at some point before one hundred years elapse, we will reach the limits of growth on our planet".²¹

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The first environmental problems, the ozone hole. discovery of the phenomenon of global warming.

Not only the Club of Rome noticed the global changes caused by human activity. Scientists already in the 1970s discovered that in the atmosphere, as a result of the concentration of CFCs (chlorofluorocarbons – the so-called freons), the ozone layer was depleted (the discovery of an ozone hole in 1985 over Antarctica). It was assessed that this process posed a direct threat to the health and life of humans, as well as animals and plants. (Ultraviolet radiation promotes the occurrence of many diseases, including genetic changes and cancer). Currently, we note the decrease in the ozone hole in Antarctica, which is a result of the adoption of the so-called Montreal Protocol (1987), which prohibited the production of CFCs (freons).²²

https://www.youtube.com/watch?v=BL1ZsAlJKXU&t=27s

Some gases that contribute to the depletion of the ozone layer belong to the group of strong, so-called greenhouse gases and influence the formation of the global warming phenomenon.²³ This phenomenon began to be discussed in 1988, when at the forum of the American

²¹Zyblikiewicz L., Klub Rzymski - po 45,

latachhttps://ruj.uj.edu.pl/xmlui/bitstream/handle/item/385/zyblikiewicz_klub_rzymski_po_45_latach_2013.pdf? sequence=1&isAllowed=y

²²www.nasa.gov https://www.nasa.gov/feature/goddard/2018/nasa-study-first-direct-proof-of-ozone-hole-recovery-due-to-chemicals-ban

²³www.ec.europa.eu https://ec.europa.eu/clima/policies/ozone_pl

Congress, Dr. Hansen presented mathematical tables showing how the temperature in the world would be shaped in the future.²⁴ According to the fifth IPCC report, the global temperature on earth should not increase by more than 1.5 C - compared to the pre-industrial temperature (today this temperature is 1 degree higher compared to the pre-industrial temperature). As a result, the number of climatic extremes and weather events has increased. (IPCC Report)

https://www.youtube.com/watch?v=gGOzHVUQCw0

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The impact of urban development on the environment on earth.

Currently, it is believed that cities cover approx. 2% of the earth's surface. At the same time, cities consume 78% of the energy produced globally, emit more than 60% of the world's CO_2 , as well as other greenhouse gases (which is the result of energy generation, transport development, industrial production, etc.). It is cities that largely contribute to the climate change currently observed in the world.²⁵

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The decline of industrial cities in the so-called global north. The development of industry in the countries of the global south and the increase of the dynamics of environmental changes.

Since the 1990s, we have been dealing with a "transfer of wealth" to developing countries (including China, India, former USSR republics), characterized by large numbers of

²⁴Nuccitelli D., 2018, 30 years later, deniers are still lying about Hansen's amazing global warming prediction https://www.theguardian.com/environment/climate-consensus-97-per-cent/2018/jun/25/30-years-later-deniers-are-still-lying-about-hansens-amazing-global-warming-prediction

²⁵Belanger P., 2017, Landscape infrastructure, Nowy Jork, Routledge

inhabitants. This process took place very dynamically, which contributed, on the one hand, to the reduction of poverty in these regions²⁶ and on the other, to the increase in CO_2 emissions (urbanization in southern Asia is one of the largest in the world).

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The effects of climate change, the increase in the occurrence of natural disaster episodes.

https://ourworldindata.org/grapher/number-of-natural-disaster-events

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The impact of weather events on the functioning of cities.

Cities, as densely built-up and inhabited spaces, with a high concentration of accompanying infrastructure, are particularly sensitive to natural disasters.

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Flooding as a result of heavy rains. Presenting the example of Copenhagen.

Heavy rainfall is increasingly being seen in cities around the world. "*Flash flood*" is caused by heavy rainfall which is rapid and over a short period of time,²⁷ with high flow and discharge velocities.²⁸ The reason is a large number of impermeable surfaces and dense housing development located in urban areas (there is a quick surface runoff). In

²⁶Perspectives on Global Development 2019: Rethinking Development Strategies, OECD Publishing.

²⁷Fronczak P., Fiedeń Ł., Grzeszna K., Działek J., Biernacki W., 2017, Powódź błyskawiczna jako zdarzenie przyrodnicze i społeczne na przykładzie powodzi w Wojcieszowie 5 lipca 2012 roku, Prace Geograficzne, 151, p. 21-57

p. 21-57 ²⁸www.money.pl https://www.money.pl/gospodarka/wiadomosci/artykul/ulewy-powodzie-blyskawicznepowodzie-miejskie,194,0,2411458.html

agglomerations, we also observe the so-called "urban floods", local floods causing the failure of the municipal sewage system infrastructure, which is not able to collect all the rainwater during the flash rainfall.²⁹ An example of such an event is the storm that occurred in Copenhagen on July 2, 2011. Three hours of rainfall was then around 113 mm per square meter, causing enormous damage estimated at \$ 1.04 billion.³⁰

https://www.bbc.com/news/av/world-europe-14007888

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Floods from river spilling. Presentation of the example of the Millennium Flood in Poland. (See: CITADINE platform)

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Ocean level rise. Bangkok example.

Climate warming is contributing to the melting of glaciers (including mountain glaciers), which contributes to rising sea and ocean levels. The conducted research showed that in the 20th century the level of seas and oceans was at the highest level in 2,800 years. The rise in these levels is due to the melting of glaciers. Over the past 20 years, it has risen by about 75mm. The latest estimates show that the increase of the level until 2100 even by 2 m is possible.³¹

This observed phenomenon affects the lives of 110 million people worldwide. If seas and

²⁹www.arcadis.com https://www.arcadis.com/pl/polska/blog-arcadis/krzysztof-kutek/powodzie-miejskie/

³⁰www.theneweconomy.com https://www.theneweconomy.com/technology/copenhagens-climate-change-flooding-response

³¹www.climate.org https://climate.org/sea-level-rise-risk-and-resilience-in-coastal-cities/

oceans rise by 2 meters to the projected levels, 630 million people worldwide will be impacted.³² The most endangered cities are: Mumbai, Guangzhou, Shanghai, Miami, Ho Chi Minh City, Kolkata, Greater New York, Osaka-Kobe, Alexandria and New Orleans³³

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Landslides. Example of Jakarta, Indonesia.

The Indonesian capital, Jakarta, may disappear underwater by 2050. The reason for this is two factors: firstly, the rise in the level of the oceans annually, and the second is the collapse of the city, which was built on wetlands, formerly occupied by 13 rivers flowing through the area.³⁴ The city has a population of 10 million, 40% of the city is below sea level. Heavy rainfall will be a particular threat to this metropolis. The deteriorating situation of its inhabitants is also the result of a lack of planning control in the city. The emergence of substandard (poverty) districts, where the inhabitants use groundwater in their households - causes the city to collapse and accelerates its decline faster than the level of the ocean rising (130 times faster). The government is planning to move the city to other areas.³⁵

More on www:

https://storymaps.arcgis.com/stories/56d6caa4dc8046c1851758d929a01541

https://earth.org/data_visualization/sea-level-rise-by-the-end-of-the-century-alexandria-2/

³²www.naukawpolsce.pap.pl https://naukawpolsce.pap.pl/aktualnosci/news%2C79239%2Cwzrost-poziomumorz-interaktywna-mapa-pokazuje-ktore-rejony-moze-zalac-woda

³³Nicholls R.J., HansonS., Herweijer C., Patmore N., Hallegatte S., Corfee-Morlot J., Chateau J., Muir-Wood R., 2007, Ranking of the world's cities most exposed to coastal flooding today and the future - Executive Summary, OECD Ranking of the World's Cities Most Expose to Coastal Flooding Today and in the Future (europa.eu)

³⁴www.focus.pl https://www.focus.pl/artykul/indonezja-przenosi-stolice-z-powodu-katastrofy-klimatycznej-jakarta-tonie-190904124200

³⁵www.earth.org https://earth.org/data_visualization/sea-level-rise-by-the-end-of-the-century-alexandria-2/

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The formation of hurricanes. An example of New York and Hurricane Sundy.

Hurricane Sandy struck in 2012, with New York (October 29) most affected and New Jersey.³⁶ Brooklyn's Red Hook neighborhood, which is home to a very poor community, with a poverty rate of 45%, was hardest hit by the hurricane. For two weeks, the inhabitants of this district were forced to live without electricity or running water for two weeks, which prevented them from accessing adequate sanitary conditions.³⁷ This event prompted the city authorities to draft a plan to protect New York against such events, the spatial changes are to focus on the new development of lower Manhattan. Half a billion dollars is to be allocated to the construction of parks around the coast. The investment projects are to protect this part of the city until 2100 - their final cost is to be \$ 10 billion.³⁸

http://www.nyc.gov/html/sirr/downloads/pdf/final_report/Ch_1_SandyImpacts_FINAL_singl es.pdf

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Heat waves. An example of Paris.

The IPCC report clearly indicates that we will observe the phenomena related to heat waves and extreme temperatures more and more often, which is related to, among others, the concentration of greenhouse gases in the atmosphere and changes in the air circulation systems in the atmosphere. One of the most tragic heat waves was the one in 2003 in Western

 $^{^{36}} www.cordis.europa.eu \ https://cordis.europa.eu/article/id/120600-new-research-warns-of-increased-hurricane-risk-to-the-northeast-united-states/pl$

 ³⁷Schmeltz M., Gonzalez S., Fuentes L., Kwan A., 2013, Lessons from Hurricane Sandy: a Community Response in Brooklyn, New York, Journal of Urban Health: Bulletin of the New York Academy of Medicine, 90 (5)

³⁸www.chronmyklimat.pl http://m.chronmyklimat.pl/wiadomosci/adaptacja/nowy-plan-klimatyczny-dla-manhattanu-wzor-dla-miejscowosci-nadbrzeznych

Europe. During that time, 35,000 people died, including 14,000 in France alone. The most tragic day was August 13, during which the average of deaths in Paris was above the mean value by almost 600%.³⁹ In that case, not only the heat during the day was important, but the occurrence of tropical nights with a temperature above 25 degrees - which meant that even at night hours, elderly people were not able to cool down and rest from the high temperature. People over 65 and those burdened with additional diseases are most exposed to the effects of this type of phenomena. The correlation between heat waves and the number of deaths during that time period has been recorded in cities around the world.⁴⁰

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A general summary of the economic, social and environmental losses in cities caused by climate change.

Number of people affected by natural disasters:

https://ourworldindata.org/grapher/number-affected-by-natural-

disasters?country=Drought~~All+natural+disasters

Fatalities as a result of certain natural disasters:

https://ourworldindata.org/uploads/2017/12/Death-rates-by-catastrophe-type-01.png

Social effects of natural disasters: https://ourworldindata.org/grapher/internally-displaced-persons-from-disasters

Economic losses: https://ourworldindata.org/grapher/weather-losses-share-gdp

People who have lost their homes as a result of natural disasters:

https://ourworldindata.org/grapher/number-homeless-from-natural-

disasters?country=~All+natural+disasters

³⁹Tomczyk A., 2014, *Cyrkulacyjne uwarunkowania występowania fal upałów w Poznaniu*, Przegląd Geograficzny, 86(1), p. 41-52

⁴⁰www.naukawpolsce.pap.pl https://naukawpolsce.pap.pl/aktualnosci/news%2C78173%2Cklimatolog-faleupalow-zabijaja-liczba-ofiar-wzrosnie-wraz-z-ociepleniem

Sensitive population. Which social groups living in urban spaces are most exposed to the effects of climate change.

Climate change and the resulting threats have an impact on local communities in terms of health, quality of life, income and preservation of cultural identity.⁴¹ Every year, on average 60 000 people die as a result of natural disasters.⁴² By 2040, the number of deaths due to climate change is projected to increase to 250,000 per year.⁴³ The most vulnerable are communities from the poorest countries in the world..⁴⁴ Although, as shown by historical data, in recent years we have seen a decrease in the number of deaths as a result of natural disasters, which is the result of more and more accurate weather, and other, forecasts, infrastructure and developed systems to respond to specific threats. The poorest population is the most vulnerable to the effects of natural disasters.⁴⁵

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⁴¹Füssel, H., 2005, *Vulnerability in Climate Change Research: A Comprehensive Conceptual Framework*,. UC Berkeley: University of California International and Area Studies

⁴²www.ourworldindata.org https://ourworldindata.org/natural-disasters

⁴³www.eea.europa.eu https://www.eea.europa.eu/pl/sygna142y/sygnaly-2015/wywiad/zmiany-klimatu-a-zdrowie-czlowieka

⁴⁴www.un.org https://www.un.org.pl/cel13

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