http://dx.doi.org/10.18778/7525-980-3

LVIV AND ŁÓDŹ

AT THE TURN OF 20th CENTURY

Historical Outline and Natural Environment

WYDAWNICTWA
UNIWERSYTETU
ŁÓDZKIEGO

Edited by
Mykola Habrel
Elżbieta Kobojek

LVIV AND ŁÓDŹ
AT THE TURN OF 20th CENTURY
Historical Outline and Natural Environment

WYDAWNICTWO UNIWERSYTETU ŁÓDZKIEGO
ŁÓDŹ 2013

Mykola Habrel – Sub-Department of Spatial Policy, Department of the Built Environment and Spatial Policy, Faculty of Geographical Sciences University of Łódź, 90-142 Łódź, Kopcińskiego St. 31

Elżbieta Kobojek – Sub-Department of the Built Environment, Department of the Built Environment and Spatial Policy, Faculty of Geographical Sciences University of Łódź, 90-142 Łódź, Kopcińskiego St. 31

REVIEWER

Janusz Słodczyk

PUBLISHING EDITOR

Iwona Gos

PROOFREADERS

Zofia Trębacz, *Piotr Wójciak*

TYPESETTING

Oficyna Wydawnicza Edytor.org

COVER DESIGN

Joanna Wojnarowska

Published by Łódź University Press

First Edition. W.06262.13.0.K

ISBN (wersja drukowana) 978-83-7525-980-3
ISBN (ebook) 978-83-7969-230-9

Łódź University Press
90-131 Łódź, Lindleya 8
www.wydawnictwo.uni.lodz.pl
e-mail: ksiegarnia@uni.lodz.pl
phone (42) 665 58 63, fax (42) 665 58 62

CONTENTS

PREFACE

In this publication the attempt was undertaken to present the economic history, spatial development and contemporary image of two cities – Lviv and Łódź. Lviv is situated on an upland in the western part of Ukraine, and Łódź in a lowland area in the central part of Poland (figure 1).

Lviv is located at the border of Roztochyia, Podillia Upland and Minor Polissia, on the watershed of the Bug and Dniester rivers, which means on the main European watershed of the Baltic Sea and the Black Sea. It was established on the important transport and trade route from the Black Sea to the Baltic Sea. The city was founded in the Poltva river valley, surrounded by hills. The height above mean sea level (AMSL) in the city is between 387 m and 240 m. Hills are built of marls, limestones, sands and sandstones covered with a layer of loess. Within the borders of the city there are many springs, giving rise to small rivers. The oldest settlement (dating back to the 13th century) situated at the foot of the Castle Hill was transformed in the 14th century into a properly founded town. Since then, Lviv has been developing constantly, becoming a major political and economic centre which played an important international role between the 15th and 18th centuries. Starting from the 16th century, it became an important centre of culture, and from the 17th century – also of education and science. From the very beginning, it was a multinational (Poles, Russians, Germans, Jews, Armenians and others) and multicultural city. In the following centuries, the number of its inhabitants increased and its beautiful spatial form was created. At the end of the 15th century Lviv had a population of 12 000,

in the mid-17th century – 33 000 and in 1910 its population reached 200 000. Between 1890 and 1914 Lviv underwent a transformation into a modern city. Nowadays, it has about 766 000 inhabitants and an area of over 171 sq. km. Average population density is 4298 persons/sq. km. Contemporary, Lviv is one of the most important political, economic and cultural centres of Ukraine.

Figure 1. Location map
1 – capital cities of Ukraine and Poland; 2 – city locations; 3 – the main European watershed of the Baltic Sea and the Black Sea; 4 – the main watershed of the Vistula and the Oder

Source: own elaboration

Łódź is situated in the Central Poland Lowlands, at the border of the Łódź Heights and Łask Plateau. The morphological landscape of the city is fairly diversified. The surface falls from 278.5 m above sea level in the north-east to 161 m in the south-west. Glacial and fluvioglacial forms composed of till and gravel as well as sands predominate in the relief. Łódź is located on the main watershed of the Vistula and the Oder. From here small rivers take their begin-

ning, flowing radially to the rivers Bzura, Warta and Pilica. Łódź was granted city rights in 1423, but until the beginning of the 19th century, it was a small town of agricultural character. Situated in woodlands and swamps, far from important trade routes, it did not play any significant role in political, social or economic life of the country. In the 16th century 40 families lived in Łódź, and at the end of the 18th century it had only 250 inhabitants. Only after the government decision in 1821 of locating here an industrial settlement, the dynamic development of the city started. In the 19th century Łódź was one of the most quickly developing centres in Europe. In 1820 it had 767 inhabitants, in 1840 already 13 000 and in 1914 almost 600 000. During this time the multinational structure of city was also formed, because many Germans, Poles, Jews and Russians were settling here. At the turn of the 19th century, Łódź was the biggest industrial centre of the Kingdom of Poland. The demographic growth of the city was accompanied by its spatial development, which, however, did not take place in a rational way (mixture of industrial and residential development, lack of sewage infrastructure). The "sprawl" of the city that could be observed was due to its textile industry being dependent of two main rivers in this area, Jasień and Łódka. These two rivers, rich in spring water running fast down the slope, were the main cause of locating here the first weaving mills at the beginning of the 19th century. But the intensive development of the textile industry and of the city itself created serious problems with water supply. Today, rivers in the city centre flow in underground collectors. Contemporary, Łódź has about 725 000 inhabitants and an area of 293 sq. km. Average population density is 2472 persons/sq. km.

In the interwar period Łódź was the second and Lviv the third biggest city of the Polish Republic. Currently, both cities have a similar number of inhabitants, but they differ substantially as regards the city area within administrative boundaries and average population density.

Although so different in their historical course of development, both cities encounter at the moment many similar problems and challenges, facing the necessity to create their future prosperity exploiting their specific local potentials and to continue their best traditions of urban growth in all aspects – spatial, social, cultural and economic.

Elżbieta Kobojek
Mykola Habrel

Oleg I. Shabliy

Ivan Franko National University of Lviv

1. LVIV IN GEOGRAPHICAL SPACE

Geographical position is an important feature of any object (state, region, locality, including the city) on the earth's surface. It represents the spatial relationship of this object to geographic objects that are outside it and have or may have a significant impact on its development, structure and functioning.

Geographical position extremely *individualizes* object, making it unique. It is an important *identifier* of the object. Thus, geographical position is a feature *specification* of geographical objects.

However, geographical position, as a category of science, is a complex conceptual and terminological system. Reflecting the significant properties of geographical objects, geographical position acts as their *attitude*. And in the attitude at least two agents are participating: the subject of the attitude (whose position is characterized) and the object (which determines the geographical position of the subject). This indicates that the geographical position of the subject largely depends on itself, that is, on its influence on the object of this binary system.

The different types of geographical position include:

1) mathematical-geographical – the position on the grid degree, determined by longitude and latitude;

2) natural-geographical – the location in respect to natural geographic objects – river systems, oceans and seas, mountain ranges, lowlands etc., zones of nature, climate, soil and plant zones, belts and regions. In short, with respect to units of the environment or their spatial combinations;

3) human-geographical – the location in relation to objects and their systems with demographic, social, economic or political influence. These objects of influence should be: communication (including commercial) lines and units, system of settlement, economic areas and regions, large enterprises and economic poles of growth etc., separate states and their units, military alliances;

4) ecologically-geographical – the relative positions of the object in relation to pollutants or "cleaners" of natural environment: in areas of air masses moving defiled, enterprises – the pollutants of air and river pools, forest or sea "producers" of ozone, oxygen and more.

For cities, especially large, this includes Lviv, also determine the proper spatial aspects of geographic location. There is so-called macro-, mezo- and microposition, such as natural and human-geographical. Each of them somehow synthesizes both "component" and geospatial attitudes and communication. Let us consider all these types in relation to a large city in Ukraine and throughout Central and Eastern Europe – Lviv.

1.1. Mathematical-geographical position

This type of position is the most operationalized. It is relatively easy to define geographical longitude and latitude (in degrees, minutes and seconds). As a rule, it shows the longitude and the latitude of the city centre, including the main home address. If the city is big, you can specify (in minutes and seconds) the extreme northern, southern, eastern and western points of its contours. There are no objections to the coordinates of the geometric centre.

Using the information of Google, we present below such data of the mathematical position of Lviv. Its geographic coordinates are: 24° 01' 26'' east longitude and 49° 50' 15.5'' north latitude. Thus, Lviv as well as the main part of Europe is in the Eastern Hemisphere at a distance of about 1855 km east of zero meridian and about 5530 km north of the equator.

This position, which is close to the median, marks the network degree north latitude (the average is 45°, which means that the difference between this figure and latitude of the city is almost five degrees). It is about 530 km. It is rather far from the median value of the east longitude (the "deviation" is approximately 66° as the difference between 90° and 24°, which is about 6300 km).

Mathematical-geographical position of Lviv should be studied in its metric relations to many centres of large areas to which it relates. In particular, the centre of Europe (it is near Vilnius), Ukraine (village of Marianivka, region of Smila, Cherkas'ka oblast'), Western region of our country (it is near the village of Strutyn, region of Zolochiv) and most of the Lvivs'ka oblast'. The distance to them is under 550 km (as to the capital of Ukraine – Kyiv), 75 km and 15 km (city of Pustomyty). So, Lviv lies almost in the geometric centre of oblast'. This, mentioned above, distance defines the *metric eccentricity* of the city.

The position of the city also can be described by *linear-metric centricity*. Its position located almost at the intersection of two lines that characterizes two European options: the main European watershed and the shortest distance between the eastern Atlantic seas – the Black Sea and the Baltic Sea. Lviv is situated in almost cross-core formed by the intersection of the said watershed and the line connecting Odessa with Gdańsk. From this cross-core position Lviv seems to be a kind of *genius loci* (the genius of the place).

If we consider the position of the system time zone (and on each account for about 15° longitude), Lviv is in the second (European) time zone. So, here, as well as throughout Ukraine the second European zone should be acted.

1.2. Natural-geographical position

First of all, there is macro-, mezo- and microposition of Lviv in the system of natural attitudes.

Macroposition of the city – it is the location in the system of large geographical units of the division of Europe. S. Rudnytskyi attributed the city to the East of this part of the world and substantiated this opinion by tectonic, climatic and other natural factors. In particular, by the position at the border, where the Eastern and Western European tectonic platforms converge.

The macroposition includes the position of Lviv in the central part of the natural zone of mixed forests. In regard to climate, Lviv is located in the zone of the transformation of moist Atlantic air masses into the continental. Recently, the amounts of moisture and heat are defined which determines plant zonation within Eastern Europe.

Lviv is located in the farthest corner of the East-European Plain, where it adjoins the Alpine mountain system of the Eastern Carpathians. There is no other city in Eastern Europe with such natural macroposition.

Mezoposition of the city – its location in the west of Podillia Upland, which gradually turns into foothill uplands of Central and Western Europe, extending parallel to the mountains of Alpine folding up to the Pyrenees on the border of France and Spain.

Within Podillia Upland, based on the Volyn'-Podillya tectonic plate, Lviv is on the extreme of its north-western slope. Thus, it is opened to Arctic air masses at any time of the year, which largely determines the annual course of climatic indicators.

Microposition of the city – a location at the junction of three natural regions: Western Podillia, Minor Polissia and Roztochyia. This coupling is represented by spatial elevation of the natural areas of these regions: Lviv Plateau (from the side of Western Podillia), Ukrainian Roztochyia and ridge Pobuggia (from the side of Minor Polissia). This is evident in the emergence of the city near the up-

per Poltva river that runs multiple threads from Roztochyia and Lviv Plateau and goes on along the north side of the valley between the ridges. The city arose on the right-side terraces of the Poltva river and was protected by marshes of its valley to the west and slopes of erosion residuals in the east and south-west.

1.3. Human-geographical position

A characteristic feature of this type of position is historical variability, especially historically dynamic was economic- and political-geographical position. All types of human-geographical position – demo-, economic-, social- and political-geographical position are interrelated and mutually conditioned.

The demographic position is determined by finding the first city in the settlement system in general and urban settlement in particular. Since that time, the city became a national and regional centre (13th–15th centuries), especially the centre of Rus' Province (1430), and has remained the core of Galician and Galician-Volyn' settlement system that has formed.

At the beginning, a number of autonomous cities in this system was more or less of the same order (Peremyshl', Belz, Volodymyr, Zvenigorod, Halych, Terebovlia). They concentrated a significant number of the population. But with the transition of Galicia under the authority of the Kingdom of Poland (late 14th century), their regional role had been reduced, and Lviv's – increased.

When Lviv together with Galicia joined Austria (1772), its population was 20 000 people. In 1875 the city had a population of 100 000. In the second half of the 19th century it was not only the seat of East Galician regional parliament, but also the core of transport railway junction. With a population of 160 000 inhabitants Lviv entered the 20th century. And at the end of this century, it reached a level of 759 000 people.

The city became the centre of the circular (above 100 and more thousand people daily during 80 years of the 20th century) and total migration. Circular migration (mainly within a radius of 30–40 km)

has led to the formation of the agglomeration of Lviv, in which Lviv is the core constantly "fueled" by human resources of nearby urban and rural settlements.

Thus, almost 700 years old Lviv itself creates utility demogeographical position, concentrating a great part of Western Ukraine's urban population.

1.4. Economic-geographical position

In the era of handicraft (feudal society) and industrialism the industrial production became the crucial force in the development of most of the cities. The focus of crafts and manufacturing in the settlement led to the concentration of population there. This also applies to Lviv.

Being in the second half of the 19th century the major industrial and commercial centre of Galicia, Lviv dramatically improved its economic-geographical position through the development of a railway network (11 lines), aiming for raw material and energy flows and creating the large-scale sales of industrial production. This role was secured and developed in the Soviet period (1939–1990 years).

Nowadays, the economic-geographical position of Lviv is determined by the following factors:

1) its location in the node of transport lines, corridors and flows in east-west and north-south direction;

2) proximity to the western border, which is the eastern border of the European Union as well;

3) the presence of extensive agricultural circumlocution suburbs as a supplier of food and raw materials for a number of industrial sectors of the "B" group;

4) the presence of extensive areas, which have not sufficiently used the natural, historic, cultural and recreational potential;

5) the existence on mezolevel (70–150 km) of large depressed industrial, predominantly mining areas – Pidkarpatskyi oil-gas-mining, Lviv-Volyn' coal and so on.

Among the regional centres of the western region (mezoposition), Lviv is characterized by the optimal raw material-, food-, energy- and transport-geographical position. As for economic and geographical microposition, it is determined for Lviv by a dense network of rural and urban settlements (such as Vynnyky, Rudne, Briuhovychi), which provide for its daily and seasonal demand for food, water, recreation services, building materials and labor resources. Largely, these settlements are serving as sleeping areas for Lviv, contributing to solving its housing problem.

1.5. Political-geographical position

The political-geographical position of Lviv was historically defined by its location in a large area of the junction of geopolitical and military-strategic interests of the Western and Eastern Europe. This is directly manifested in the constant struggle for Lviv between Poland (especially by First and Second Polish Republic) and Russia (the Russian Empire and Soviet Union). Also, there were the interests of the Germanic system (Austria, Germany) and even Hungary.

The position of Lviv in close proximity to Western Europe with its cultural, spiritual, economic and political centres was largely the basis for the formation and consolidation of the town as an outpost of the Ukrainian state and national mentality in their western geopolitical and geostrategic terms.

The most important feature of modern Lviv's political-geographical position is its proximity (70 km) to the western sector of the Ukrainian state border. It is only natural that here is situated the western regional customs house as well as Command of the Western Operational Military District.

This situation is automatically determined by proximity to the system of Western democracy, Poland in particular forming the North Atlantic military-defense organization NATO. This proximity leads to the establishment and operation of the Lviv training centre (the so-called Yavoriv range), which often carries out military training

and particularly determines the military-strategic geographical position of Lviv.

The political-geographical position of Lviv is closely linked to its geopolitical position. In particular, it refers to the relative proximity of the capitals of neighboring states (of course, primarily the capital of Ukraine – Kyiv). These capitals are the centres of the state, international geo-economic and military-political decisions. Thus, the distance to Kyiv is 468 km (straight line) to Warsaw – 345 km, Cracow (former capital of Poland) – 290 km, Budapest – 450 km, Minsk – 504 km, Chisinau – 450 km, Bucharest – 612 km, Bratislava – 535 km. In this respect, Lviv has better PGP than the capital of Ukraine – Kyiv, though, of course, it is not comparable to the latter. But by virtue of PGP, Lviv often became and will become the venue of interstate Central-European summits, conferences and meetings, especially Ukrainian-Polish events.

1.6. Ecological-geographical position

This kind of geographical position was important in the last decades of the 20th century and at the beginning of the 21st century. It is associated with deterioration of the environment due to industrial, military and even scientific and technological activities of mankind.

First of all, ecological-geographical position is determined by establishing the existence of zones and areas in which are concentrated companies-pollutants of air, surface and groundwater, soils, flora and fauna, those that create negative eco-background for normal functioning of humans as biological creatures. Factors of environment pollution may affect people directly (air pollution) or indirectly (through pollution, such as heavy metals in soil, groundwater and food products).

At the macrolevel (ecological-geographical macroposition), what is important for Lviv, its location in the area of so-called *western transfer* of air masses from mining areas of Western and Central Europe. In particular, from electric power and chemical enterprises

of the Ruhr and Silesian coal basins. In these masses are formed acid rains, which is especially polluting for soil, water, flora and fauna because of poorly active sulfuric and nitric acid.

At the mezolevel a major source of pollution in Poland is the Tarnobzhehskyi Sulfur-extraction Basin (completely gets into the zone of western transfer). This also refers to two industrial-extraction areas: to the north of the city – Lviv-Volyn' Basin with a large Dobrotvir Thermal Power Plant and to the south – Pidkarpatskyi gas-oil-sulfuric area with a strong (2 400 000 kW) Burshtyn Thermal Power Plant. Although the distance to these pollutants is quite large (70 km or more), but their impact on the natural environment of Lviv is manifested both directly (depending on the wind) and indirectly.

At the level of micro-geographical position no special effect on the ecological situation of Lviv has been observed, except for "own" emissions by road transport and water pollution.

The improvement of Lviv's ecological-geographical position is related to the following features of the surrounding natural environment elements:

1) the proximity of large areas of deciduous and coniferous forests in the Ukrainian Carpathians. Its excretion of the phytoncides and "production" of oxygen with carbon dioxide absorption creates a healthy atmosphere for human life, including the urban node which consists of Lviv with the neighborhood;

2) the proximity of the parkland Roztochyia (including the National Park Roztochyia), which is wedged in Lviv from the north-west. Roztochyia with forested Opillia and Holohory-Kremenets-strand performs an important ecological function. Its territory serves mainly as weekend area of recreation for citizens and supplies Lviv with clean water (Rava-Rus'ka, Maheriv, Krekhiv etc.).

Thus, the ecological-geographical position of Lviv is generally favorable.

Geographical position of Lviv as a large urban centre of Western Ukraine has a complex and controversial character. On the one hand, it is clearly advantageous (location of the city in the Western and Central geocultural sphere, proximity to European socio-economic

and political structures, proximity to the state border of Ukraine, being in the zone of western transfer of moist air masses). On the other hand, all these positive characteristics in certain historical periods turned out to have negative consequences: more than once Lviv was in the area of the first military attack from the West (1918, 1941), the first attack of acid rain in the region, coming from industrial areas of Western and Central Europe, and so on.

Overall, taking into account the complexity of the geographical position of Lviv, it can be said that there are more advantages than disadvantages in this position. This is largely due to the fact that Lviv is a powerful urban determinant of human-geographical position of the surrounding area within a radius of 200–250 km (including even the territory of Poland) and thereby increases the benefits of its "position-by-itself".

Elżbieta Kobojek
Iwona Pielesiak
University of Łódź

2. ŁÓDŹ IN GEOGRAPHICAL SPACE

Łódź is located in Central Poland, ca. 30 km south of the geometric centre of Poland. This best describes the city's location and one might think that it should have considerable influence on its development and importance. However, this has not always been the case. Regardless of its central location, Łódź has long remained outside the main stream of political, social and economic trends. This situation was caused by various factors. To some extent, it was a result of the city's natural location between two historic regions, Wielkopolska (Greater Poland) in the west and Mazowsze (Mazovia) in the east. Only the city's rapid development at the beginning of the 19th century brought an important change. Therefore, to fully understand the phenomenon of Łódź, it is necessary to define the city's geographical location, including its location in the context of natural, historical and political conditions.

2.1. Natural-geographical position

In terms of nature, Łódź has a borderline location, both as regards the geological-tectonic features and its relief, hydrography, climate and plant life. Just a few dozen kilometers north-east of the city lies

one of the most important borders of the continent – the line separating the Pre-Cambrian platform of Eastern Europe from Paleozoic formations of Western Europe (Stupnicka 1989, p. 14). In Central Poland Mesozoic units are dominant (figure 2.1). In the north-east section of Łódź lies a border separating the Central Poland anticlinorium and the Mogilno-Łódź basin. The anticlinorium is mostly composed of Upper Jurassic sediments, while the basin is filled with Cretaceous sediments (Dadlez et al. 2000). The basin turned out to be extremely important for Łódź as it is a large reservoir of groundwater. It is this groundwater enabled the great expansion of industry in Łódź, and today is the main source of water for the residents of this city.

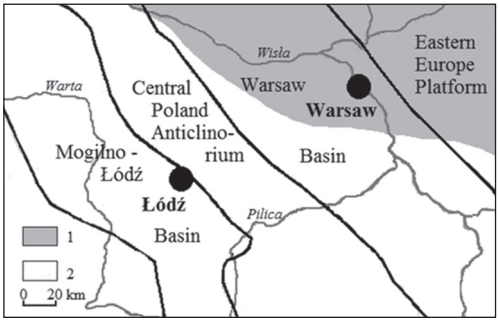

Figure 2.1. Location of Łódź in geological structures of Central Poland
1 – the Pre-Cambrian platform of Eastern Europe; 2 – the Paleozoic platform of Western Europe

Source: Stupnicka (1989), simplified

Latitudinal composition of the main morphological formations is characteristic of Central Poland, with wide ice-marginal valleys and plateaus reaching 100–150 m above sea level. This composition is disturbed by longitudinally stretching elevated area in the AMSL range of 200 m or even 280 m in some sections (figure 2.2). In the south it meets a range of uplands, while in the north, through distinct gradations measuring ca. 100 m, it transforms into the plains

of Central Poland. This elevation is also distinct in the landscape in the eastern and western direction because of significant mean elevations in relation to the nearest surroundings. Łódź was founded right at the feet of the highest western elevations.

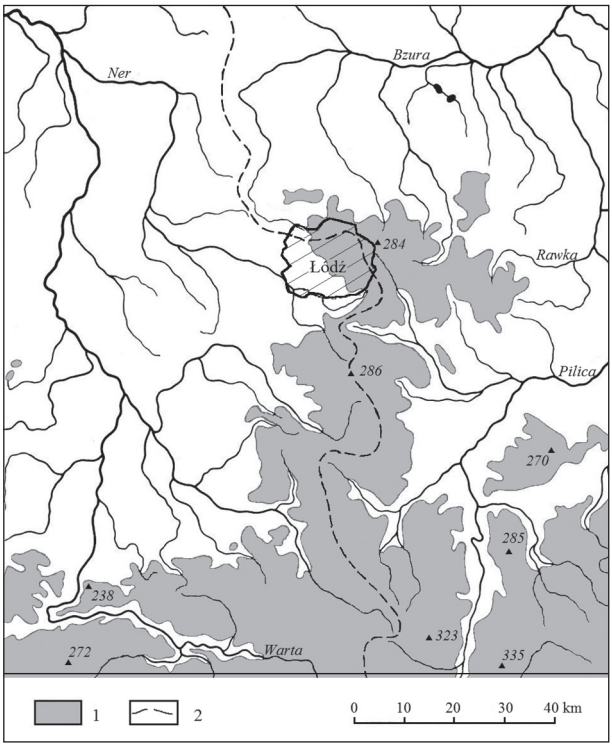

Figure 2.2. Area elevated more than 200 m above sea level (1) and watershed of the Vistula and the Oder (2)

Source: Dylikowa (1973), simplified

Geographers studying the area of Central Poland have long been observing the distinctive character of Łódź region's landscape. Extensive research on the natural environment conducted since 1945 by Łódź University scholars has resulted in the identification within

Niziny Środkowopolskie (Central Poland Lowlands) of a geographic area called Wyżyna Łódzka (Łódź Highland) (Dylik 1947, p. 239; Klatkowa 1972a, p. 240; Dylikowa 1973, pp. 485–532; 1974, pp. 160–166). It is bounded by three deep valleys: the valley of the Warta to the west, the valley of the central Bzura to the north, and the valley of the Rawka and the Pilica to the east. The main axis of this region was, naturally, the longitudinally stretching highest raised area.

The term "Łódź Highland", commonly used by Łódź geographers until the 1990s, is not appropriate. According to geomorphological classifications, highlands areas are located at the elevations over 300 m above sea level, composed of rocks from an older foundation. The Łódź region, rising above the plains of Central Poland, is composed of Quaternary sediment, fluvioglacial sediment and till, which does not fit the definition of uplands.

According to the widely used division of Poland into physical-geographical units by Kondracki (1998, pp. 155–162, 196–198), the area of Łódź is located within the area of Niziny Środkowopolskie, at the borderline between two macro-regions: Nizina Południowowielkopolska (Southern Greater Poland Lowland) and Wzniesienia Południowomazowieckie (Southern Mazovia Heights). The majority of the area of Łódź is located within Wysoczyzna Łaska (Łask Plateau), which belongs to Nizina Południowowielkopolska. Only the northern and eastern reaches of the city lie on Łódź Heights, which in turn belong to Wzniesienia Południowomazowieckie.

Łódź is located in the major watershed of the Vistula and the Oder (figure 2.1). Wzniesienia Łódzkie (Łódź Heights) constitute a water node where watershed lines of the main rivers of the region meet. From here, rivers radiate towards the Bzura, the Warta and the Pilica. The city's exceptional location away from large rivers, at the borderline of the Vistula and the Oder watershed, has been the reason for considerable shortages of surface water for various applications.

Poland lies in the temperate climate zone. The temperateness is related to the influence of continental masses from the east and

oceanic masses from the west. Łódź is located in Central Poland, which is why the oceanic and continental influences it receives are not extreme. As a result, meteorological values for Łódź are similar to mean values for Poland – annual, seasonal and monthly. However, the effect of the higher elevated area on rainfall in relation to other neighboring areas is noticeable. For the last 100 years, the area has also been a subject to some modifications caused by the large city.

The plant life of Wzniesienia Łódzkie shows a distinct connection to the uplands of Southern Poland. Near the northern borders of Łódź there lie the borders of the maximum northern reach of forest-forming trees: Common beech (*Fagus sylvatica*), European silver fir (*Abies alba*) and Norway spruce (*Picea abies*). Mountain species are also a significant group within the region's plant life. Therefore, this is where the borderline between high-level geobotanical lands of the northern Pas Wielkich Dolin (Great Valleys Belt) and the southern Pas Wyżyn Środkowych (Central Uplands Belt) was established (Szafer 1972, pp. 14, 149–152). Łódź is located within Północne Wysoczyzny Brzeżne (Northern Borderline Plateaus), which constitute a part of Pas Wyżyn Środkowych.

2.2. Historical development of the settlement

Contemporary, Łódź is the biggest city in Central Poland as well as its main administrative centre. However, when it was granted city rights, much bigger and dynamic cities had already existed on the periphery of the region, such as the capitals of Łęczyca and Sieradz duchies (Machlański 2009, pp. 21–15). Gaining the urban status did not mean immediate acceleration of socio-economic development for Łódź. Prosperity did not come until the 19th century – 390 years after the village Łodzia was given civic rights and became a town. Surprisingly, the rapid demographic and spatial growth, resulting from massive industrialization, did not bring automatic improvement in the position of Łódź in the administrative hierarchy. This fact may be attributed to the political situation of the region, which

initially was governed by Prussian administration, and afterwards, being a part of so-called Congress Poland, was dependent on Russia. The following years confirm the observation that the role of Łódź in territorial governance systems was prominental in times of free Poland and marginal when political dependence from another country occurred.

In the early historical era, the settlement of the Łódź area was the most developed in the vicinity of Łęczyca – at the concurrence of the Bzura river and Warsaw–Berlin ice-marginal valley, in the vicinity of Sieradz – in the main and secondary valleys of the Warta river as well as in the vicinity of Pajęczno, Radomsko and Przedbórz – in the main and secondary valleys of the Pilica river (Dylik 1971, p. 63). Much fewer open and fortified settlements have been found at the catchment of the Rawka river and in the horizontal section of the Bzura river (in the vicinity of Łowicz) as well as in the vicinity of present-day Pabianice (in an area known as Chropy).

Characteristic of the area of Central Poland at the beginning of its existence was its peripheral location in comparison to much more developed areas of Greater Poland, Silesia, Lesser Poland and Mazovia. Because of its specific location among the other settlements a lot of travel routes, both national and international, would cross in this region, i.e. Moravia–Kujawy route (Wieluń–Sieradz–Łęczyca–Włocławek / Turek–Konin); the salt route from Greater to Lesser Poland (Radomsko–Sieradz–Kalisz); Toruń–Lviv route (Gostynin–Łowicz–Rawa Mazowiecka–Radom) and the route leading from Rus to Western Pomerania (Sulejów–Wolbórz–Pabianice–Lutomiersk–Uniejów) (Machlański 2009, p. 30). As far as the location of the routes is concerned, natural conditions were of importance, especially the shape of the hydrographic network which determined the crossing over the Bzura river in Łęczyca and Łowicz, the Warta river in Sieradz and Uniejów, and the Pilica river in Przedbórz, Sulejów and Inowłódz.

The shape of state administration started crystallizing in the 9th century. In this period, free people started being more and more dependent on feudal lords, this phenomenon was, however,

not as widespread as in the Western Europe. Much better social and economic conditions on Polish territory in comparison to other countries, which resulted from the positive attitude of feudal lords towards taking over so far undeveloped land, led to an increased influx of foreigners who would settle down under the German law (hereditary land ownership, temporary exemption from paying the feudal dues, exclusion from the state jurisdiction for the benefit of the feudal lord). As a result of the process, bigger and bigger areas of the primeval forest that surround today's Łódź were under the anthropogenic impact on the environment. Settlers would move from relatively easy to plow and travel river valleys to plateaus (Dylik 1971, pp. 75–80). The primeval forest near Łódź survived through the whole period of the Middle Ages. Its final destruction was a result of rapid industrial development of Łódź and nearby towns in the 19th century.

As has already been mentioned, Łódź does not belong to the group of the oldest towns in the area, even though it was granted civic rights already in 1423. Much longer history can be the pride of Łęczyca, Łowicz, Sieradz, Szadek, Wieluń and settlements which with time lost their civic rights, i.e. Bolesławiec, Nowa Brzeźnica, Stara Brzeźnica, Kazimierz, Lutomiersk, Ruda and Wolbórz (Dylik 1971, pp. 81–84). Sources state that in some of the above mentioned settlements cloth making craft developed already in the 13th century. Such production was located the earliest in Brzeziny, Lutomiersk, Łęczyca, Pabianice, Piotrków, Rzgów, Sieradz, Warta and Wieluń (Machlański 2009, p. 30). The turn of the 16th and 17th centuries is the time of rapid development of handicraft in Central Poland, i.e. in Rawa Mazowiecka people manufactured belts that imitated Turkish and Persian products, beer was produced in Piątek, and water mills were traded in Przedbórz. Generally, the dominant economic activity at that time was agriculture.

The slow development of settlement in the immediate neighborhood of Łódź was a direct result of unfavorable natural conditions. Highly diverse relief and stony soil hindered the development of ag-

riculture, whereas the primeval forest hindered the development of transport.

Initially, Łódź was a small agricultural, trading and handicraft settlement. The oldest official mentions concerning this town come from 1332. It was then a village that belonged to the bishops of Włocławek and whose rights were changed from Polish to Neumarkter law in 1397. A landmark in the history of the settlement was its conversion into town that was done in 1423 under the Magdeburg law. In the middle of the 15th century Łódź was inhabited by 100 people; the number rose gradually and at the turn of the 16th and 17th century there were 1000 inhabitants (Kaczmarek 1962, p. 5).

For a town that was developing it was disastrous that in the 17th century armies marches through it, feudalism and church exploited people and epidemics reduced its population to 200 people at the end of the 18th century (Kaczmarek 1962, p. 6). The proof for its low position until the end of the 18th century is the fact that administratively it belonged to the county of Brzeziny. Being an episcopal town, after the second partition of Poland Łódź was taken over by the government.

As a result of the second and the third partition of Poland, Łódź and the territories surrounding became a part of the Prussian sector (the province of South Prussia). New administration was built by Prussian clerks who came to the region with little knowledge of the country and often not knowing the Polish language. The territory of Central Poland was administrated by a foreign ruler in two departments – kaliski department (to which belonged i.a. Warta, Sieradz, Wieluń, Piotrków Trybunalski and Radomsko) and warszawski department (i.e. Łęczyca, Zgierz, Brzeziny, Rawa Mazowiecka), which were also divided into counties (Walicki 2009, p. 35).

The changes on the political map resulted in renewed immigration to the territory of Central Poland. Especially noticeable for this time period is the German colonization that kept annexing more and more of the primeval forest surrounding Łódź. The origin of the influx of people then called the fryderycjańska colonization (from

the name of the Prussian king – *Frederick the Great*) is connected, for example, with the inception of the village Nowosolna that is nowadays a part of Łódź. Among the people who colonized this area at that time were not only farmers but qualified craftsmen as well. The greatest stimulus for the development of Łódź and nearby private towns – Aleksandrów and Konstantynów Łódzki, and Ozorków as well as a bit farther situated Tomaszów Mazowiecki and Zduńska Wola – turned out to be the influx of cloth makers and linen and cotton weavers.

The reconstruction of the Polish state during the times of the Duchy of Warsaw (1807–1815) did not bring about much change in the division of the territory of Central Poland, introducing only slight corrections to the boundaries of departments and counties (Walicki 2009, p. 40). Valid changes in the administrative location of Łódź took place as a consequence of creating the Kingdom of Poland, when voivodeships were introduced in place of departments. At the same time, the role of counties was limited as they were deprived of legislative and they were voting as well as administrative power (Walicki 2009, pp. 40–45). After the defeat of the November Uprising, the administrative system of the Polish territory was being gradually changed. From 1837 voivodeships were called provinces and counties were replaced by districts; those changes had, however, no major impact on the competences of the governing bodies.

Shortly after the creation of Congress Poland, in 1816, by virtue of the authorities' decision to support immigration of the so-called "useful foreigners" (handicraftsmen and outwork employers), another wave of settlers from Greater Poland, Silesia and Prussia started coming to the governmental territory (Dylik 1971, pp. 124–136). Further parts of the primeval forest were cut down for the sake of those new settlers whose housing was located in Andrzejów, what is today a part of Łódź, and two nearby villages of Andrespol and Justynów. The influx of settlers slowed down temporarily in the1840s and increased again as a result of enfranchisement of peasants that took place in 1864. Lack of work force in landed estates caused by

abolition of serfdom contributed significantly to the fact that colonization flourished, as landed properties were gradually parceled out.

Apart from the factors that have already been mentioned, the political and economic situation of Polish territories during the annexation period influenced the development of Łódź. In consequence of growing competitiveness of Western Europe and exclusion of Greater Poland from the newly formed Congress Poland, which resulted in an isolation of its textile industry from the Russian market, clothing manufacturing was gradually transferred to Congress Poland (Dylik 1971, pp. 137–151). Initially, the most dynamically developing town on the territories that are discussed in this article was not Łódź but nearby Zgierz – a governmental town whose authorities offered settlers plots, building materials for houses and workshops and temporary exemption from rents and taxes as well as from military service (the last exemption applied, however, only to people born abroad). The aim of those privileges was to encourage people to settle down in Zgierz. Apart from Zgierz, by virtue of a resolution made in 1820 by Józef Zajączek, who was the governor of Congress Poland, Łódź, Przedecz, Dąbie and Gostynin were also given the government's support for developing the clothing industry (Koter et al. 2005, pp. 9–16). A formal permission for creating a factory settlement was given in 1821 and Rajmund Rembieliński, who was then the governor of Mazovia voivodship, was appointed the supervisor. The main factors that led to the decision of establishing the clothing industry in Łódź included freedom of the use of land (since it was a governmental town) which enabled spatial development; access to big water supplies (watershed zone); availability of building materials (post-glacial deposits – clay, forests – wood); transport accessibility (location near the route between Łęczyca and Piotrków Trybunalski) and the attitude of local authorities whose aim was to stimulate the socio-economic development of the area they were administering. The permission to build a factory settlement in Łódź was motivated directly by positive opinions presented in reports on the town and its resources written by Romuald Rembieliński and

Stanisław Staszic. The latter was a scientist and a journalist, a supporter if industrialization.

Industrial colonization of Łódź started in 1822, when first settlers came to the town. By 1830, there had altogether arrived 1008 families of craftsmen who manufactured woolen cloths, wove linen and cotton (Koter et al. 2005, pp. 9–16). The structure of production was different from the one in rapidly developing Zgierz, Ozorków, Konstantynów and Aleksandrów Łódzki, where cloth making craft strongly dominated. The introduction of protective tax on imports from the West in 1822, the introduction of low tax on woolen cloth exported to Russia and the government orders for the army had a positive impact on the industrialization of Łódź in its initial stage of development.

In the first 10 years of industrialization of Łódź, its population increased five times and reached 4343 inhabitants in 1830. With time, next to small weaving workshops and factories, much bigger centralized production plants started appearing. The prosperity of those workshops was interrupted by the outbreak of an armed conflict between Poland and Russia in 1830 (the November Uprising). After the uprising, a high export tax was introduced on Polish woolen cloth, which in turn led to the emigration of woolen production and a gradual change in the industry which concentrated on cotton products manufactured for the domestic market. This new economic situation was advantageous for Łódź, where this type of manufacturing had been already present.

The decision to create a clothing settlement did not have parallel consequences for the administrative status of Łódź. Granting rights and privileges of a provincial settlement in 1841 (initially in Mazovia province, and after this province joined Kaliska province in 1844, in Warsaw province) and then of a county town had little administrative consequences. The increasing importance of Łódź was, however, noticed by the post service which located one of its postal units there. Horses and carriages transporting correspondence were exchanged at this post (Sobczyński 2000, p. 16).

Increasing capital of manufacturers and expansion of the ma-

chine stock, which was initiated by Ludwik Geyer at the end of the 1830s, gave dynamism to the production of cotton fabrics in Łódź. Additionally, the economic situation of the region was improved by the total abolition of tax on goods exported to Russia, which took place in 1852. Home based work at small weaving workshops was gradually being replaced by employing more and more workers in big, mechanized factories. Thanks to the enfranchisement of peasants, the demand on the local market soon increased. Besides purchasing the goods manufactured by the industry, they often found work in town factories. It was reflected in an extraordinary dynamic growth of the town's population that lasted until the outbreak of the First World War. It is estimated that the population of Łódź increased over 623 times between 1820 and 1914 (Koter et al. 2005, p. 12).

The dynamics of the changes in the town's population were extraordinary, both in the national and the European context. The pace of the population growth in Łódź was much quicker than in other big industrial towns on the continent, i.e. Manchester, Birmingham, Glasgow, Cologne, Hamburg or Lyon. Until the 1840s, German population played a major role in migration to the town. Since the 1850s, Jewish population has started coming to Łódź. Initially, the immigrants came mainly from Congress Poland, a decade later more and more immigrants were coming from Russia.

The enfranchisement of peasants and attempt the limit of the role of the Polish gentry led to the commune reform, which took place after the January Uprising. As a consequence, on the territory being discussed communes were formed and governed by village administrators selected from among peasants. In theory, they acted independently, but in reality they were subordinate to the poviat and provincial administrators (Walicki 2009, p. 44).

The 19th century not only brought a significant growth of population and economic development but also development of railway. The town was not connected to the first in this region railway line between Warsaw and Vienna until 1866, although the line had existed since 1845. Equally important in the development of the trans-

port network of Łódź was the Kaliska line, finished in 1903, which connected Warsaw with Kalisz through Zgierz, Łódź and Pabianice. A few years later two railway lines that previously had not been connected were also integrated (Pielesiak 2012, p. 64).

Before the outbreak of the First World War, Łódź temporarily improved its position in the field of education. Between 1864 and 1908, thanks to the fact that some of the competences were taken away from the provincial governments and Łódź School Administration was created, the town had a higher-level function in administering education on the territories of the following poviats: brzeziński, kaliski, łęczycki, piotrkowski, sieradzki and wieluński. With time, however, the institution was moved to Piotrków Trybunalski (Sobczyński 2000, p. 7; Walicki 2009, p. 45).

2.3. Administrative position

In 1867, during administrative changes which increased the number of provinces on the territory of the Kingdom of Poland to strengthen the supervision of the country, no separate territorial unit was created for Łódź. Despite its considerable population, it was included in the piotrkowska province. The only success was the establishment of the łódzki poviat. Nine years later the headquarters of the regional court were established in Łódź. Before the First World War, there were several other attempts to strengthen the position of the town in the Kingdom's administration. In 1893 action was taken to move the headquarters of the province governor from Piotrków Trybunalski to Łódź, but it was not successful. Another unsuccessful attempt to improve the position of the town was made the day before the outbreak of the war by the industrial circles of Łódź (Sobczyński 2000, p. 8). The main arguments against the relocation of administration to Łódź, apart from the protests of the authorities and inhabitants of Piotrków Trybunalski, turned out to be: peripheral location of the town and high costs of renting buildings for the needs of administration. At the same time, there were some plans to

move the headquarters from Kalisz to Łódź or Łęczyca, yet the idea was also abandoned. The only change that was introduced at that time was reorganization and strengthening of the police in Łódź (in 1897 the administration of gendarmerie was established) (Walicki 2009, pp. 49–60).

The First World War brought significant population loss in Łódź. The invasion of the German army, confiscation of properties and immobilization of industrial production caused mass emigration from the town (Koter et al. 2005, p. 15). Because of massive war destructions and loss of the Eastern markets the economic development of the town was much hindered. Gradually, however, the number of inhabitants started rising, mainly as a result of an influx of new inhabitants from łódzkie and warszawskie voivodeships.

After the First World War and 123 years of annexation, independent Poland was reborn. In the concept of territorial division of the country, Łódź was the centre of the voivodship because it had strong economic potential and the most inhabitants in the Western part of the former Kingdom of Poland (Badziak 2009, p. 63). In this way Łódź gainded a higher position in administrative hierarchy than previously more important towns like Kalisz and Piotrków Trybunalski. Łódzkie voivodeship, established in 1919, was initially inhabited by 2 436 710 people and consisted of 13 poviats (brzeziński, kaliski, kolski, koniński, łaski, łęczycki, łódzki, noworadomski, which since 1922 has been called radomszczański, piotrkowski, sieradzki, słupecki and wieluński) (Sobczyński 2000, p. 8; Badziak et al. 2009, p. 87). The voivodeship was structured in that way until 1932 when słupecki poviat was separated from it; the area that was administered from Łódź covered then 19 034 sq. km. The next change of borders in 1938, whose aim was to limit the legibility of borders from the annexation times, reduced the territory of the unit by 6317 sq. km (by including kaliski, kolski, koniński and turecki poviats into poznańskie voivodeship). To compensate for the territory loss, a year later 4 poviats of warszawskie voivodeship were attached to łódzkie voivodeship (kutnowski, łowicki, skierniewicki and rawski) and 2 poviats from kieleckie voivodship (opoczyński

and konecki excluding 2 towns – Skarżysko-Kamienna and Szydłowiec and 2 communes – Szydłowiec and Bliżyn). The day before the First World War łódzkie voivodeship consisted of 14 poviats and covered 20 446 sq. km.

Between 1918 and 1921, the headquarters of General Military District Command of Łódź number IV were located in Łódź, and between 1921 and 1939, there were the headquarters of Corps District Command number IV (Jarno 2009, p. 169). During the period between the two World Wars, the town's administrative position in the Roman Catholic Church was also strengthened, as it became the seat of diocese (Badziak, Łapa 2009, p. 12). In 1921, the diocese of Łódź consisted of 5 deaneries and 67 parishes. As a result of a several changes of the external and internal borders of the unit, in 1925 it consisted already of 15 deaneries and 131 parishes that covered altogether 7450 sq. km (Przybysz 2009, p. 183).

Successive changes in the administrative hierarchy of Łódź took place in 1939. Just after the outbreak of the Second World War the occupiers were planning to incorporate the town into the protectorate of the General Government. Initially, the capital of the protectorate was to be Łódź, but German inhabitants of the town were opposed to this decision. Consequently, the town was incorporated into the Third Reich on 9th November 1939 (Sobczyński 2000, p. 10). The border line passed between Brzeziny and Pajęczno. Apart from Łódź, also partly łódzki, brzeziński, piotrkowski and radomszczański poviats and whole łaski, łęczycki, sieradzki and wieluński poviats were not incorporated into the General Government. This area was under the administration of kaliski district whose seat was in Kalisz and from 1941 in Łódź (at that time renamed Litzmannstadt). No official change of the name came along the change of the seat so the district was called łódzko-kaliski.

At the end of the Second World War, the town once again faced significant population loss. Łódź lost almost 200 000 inhabitants. As a consequence of the occupiers' policy and after-war migrations, the nationality structure changed significantly. Another consequence of the war were material damages, which were, however, not as sig-

nificant as in Warsaw, so during the first years after the war Łódź played the role of an unofficial capital.

The end of the war and creation of a new political system once again changed the position of Łódź in the administrative hierarchy of Poland. For the first 5 years after the war the country was administratively divided the way it used to be before September 1939, which means that łódzkie voivodeship consisted once again of 14 poviats (brzeziński, konecki, kutnowski, łaski, łęczycki, łowicki, łódzki, opoczyński, piotrkowski, radomszczański, rawski, sieradzki, skierniewicki and wieluński) with 232 rural communes (Sobczyński 2000, p. 10; Olejnik 2009, p. 210). Apart from the mentioned ones, the administrative unit of Łódź consisted also of 4 separate towns: Zgierz, Pabianice and urban poviats – Piotrków Trybunalski and Tomaszów Mazowiecki. Łódzkie voivodeship covered then 19 912 sq. km, that is 6.3% of the country's territory (Olejnik 2009, p. 209). For a short period of time (1945–1946), Łódź regained its significant position in the territorial system of military command, as the garrison in Łódź was then the headquarters of Military District Command number VI which administered the territory of 11 poviats of kieleckie voivodeship and 14 poviats of łódzkie voivodeship.

In 1950, a change of the borders of łódzkie voivodeship took place and the area it covered decreased to 16 798 sq. km (konecki and opoczyński poviats became a part of kieleckie voivodeship) (Sobczyński 2000, p. 11). Four years later the internal division of the unit was modified by creation of a new poviat that was called wieruszowski and in 1956 other 3 poviats were separated: bełchatowski, pajęczański and poddębicki. Those changes brought about other changes in the borders of the voivodship between 1954 and 1963, as a result of which the voivodeship covered an area of 17 065 sq. km. Łódzkie voivodeship in its new shape consisted of 16 poviats (bełchatowski, brzeziński, kutnowski, łaski, łęczycki, łowicki, łódzki, pajęczański, piotrkowski, poddębicki, radomszczański, rawski, sieradzki, skierniewicki, wieluński and wieruszowski) and 5 separated towns (Pabianice, Piotrków Trybunalski, Tomaszów Mazowiecki, Zduńska Wola and Zgierz). It did not cover as much land

as it used to before the war. The difference came up to 3381 sq. km.

Between 1973 and 1975, a thorough reform of the administrative system was carried out. A reduced, two-level territorial division was introduced. Since that time the state was administered only at the level of voivodeship or commune (the division into poviats was eliminated). Apart from the reorganization of the administrative division, the reform included also a radical increase in the number of voivodeships – from 17 to 49. The area previously belonging to łódzkie voivodeship was divided among new units with seats in Kalisz, Konin, Piotrków Trybunalski, Płock, Skierniewice and Sieradz, as a result of which Łódź administered an area of only 1523.4 sq. km, thus becoming the smallest unit of this kind in the country. It was even smaller than the urban metropolitan area of Łódź (Sobczyński 2000, p. 11; Kasiński 2009, p. 233). The new voivodeship (Urban Łódź) consisted, apart from the central town, of 7 towns that had the rights of communes (Aleksandrów Łódzki, Głowno, Konstantynów Łódzki, Ozorków, Pabianice, Stryków and Zgierz) and 12 communes (Aleksandrów Łódzki, Andrespol, Brójce, Głowno, Ksawerów, Nowosolna, Ozorków, Pabianice, Parzęczew, Rzgów, Stryków and Zgierz).

After the change of the political system of Poland, the position of Łódź as a territorial administrative centre changed once again. The 1999 reform introduced again a three-tier division introducing additionally a mixed type of administration at the level of voivodeship (governmental administration headed by a voivodeship governor and local government assembly as local governmental administration led by marshal of the voivodeship). The number of voivodeships changed once again – in the new political and economic situation it decreased to 16. Following the reform, łódzkie voivodeship covers nowadays 18 218.95 sq. km and is inhabited by 2 541 907 people, which constitutes 5.8% of the whole area and 6.6% of the whole population of Poland (data provided by the Polish Central Statistical Office for 2011) (figure 2.3). Initially, it consisted of 20 country districts (bełchatowski, kutnowski, łaski, łęczycki, łowicki, łódzki wschodni, opoczyński, pabianicki, pajęczański,

piotrkowski, poddębicki, radomszczański, rawski, sieradzki, skierniewicki, tomaszowski, wieluński, wieruszowski, zduńskowolski and zgierski) and 3 towns with the rights of poviat (Łódź, Piotrków Trybunalski and Skierniewice). Following the request of the inhabitants of Brzeziny and neighboring communes, an adjustment of the internal administrative division of łódzkie voivodeship was made in 2001. Brzeziński poviat, which consists of urban Brzeziny, rural Brzeziny, Dmosin, Jęzów and Rogów, was separated from the western łódzki poviat.

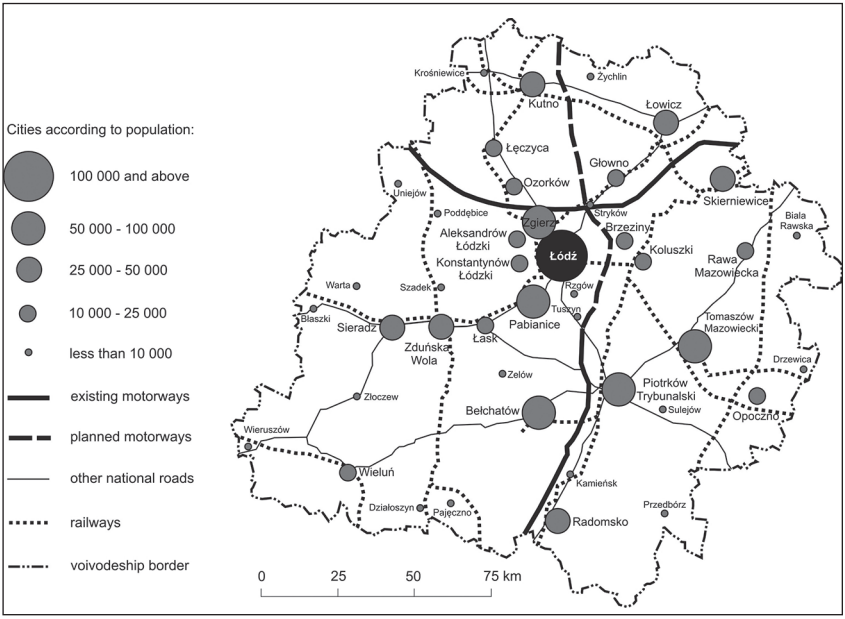

Figure 2.3. Contemporary Łódź in the settlement and transportation network of the voivodeship

Source: Pielesiak (2012, p. 60), changed

At the end of the 20th century, Łódź has gained a higher position in the territorial administrative structures of the Roman Catholic Church. In 1992, the diocese that was administered from Łódź was

elevated to the rank of an archdiocese, which reports directly to the Holy See. At the same time, some of the units that previously belonged to it (deaneries Tum and Łęczyca as well as the parishes of Dmosin, Głowno, Głowno Osiny and Głowno Zabrzeźnia from Stryków deanery) were separated from it and attached to a newly-created łowicka diocese. Within the modified borders, łódzka diocese included 34 deaneries with 193 parishes (5200 sq. km). In 2004 the Religious Metropolis of Łódź was created out of łódzka diocese and a unit that was administered by Łowicz and subjected to Warsaw (Przybysz 2009, pp. 181–185). It is one of fourteen such units in Poland.

Characteristic of contemporary Łódź is its central location in relation to the borders of Poland as well as the biggest Polish cities, which makes its economic development easier and paradoxically more difficult at the same time. One advantage of such a specific location is potentially high transport accessibility, on the other hand, short distance to other developed and attractive cities, especially the capital (the centres of Łódź and Warsaw are in straight line only 120 km far from each other), hinders the development of exogenous activities. Negative effects of the location were noticed already in the mid-20th century (Straszewicz 1962, p. 103).

One way of improving the economic position of the city was once seen in a bipolar Łódź–Warsaw arrangement (Markowski, Kudłacz 2002, pp. 15–36). Nowadays, it seems more plausible to implement the activities connecting Łódź with its direct resources by establishing Łódź Metropolitan Area. According to the latest land use plan of łódzkie voivodeship of 2010, the area shall cover 2862.8 sq. km and include Łódź along with 31 neighboring communes. The idea behind establishing such metropolitan areas – areas independent of the existing three-level administrative division of the country – is more efficient administration of an urban agglomeration. The ultimate resolutions concerning the scope of their activities have not been made yet. According to the metropolitan

act of 2008, the responsibilities of such units shall cover spatial, road and public transport management, environment protection, energy, gas and water supplies, wastewater and municipal waste collection and neutralization, collective safety, public policy, fire prevention and management under crisis circumstances.

Bohdan Posatskyy

Lviv Polytechnic National University

3. ORIGINS AND SPATIAL DEVELOPMENT OF LVIV

3.1. Introduction

Lviv is one of the biggest cities in Ukraine, an industrial and cultural centre and a transport node of Western Ukraine. It is situated on the main European watershed, which divides the rivers from the Baltic Sea and the Black Sea basins.

The city of Lviv is known as one of the capitals of Halytsko-Volynsky Principality, the western part of Kyivska Rus since the mid-13th century. It is believed that this town was founded by Prince Danylo Halytsky (Daniel of Halycz) on the formerly populated land, on the crossroads of important medieval trade routes that were linking the towns of Central Europe with Kyiv and the towns of Baltic Sea coast with the Pontic littoral.

3.2. Origins in 13th century

Rich archaeological and historical material indicates that Lviv of the 13th century consisted of several parts. The first one was a fortified core of the town (13th century) on Prince's Hill (figures 3.1–3.2).

Its general appearance can be envisioned now in a rather hypothetical way. It is possible that a "pillar" defence tower surrounded by earthen rampart and wooden felling was located there (Krypiakevych 1932, new edition 1991, p. 13). The second part was a castle, known as High Castle (figure 3.3). Its construction began in the second half of the 14th century on a high hill to the east of Prince's Hill (Knyazha Hora) and become a large construction 120 m long and more than 20 m wide, with high walls and several towers (Krypiakevych 1932, p. 22).

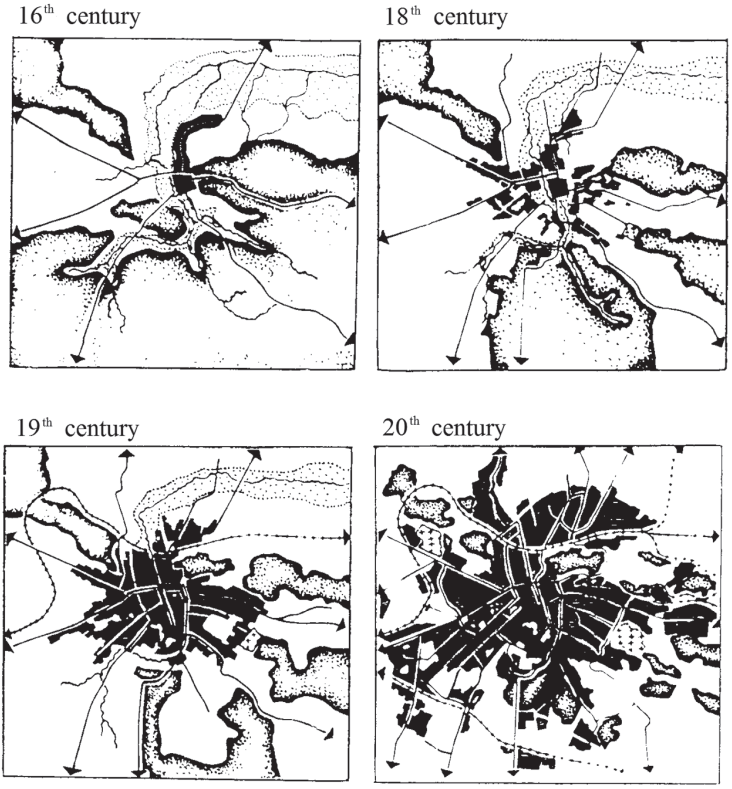

Figure 3.1. Stages of the city spatial development in 14th–20th centuries

Source: *Lviv* (1990)

In the eastern direction from Castle Hill lied Leo's Hill with no structures on it. The third part was a fortified Prince's courtyard with a treasury, located on a terrace to the south of Prince's Hill and embraced by earthen and wooden fortifications. The fourth part was formed by the outskirts of the city (Pidhoroddya or Posad) on the terraces lying lower than the mentioned fortifications. They consisted of wooden dwelling houses and stone and wooden churches.

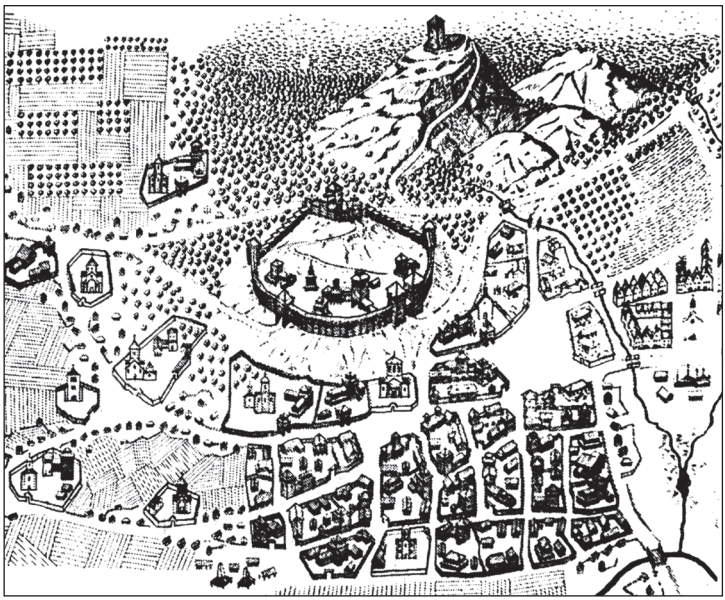

Figure 3.2. The view of Lviv in the second part of 13th century, according to I. Bazarnyk

Source: Sekretariuk (ed.) (1984), p. 16

One can conceive of the image of Lviv of that time was a picturesque mixture of fortifications on the hills and urban housing at their feet in typical environs: hills, terraces, the Poltva river valley. In the first phase of the town's development the Prince's and High Castles, due to their advantageous location, became the main architectural town-scape dominants, commanding the environs.

The constructing of numerous temples during the second half of the 13th century and the first half of the 14th century (on the territory of Posad) had significantly changed its general image. It is known that at that time there were more than ten Orthodox churches and monasteries in the town as well as two Armenian churches, two Roman Catholic cathedrals and, presumably, a mosque and a synagogue (Trehubova, Mykh 1989, pp. 45–51).

Reconstructed in the course of centuries, only the Church of St. Nicholas, the Church of St. Parasceve, the Church of St. Onufry, the Church of St. John the Baptist, and the Church of St. Mary of Snow have been preserved and still remain local architectural dominants.

The territory of Posad had its core – the Staryi Rynok Square (Old Market Square) (still existing), 1.5–2 km long, which was situated along the former Volynsky Route (Volynsky Shlakh), the site of the present Bohdan Khmelnytsky Street. The townscape of Posad, i.e. the largest part of the town at that time, was characterized by sharp contrast between numerous temples with one–two storey wooden dwelling houses. In the west it was limited by the swampy Poltva river valley.

On the whole, in the mid-14th century the townscape of Lviv probably resembled other towns of Kyivska Rus – Kyiv, Volodymyr, Halych and Chernihiv. Natural, architectural and urban elements, spontaneous planning of the territory, and stone and wooden housing formed an integral unity.

3.3. New planned development of Lviv

Beginning from the mid-14th century, new urban territory development got started on the plain, to the south from the Old Rus Posad.[1] There is a hypothesis that mastering of the new territory was commenced earlier, but it was definitely shaped only during the re-

[1] In the second half of the 14th century Lviv and suburban areas were incorporated into the Polish Kingdom. In 1356 Lviv took on the Magdeburg law.

construction after the devastating fire of 1381 (Rudnytskyy after Sekretariuk ed. 1984, p. 21) (figure 3.3).

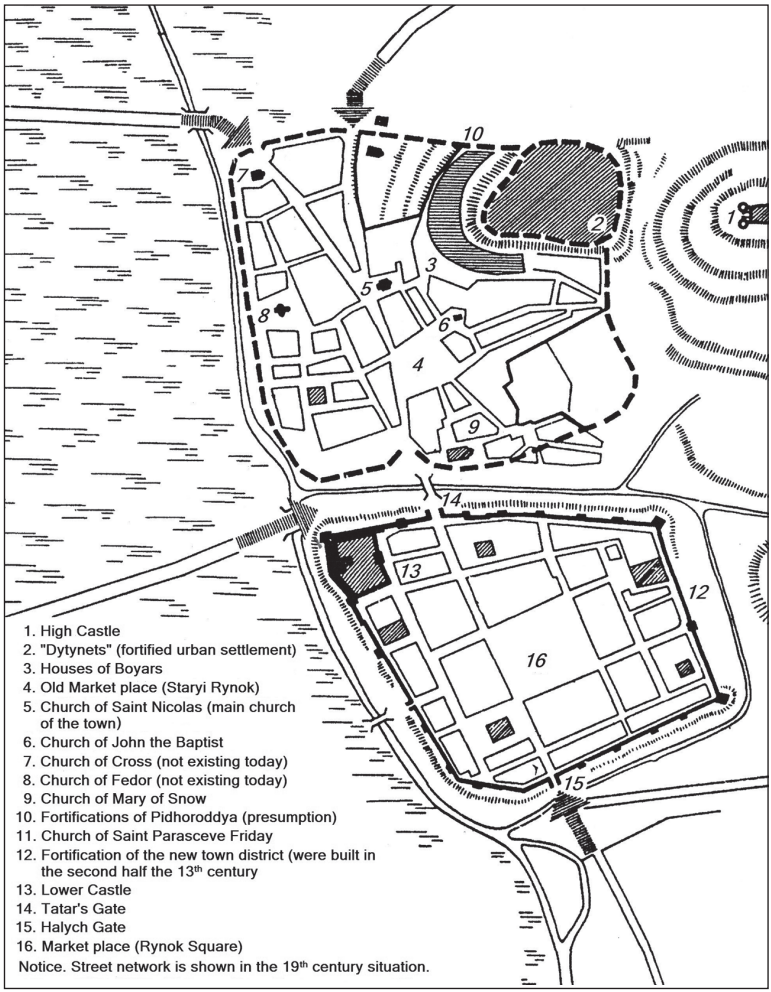

Figure 3.3. Central part of Lviv in the end of the 13th–14th centuries, according to A. Rudnytskyy

Source: Sekretariuk (ed.) (1984), p. 21

The new urban area was planned with a rectangular Rynok Square (Market Square) in the centre of it. The area of the town, embraced by walls, totalled 18 ha and contained about 250 built-up plots (Trehubova, Mykh 1989, pp. 45–51). The regular urban planning system was typical to the Central European towns of that time, the similarity of sizes of urban plots was predetermined by the Magdeburg law.

The Rynok Square was a compositional centre of medieval Lviv. There crossed the main streets, leading to Halych and Cracow gates. The centre of the Rynok Square was occupied by the Town Hall with a lofty tower and a clock mounted on it. Along the perimeter of the square were constructed three-window houses of merchants and nobles. The buildings were bordered with the pedestrian pavements of hewn stone, slightly lifted over the road. The Rynok Square and the main streets had cobble-stone roads.

Within the town walls there was no greenery, except for small gardens belonging to monasteries. This description of the general appearance of Lviv in the 16th and 17th centuries is based on the oldest reference, left by the Gdańsk merchant Martin Gruneweg (Bryk 1986, pp. 61–69).

One can suppose that in the 15th–16th centuries Lviv was shaped by regular Gothic planning and Gothic housing inside the walls. The towers of the Town Hall, town fortifications and churches dominated the silhouette of Lviv at that time, against the equal low-rise buildings of town-dwellers.

A total change in the city landscape took place in the 15th–16th centuries. Compactly built-up sites of almost alike dwelling blocks, separated by narrow streets, became the peculiar feature in the perception of the town from the "inside". Perspectives of the streets are concluded with towers of the Town Hall, churches or town fortifications.

From the "outside" the town looked like a compact formation with a variegated silhouette, encircled by a ring of walls. Like previously, the High Castle, located on a hill, commanded the town. It remained

the dominant element of the town's panorama and silhouette, as it is seen in the oldest general view of Lviv in an engraving by Aurelio Passaroti from the beginning of the 17th century (Zapasko 1989).

The defensive walls played an important role in Lviv's image. Besides the High Castle mentioned above, two rings of walls were part of them: the internal High Wall and the external Low Wall, which encircled the town. The High Wall was fortified with 28 square towers, while the low wall had 18 semicircular towers (Vujcyk 1991, p. 15).

It should be noted that the general townscape of Lviv before the mid-16th century can be envisioned mainly on the basis of historical literary sources, because the buildings of old Lviv suffered considerable damage in the fire of 1527 (Vujcyk 1991, p. 30).

The unfortified suburbs were located beyond the walls. One of them, a northern suburb, called Pidzamche (Under the Castle), the site of the former Old Rus Posad, located on Volynsky Route, became a part of the Cracow suburb. The southern Halytsky suburb was formed on trade routes to Kyiv and Halych (the present Lychakivska Street and Zelena Street). The appearance of the outskirts differed greatly from the general look of the town inside the walls. The suburbs had small wooden houses with gardens and orchards. Buildings of the Orthodox and Catholic churches and monasteries stood out against this background. The growing importance of the suburbs led to their fortifying and creating a kind of separate town (Trehubova, Mykh 1989, p. 51).

3.4. Classic architectural styles

From the second half of the 16th century to the end of the 19th century, spatial development of Lviv is marked by the evolution of architectural and urban forms of the Renaissance, Baroque, Classicism and Eclecticism. The Old Rus churches: the Church of St. Nicolas, the Church of St. Onufry, the Church of St. Parasceve and the Armenian Cathedral were reconstructed. Also the oldest Catholic Cathedral of St. John the Baptist and the Cathedral of Blessed Virgin Mary

(Latin Cathedral) underwent serious alterations. The Gothic cathedral gained a new architectural form and became an example of evolution of forms of the classic architectural styles, beginning from the Gothic to the Baroque.

One of the best monuments of the Renaissance in Lviv is the Ensemble of the Church of the Assumption, a masterpiece of Ukrainian architecture of the 16th and early 17th centuries. The ensemble harmoniously combines three constructions of different sizes: a 66-metre-high bell-tower, named the Korniakt Tower, the Church of the Assumption and the small Chapel of the Three Prelates.

Among the most significant Baroque constructions of the 17th–18th centuries Lviv are the following churches: the Church of St. Peter and St. Paul of the Jesuit Order, the Church of St. Michael of the monastery of Barefoot Carmelites, the Church of St. Antonius and the Church of Mary Magdalene.

A special place in the spatial composition of the historical centre of the town is occupied by the Church of the Bernardines and the Church of the Dominicans. These monumental edifices dominate the image of the adjoining streets and squares. Their towers are the last links of the perspectives of streets and play an important role in the formation of the townscape of the historical city centre.

Among the greatest attainments of the Baroque style in Lviv is the ensemble of the Greek-Catholic Cathedral of St. George.[2] It was built in the mid-18th century on a high hilltop west of the historical urban core, on the site of a small 13th century wooden church. The Cathedral of St. George has become one of the main dominants in the town's physiognomy. Its dome is easily seen from afar.

The Renaissance and Baroque edifices have imported new peculiar features into the townscape of Lviv: they greatly enriched the composition of streets and squares, and made the townscape of

[2] After the endorsement for the Church Union of Brest in 1596, the Greek Catholic (the Uniate) Church was formed. Ukrainian people was divided into Orthodox and Uniates.

the centre more attractive. In a densely built-up town, towers and belfries of religious buildings became spatial reference-points. They also defined national and religious affiliation of residential blocks, being typical features of multinational Lviv of the 13th–18th centuries. The northern residential quarters were inhabited by Armenians (Orthodox and Catholic), central – by Poles and Germans (Roman Catholic), south-eastern – by Jews (Israelite), and eastern districts – by Ruthenians, i.e. Ukrainians (Orthodox).

In the 15th–16th centuries, the Rynok Square – the largest open space in the town – fulfilled a very important function. The square (142 m by 129 m), construct according to the requirements of the Magdeburg law, was built-up (from the end of the 14th century) by dwelling houses on 52 plots along the perimeter of the square. Today, 45 houses are located on the Rynok Square.

Before the fire of 1527, the buildings were in the Gothic style. After the reconstruction, they received the Renaissance and Baroque forms (figure 3.4). At first, buildings typically had three windows in the facades; later, in the 16th–17th centuries, large palaces were constructed beside ordinary houses. They were created by joining together several previous constructions.

The Rynok Square has preserved the unity of spatial composition to this day and remains the compositional centre of the late medieval part of the city.

At the end of the 18th century, the townscape of Lviv was formed by the following constituent parts: the medieval core encircled by a double ring of fortifications and the strip of suburbs around it. Among the suburban areas, Pidzamche with the Old Rus urban territory at the foot of the High Castle occupied a special place. The outskirts of the town had their own spatial dominants. For example, the Cracow suburb had St. George's Cathedral, wheras the Lychakiv suburb – the Church of St. Antonius. They were at the same time important components of the general townscape, as has been already emphasized.

Figure 3.4. Ensemble of the Church of the Assumption and the Korniakt Tower, 17th century

Source: drawing according to photo by B. Posatskyy

3.5. New urban centre

The abolishion of Magdeburg law in 1793 and dismantling of the town's fortification walls in 1777–1820 became a turning point in the development of Lviv's urban space. Removal of the walls opened a new opportunity for the spatial development of the town and facilitated the creation of a new urban centre. According to the Eu-

ropean notion of that time, a new centre of the town had to consist of a system of boulevards with planted trees and shrubbery, and built-up parade mansions. New city centre occupied swampy areas in the Poltva river valley to the West and South of medieval town. It can presumed that there was an idea of surrounding of the city centre by the circle boulevard.

In Lviv two fragments of a planned circular boulevard were built: Gubernatorsky (Governor's) and Hetmansky (Hetman's) Ramparts. The latter, today called Prospekt Svobody (Svoboda Avenue), became the main street of the town. It consists of two thoroughfares and a wide pedestrian lane between them. New monumental buildings were constructed in the boulevard: the Opera House, the National Museum (formerly – the Museum of Arts and Crafts), banks, offices and residential buildings.

The architectural forms of the houses in the boulevard are characterized by resplendence of sculptural details and they are interesting examples of the eclectic architecture of the end of the 19th century.

Construction of the new boulevards was aimed at creation of a new urban centre to the west from the medieval town area. The building of the residence of the Galician Parliament, with main facade facing the park of Ivan Franko, also facilitated this process.

At the same time, the development of the historical trade routes directions, radially forking from the medieval core of the city, is continued. They are transformed into main thoroughfares and built-up with 3–5-storey dwelling houses with shops on the groundfloors. Thus, the radial streets remain the main streets and they are connected with a vast network of minor streets – in this way the territory is divided into numerous urban blocks, which form a ring around the medieval central part (figure 3.5).

The image of the city is becoming homogenous due to the stylistic unity of housing at the turn of the 19th century (Classicism, Eclecticism and Modernist style, or Secession). The new Town Hall is being erected in the Rynok Square, with a massive tower (almost 60 m high), which is designed to be a partner of the Renaissance and Baroque towers in the silhouette of the city centre (figures 3.6–3.7).

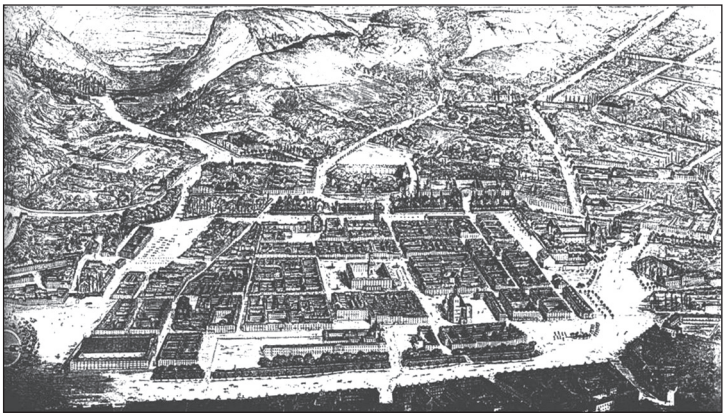

Figure 3.5. The view of the city in 1866, unknown artist

Source: Zapasko (1989), p. 19

Figure 3.6. City Hall Tower (19th century) and the city core in the background

Source: drawing according to postcard

Figure 3.7. Neptun Fountain in Rynok Square, 18th century

Source: drawing according to photo by B. Posatskyy

The Castle Hill still commands the housing in the central part of the city, but the castle itself disappeared, having been turned into a quarry.

In the mid-19th century, a city park was created on the terraces at the foot of the High Castle. An artificial mound was built on the upper terrace, top of which is crowned by a viewing platform (Mohytych 1996, p. 8). The viewing platform (413 m above sea level) commands a scenic panorama of Lviv, i.e. Lviv townscape comprising the former Poltva river valley and the hills of Roztochyia around the valley.

3.6. The 20th century pre-war period

At the end of the 19th century, to the west and north of the city core, close to the Main Railway Station and Pidzamche station, a small industrial site and several housing blocks appeared, but their spatial

impact was limited. A railway line between Cracow and Lviv was built in 1861 and this improved the development of the western and northern areas of the city.

The Main Railway Station complex, a relic of engineering and artistic thought of the early 20th century, was completed in 1903. It is the most representative example of the Art Nouveau epoch in Lviv (Biryulyov 2007, pp. 268–269).

Spatial development of the city has a rich history in terms of its reflection in urban planning documentation during the 20th century. In 1920, I. Drexler highlighted some aspects of the problem by publishing the conceptual design of "Great Lviv". In this study attention was paid mainly to the territorial growth of the city and formation of suburban areas. The city centre, however, remained unchanged. Drexler emphasized the advantageous geographical position of the city for the development of an overland route between the East and West, and the coasts of the Baltic Sea and the Black Sea (Drexler 1920).

Drexler's postulate concerning the expansion of the city started to be realized in 1931, when the area of Lviv increased from 32 sq. km to 64 sq. km^2. The nearby villages of Znesinnia, Kryvchyci, Kulparkiv, Cyhnivka, Levandivka, Klepariv, Holosko Male and Zamarstyniv were included within the city limits (Czerner 1997, p. 87).

In the first half of the 20th century, the city developed mainly through intensive redevelopment. Old houses were replaced by new buildings. In the central part new residential buildings were constructed, and in outlying districts of the city some new estates of villa-type housing were created: Novyy Lviv (New Lviv) in the southern part and the Profesorska Kolonia (Professors' Colony) in the eastern part. The eclectic and secession style buildings were replaced by modern functionalist forms of architecture, influenced by prevalent trends in European architecture of that time.

It can be noticed that architectural forms of residential and public buildings of the 1920s–1930s are milder, and their proportions and details are smaller in comparison with the "classics of functionalism" in Western Europe.

3.7. Nazi plan of the city development

The most radical approach to the development of the city was introduced in the reconstruction project, completed in 1943 during Nazi occupation in Cracow urban planning office (figure 3.8).

Figure 3.8. Nazi Project of "Crown of the City", 1943

Source: Hallbauer (1944), p. 12

The reconstructed street network was supposed to be the foundation of a new spatial organization of the city. The main radial streets in the centre were the same, but they were connected by an inner semicircular boulevard, which consisted of two roadways separated by a green stripe.

The project envisaged creation of a new centre for city government on the Citadel Hill. This monumental complex was given the name "city crown" and it was intended to play a dominant role in the city silhouette to demonstrate the supremacy of Nazi ideology. Project documentation shows that German planners anticipated a two-centred downtown area and a radical change in the architectural appearance of the central part (Posatskyy 2002, pp. 118–126).

3.8. Spatial development in 1945–1990 (under Soviet rule)

After the reinclusion of Lviv in the USSR in July 1944, Soviet authorities aimed at transformation of the city into an industrial centre. However, the main creative challenge of urban architecture was the formation of ensembles that would symbolize in their spatial forms the "victorious progress of socialism". A dominant feature of the spatial forms of architecture in the 1940s was creative development of classical heritage, which involved a widespread use of axial-symmetrical compositions and classic forms of urban design and architecture.

On the one hand, the Soviet authors of the 1946 master plan for Lviv understood the unique historical and architectural heritage of the city and offered to save it, but on the other hand – it was necessary to transform the image of the city into a typical Soviet style, not only in essence but in form.

That is why creation of about 3 km-long north-south "compositional axis of the city" was proposed (Shevchenko, Svoboda, Chornovil avenues), which began in the central part and ended on the northern outskirts. The central unit of the city – its core – was to become the new large central area (one of the largest at that time in the USSR), located directly behind the Opera House and connected by a boulevard with the High Castle. A large, 50 m high statue of Lenin was to be erected, and in this way the "communist system of coordinates would be canonized" in the city centre (Cherkies 1999, pp. 99–104).

If we consider the master plan of 1946 in terms of urban design transformation, we note that transformation of the radial layout into the radial-ring type was planned and simultaneously a linear-nodular scheme of the city centre was designed. The master plan of the city was considered in 1946 at the governmental level several times, but ultimately it did not become an active town planning document.

From the functional point of view, the master plan of 1946 envisaged Lviv as an industrial city and resulted in replacing small

pre-war factories with large industrial plants, such as a glass factory, a plant producing agricultural machines or an autoloaders factory (*Istoria mist i sil URSR*… 1986, p. 84).

Development of industry stimulated a rapid growth of population from 186 000 in 1945 to 356 000 in 1948. This was a migratory increase – soldiers, administrative and party employers, teachers, doctors, chief leaders of industrial enterprises and thousands of workers from other USSR cities were sent to Lviv (Lozynskyy 2005, p. 195).

On the whole, during the first post-war years the territory of Lviv remained within the limits of 1931, when a few villages were added to the territory of the city – it was equal to 65 sq. km. The enlargement of the city area began in 1951, which reached 155 sq. km in 1980. The suburban towns of Bryukhovychi and Vynnyky were incorporated in 1957 and in 1959. In 1980 were added territories in the southern sector of the city near the villages of Kozelnyky and Zubra (Posatskyy 2007, p. 220).

The next phase of spatial development of the city centre was documented by the master plans approved in 1956 and in 1966. The concept of the radial-ring system as well as the development of the city centre in the northern direction along the Chornovil Avenue were confirmed on the basis of the area layout. However, after some time the real growth rates of the city exceeded those envisaged in the master plan for the 20-year period. For example, the population in 1965 was 495 000, while the 1956 master plan projected 520 000 people in 1975.

Therefore, the development of a new master plan started in Kyiv Institute "Dnipromisto" and the document was approved in 1966 (Biryulyov 2008, pp. 607, 610). Growth of industry demanded allocation of new territories for industrial enterprises and residential blocks. New industrial and residential sites were first designated in the 1950s–1960s in the western sector of the town, and in the 1970s–1980s new housing estates appeared in the vast territories of the southern, northern and eastern sectors of the city (figures 3.9–3.10).

The new industrial and housing districts had a much larger than previously spatial scale of urban design, determined by the theory of Soviet urban planning of that time. Territorial planning involved a change of the urban form. Traditional blocks were replaced by free-standing separate buildings.

At first, new housing consisted of 5–9-storey buildings. In the 1970s and during the 1980s, the height of the houses increased to 12–15 floors. Thus, large housing estates with great numbers of multi-storey buildings were formed.

In this way the age-old tradition of housing blocks typical to Lviv until 1939 was abandoned. The change of the spatial scale involved creation of a new urban landscape, conforming with the new rules and tendencies. The compact urban housing of the first half of the 20th century was replaced by housing areas consisting of "separately located" buildings with vast spaces between them.

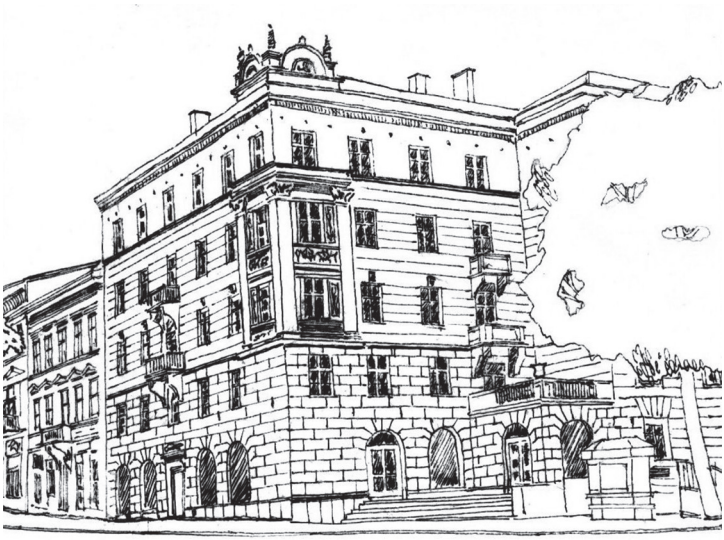

Figure 3.9. Apartment house in Horodotska Street, 1950

Source: drawing according to photo by B. Posatskyy

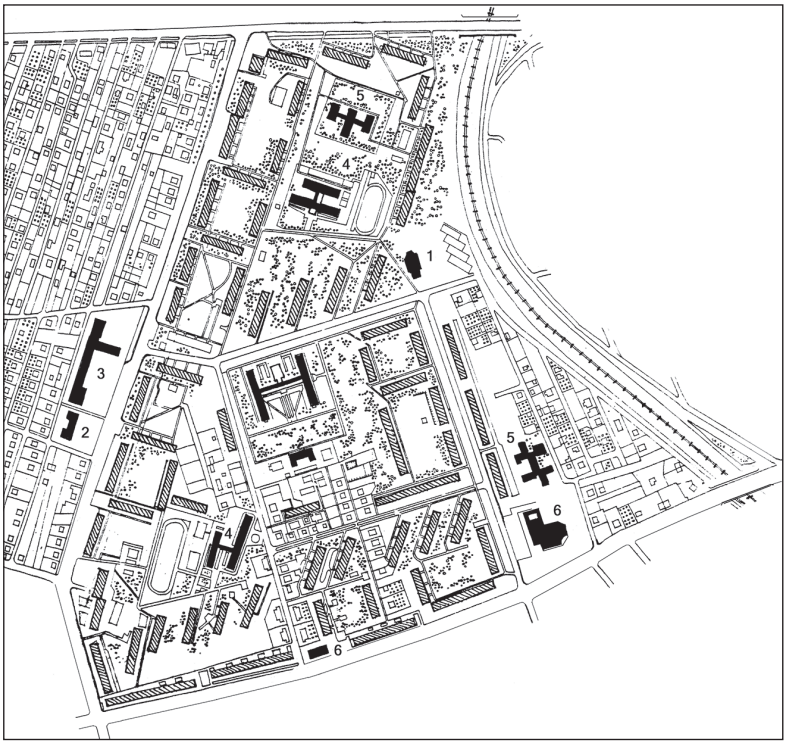

Figure 3.10. Sketch plan of the residential district, 1970
1 – church; 2 – office; 3 – clinic; 4 – high school; 5 – kindergarten;
6 – shopping centre

Source: Lviv, Dipromisto

In accordance with the general master plan conception of 1966, the territory of the city built-up before 1939, which was surrounded by a semicircle of railways (Pidzamche – the Main Station – Persenkivka), became the central part of the city. The railways of this area formed a "spatial border", which divided the "old" pre-war city and the "new" pos-twar part.

In the master plan of 1966, the height of the apartment houses was increased to 9–12 storeys in large housing districts, but a few small low-rise housing estates were also planned.

From the perspective of time it is possible to state that by 1990 most postulates of the Lviv master plan were realized. Industrial districts were built in the northern, southern and western parts of city. Housing districts were construct in compliance with the principle "housing not far away from the place of work". In this period of the centralized economy, it was possible to give apartments to enterprise workers near their workplaces. New large housing districts were built in the southern sector of the city, in which large panel 9-floor blocks of flats or brick houses with combined reinforced-concrete elements prevailed.

During 1966–1985, more than thirty large industrial enterprises were built in Lviv, such as bus factory, autoloaders factory, agricultural machines factory, three machine-tools factories, eight electronics and electrical engineering plants, five light industry plants and five food retail enterprises. A common characteristic of these enterprises was a relatively small demand for raw materials, but great demand for workers, as most enterprises worked in two shifts (Mazur, Posatskyy 2010, p. 106).

Intensive industrialization in Lviv during 1960–1980 was not accompanied by adequate development of the service sector, street network (except the southern sector) and technical infrastructure of the city. Three service subcentres planned in the master plan of 1966 were not built, only a building of a new administrative centre in the southern part of Lviv was begun, but it was not completed before the disintegration of the USSR in 1991. That is why all administrative, economic and cultural functions at the regional, county and city level remained in the old place in the central part of the city, which caused at the end of the 20th century an excessively high density of the existent urban structure.

The increasing "density" of the central part of the city and construction of multi-storey housing in peripheral districts in Lviv, with the practically unchanging area of the city, resulted in considerable density of population, which in 1989 reached 5118 persons/sq. km. At that time, a similar index for Kyiv was 3207, Donetsk – 3072, Odesa – 5463, Kharkiv – 5263 (Posatskyy 2001, p. 9).

In the 1950s–1980s, apart from industry (traditional branch of the economic activity of a Soviet city), such branches as administrative management, culture, higher education and science were developing in Lviv. From the beginning of the 20th century Lviv was a well-known centre of higher education and science, which was reflected in large representative building in city space. These functions were developed in 1970–1980 in state establishments for higher educational (70 000 students) in the city as well as the scientific centre of the Academy of Sciences of Ukraine. To meet these needs, new buildings for higher education institutions and scientific institutes were constructed (the new complexes of Lviv Polytechnic, Veterinary Academy, Academy of Arts, Research Institutes of the Academy of Sciences), including students' dormitories, sports grounds etc. (figure 3.11).

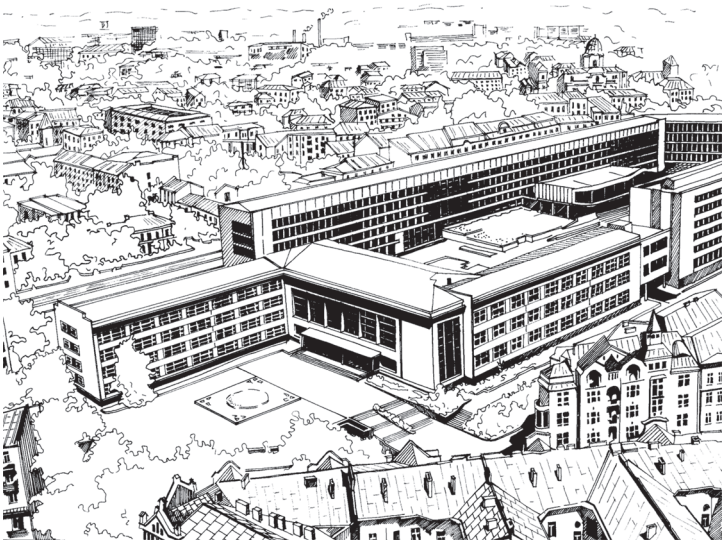

Figure 3.11. New buildings of the Lviv Politechnic National University

Source: drawing according to photo by RATAU

According to provisions of the city master plan of 1966, during the 1960s–1980s a new district of scientific institutions and related enterprises as well as housing districts of multi-storey buildings appeared in the south-western part of the city along Naukova Street. This street also functions as a mid-link of the southern inner city transport circle, which, together with new streets (Volodymyr Velykyy and Khutorivka) link western and south-eastern directions (Horodotska and Zelena main radial streets).

A peculiar example of a new residential district is Sykhiv, situated in the southern sector of the city. It was constructed during the last two decades of the 20th century. Housing construction in this area started in the 1980s and during the first several years consisted of a groups of 9-storey buildings of the same type, located almost regularly on the territory (figure 3.12). This residential district occupies an area of 300 ha between Zelena and Stryiska streets, former trade routes, going in the north-eastern and southern directions from Lviv. The industrial Sykhiv zone was developed to the east of it, and another new residential area – to the west.

Figure 3.12. The general view of Sykhiv residential district

Source: drawing according to photo by B. Posatskyy

A residential district typically consisted of large apartment blocks grouped around a kindergarten (a residential group); seve-

ral such residential groups formed a neighborhood (*mikrorayon*), with a school in the centre. Communal service facilities were usually located close to traffic streets. Trade and communal services were housed in 2–3-storey buildings.

All the houses were constructed according to the so called "typical house" pattern and could differ from one another only by the colour of walls and minor details. As a result, town image was unified and had a monotonous appearance.

During the first decade, residential buildings in Sykhiv district consisted of 9-storey large panel apartment blocks (figure 3.13). Later on, after the 1990s, the unification requirement was eliminated and separate 12–15-storey tower blocks began to appear, acting as spatial landmarks.

In another way, implementation of the master plan of 1966 was quite successful during the period until 1990, taking into account the creation of new residential districts in peripheral areas. The same can be said about the construction of industrial districts. A large belt of new districts was created during the 1970s and 1980s around the pre-war urban area. The population of Lviv in 1995 amounted to 807 000 within a total area of 152 sq. km and built-up area of 109 sq. km (*Statystychnyy chorichnyk* 1998, p. 27).

Figure 3.13. Apartment houses in Chornovil Avenue, 1980

Source: drawing according to photo by B. Posatskyy

3.9. In the independent state

The collapse of the Soviet Union in 1991 put an end to the centralized organization and financing of urban development. The economic system was changed, introduction of market principles of *ménage* began. At the same time, a national economy was overcome by a crisis, as a result of chaos in the legal system and common sharp decrease of state investments in all sectors of economy and also shortage of experience of activity in the new social-economic conditions.

Work on town planning documents in Ukraine, generally, stopped for over a decade. Only at the end of the 1990s began revision of master plans of the biggest cities – Kyiv, Kharkiv, Odesa, Dnipropetrovsk and Lviv (Bilokon 2005, p. 11).

In Lviv these changes were felt particularly strongly, because many engineering, electrical engineering and electronic industry enterprises working for the Soviet Union military sector were located there. The financing of these enterprises stopped from day to day and thousands of workers were dismissed.

After a few years, it became clear that Lviv is not a considerable industrial centre anymore. Former large enterprises appeared to be competitively disabled because of technological backwardness and inability to work in a competitive environment. Their privatization was conducted and in place of former one owner (the state) several private proprietors usually started to appear. It required the division of the real estate and territory of enterprises into separate parts.

Mass reorientation of the former factory workers (workers and engineering staff) to new types of professional activity took place. Three circumstances played an important part in this process: (a) restitution of private property; (b) proximity of Lviv to the border of Poland; (c) opening of the western and south-western border of Ukraine (with Poland, Slovakia, Hungary, Romania) (Posatskyy 2010, p. 65). Such circumstances caused a real boom in private trade and catering industry development in Lviv. It can be said that the city regained its position of an important node on the traditional trade route from Central Europe to the coast of the Black Sea.

Besides the trade function, the sector of banking, insurance and legal services began to develop quickly in Lviv. Branches of all large Ukrainian banks, banks with foreign capital, insurance companies, other financial institutions, and private notarial offices opened in the city. Restrictions of the Soviet time on individual housing construction were lifted, which caused rapid housing development in the suburbs of Lviv. The building of gas stations, shops and car service stations began, too.

The change of the political system entailed a revival of Church activity. Lviv regained the status of a multiconfessional city, with Greek-Catholic, Orthodox and Roman-Catholic confessions prevailing. The religious needs of the inhabitants in the central part of the city could be satisfied with the existing old churches. But in the new peripheral districts no churches were built during the Soviet period, and they started to be constructed quickly. More than ten churches were built at that time.

From the beginning, the complicated process of spatial development of Lviv in new conditions required coordination by the city authorities, but it did not happen. The newly formed local city authorities appeared not to be ready to control the process of the city's balanced spatial development in market economy conditions. The new edition (but really not so new) of town-planning norms, accepted in 1992, did not give answers to many questions about urban development, which arose in the process of social-economic transformation (*Derzhawni budiwelni normy* 1992).

In these conditions a new master plan of Lviv (Mistoproekt), accepted in 1993, was prepared: the territory of the city was divided into four planning districts with complex functional use (industrial areas, residential areas, service centres, green areas), and with this the relative balance of labor and settling adopted as 70%**.**

Clearly, in the conditions of market economy this approach was unrealistic and for this reason the new master plan turned out to be a document of little use in practical activity. In this master plan the city was mainly viewed as an industrial centre and functional zoning of the territory was based on it. For example, international

transport corridors and considerable territorial needs of logistics development to serve the growing transit traffic were not taken into account (Posatskyy 2010, p. 75).

According to one of European cities classifications, in the 1990s Lviv was in the seventh group, among with Dresden, Brno, Ostrava, Vilnius, Wrocław, Lublin, and Kaunas. It means that the city is regarded as an important regional centre. In this classification, the capital of Ukraine, Kyiv, is in the fifth group with Vienna, Geneva, Prague, Budapest, Warsaw etc.

By 1991, the architectural image of Sykhiv was changed by appearance of religious buidings – churches and chapels (figure 3.14). During the first years of independent Ukraine, they were built spontaneously by local communities, almost without architects. Today, the most famous new church in Lviv is the one constructed in 1995–2000 in the centre of the Sykhiv district – the Greek-Catholic Church of Nativity of the Holy Virgin, designed by a famous Canadian architect Radoslav Zhuk (Biryulyov ed. 2007, p. 382).

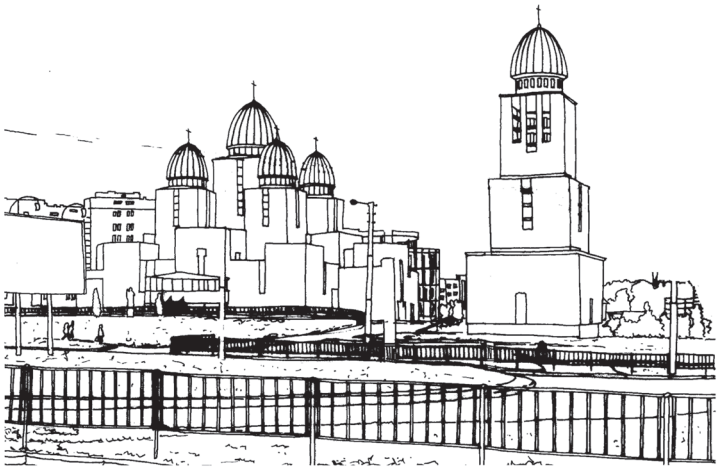

Figure 3.14. The Church of Nativity of the Holy Virgin in Sykhiv district, 2000

Source: drawing according to photo by B. Posatskyy

New monuments of great Ukrainians are among the major elements of contemporary townscape of the city centre. One of them is the monument of the greatest Ukrainian poet Taras Shevchenko, built in 1992–1995. To the left from the figure of the poet is the highly symbolic Wave of National Revival. This monument changed a section of the main Lviv street – Svoboda Avenue. At the end of Shevchenko Avenue is the monument of Mykhailo Hrushevskyy, the first President of Ukraine in 1917–1918.

In honour of a Ukrainian society "Prosvita" (Enlightenment), which functioned in Lviv from 1868 propagating the idea of enlightenment of common people, a monument was installed in 1993 in a small square in Lysenko Street (Biryulyov ed. 2007, p. 79).

In Chornovil Avenue a monument to the victims of Lviv ghetto 1941–1943, dramatic in form, was put up in 1992. In the centre of Markiyan Shashkevych Square is a very expressive monument (built in 1997) to the victims of communist crimes in Lviv region. At the crossing of Ivan Franko and Parkova streets a monument to Ivan Trush, one of the leading figures of Ukrainian painting of the first half of the 20th century, was erected in 1996.

Other new additions in the central part of Lviv are several "infill" buildings put up in the surrounding of 19th century housing. We can see this situation in many streets in the 19th century part of the city.

The Historic Centre of Lviv was inscribed in 1998 on UNESCO World Cultural and Natural Heritage List, because it is "the only city in Ukraine that has completely preserved its Medieval planning scheme, peculiarities of the urban building and greening. 2000 historical monuments that illustrate the establishment and the history of town development have been included in the national register. They represent practically all styles and trends of Central Europe urban form from the 13th to the 20th centuries" (Shular ed. 1997, p. 38).

At the beginning of the 1990s, territorial development of the residential and industrial areas within the city almost stopped. Instead, private single family house architecture in the suburban

zone gained momentum, and in 1991–1997 a belt of 2–3-storey houses encircling the high-rise housing areas of the 1960s–1980s was created. Changes in the legislation facilitated this process, allowing construction of single family houses by private investors, practically without limitation.

A paradoxical situation emerged. New low-rise housing became a kind of demonstration of "free activity" on the territory, unlike in the previous period, when strict requirements and limitations, and multi-storey monoculture were compulsory. The too literally understood "freedom" in planning and housing construction resulted in spatial chaos in the suburbs of Lviv. Today, we can see dozens of separately located single family houses, in various styles and different phases of completion, which creates disorder in urban landscape.

At the end of the 1990s, the townscape in the peripheral zone of Lviv's central part (at the border with new high rise housing estates) was slightly changing. Construction of 4–5-storey apartment housing with flats equipped in correspondence with contemporary European requirements was commenced in this zone. These houses were built by private investors on separate free plots, mostly among existing 2–3-storey housing.

A peculiar feature of the architectural image of these buildings is a combination of forms of European Post-Modernism and regional Sub-Carpathian architecture. The houses posses slopping roofs, covered with roofings, facades are built of bricks, covered with plaster, with wooden, glass, metal and plastic elements.

3.10. Spatial changes in the early 21st century

In the early 21st century, in Ukraine began the process of modifying the function of industrial areas. The former Soviet enterprises went bankrupt and their property was transferred to the new private owners. However, in terms of spatial distribution of territories, this meant division into relatively small parts, because the new owners

usually did not have enough money to purchase large sites. For example, the premises of the factory "Kineskop" have been divided between a dozen owners, but there are still buildings which "nobody owns" and they are slowly collapsing. Now, the new owners (car wash, auto parts stores, home appliances, building materials, bank branches, dry cleaning, laundry, offices of companies) occupy separate rooms of the former large industrial buildings, whose facades are facing the street. The reconstruction of buildings is conducted according to their needs from part to part.

The situation changed somewhat at the end of the first decade of the 21st century, when more wealthy investors appeared in the real estate market. These investors buy former business development centres and reconstruct them for their new purposes. Examples include the factory of industrial valves, transformed into a trade, and exhibition centre "Lemberg" on Bohdan Khmelnytsky Street, and the site of a forklifts plant on Shevchenko Street, where construction of a large shopping and entertaineinment complex is planned.

In today's Lviv are built small residential complexes consisting of several high-rise buildings and the necessary service facilities (trade, kindergartens, bank branches etc.). Two such complexes are to be finished soon in the southern part of the city on a former industrial area near Pasichna Street.

It has also become evident that for Lviv's development in the new conditions two factors are of particular importance: A – geographic location at the crossroads of European land routes; B – historical and cultural potential of the city (material and spiritual).

In September 2010, the City Council approved a general plan for the city until 2025 (figure 3.15). This document sets out development plans encompassing nearby settlements of Bryuhovichi, Riasne, Pidholosko, Zymna Voda, Solonka, Sokilnyky, Zubra, Pidbirtsi, Vynnyky Lysynychi and Soroky, located 2–3 km from the existing ring road. The new ring road is proposed to be built at a distance of 20–25 km from the city. The existing ring road will be a city street connecting these villages.

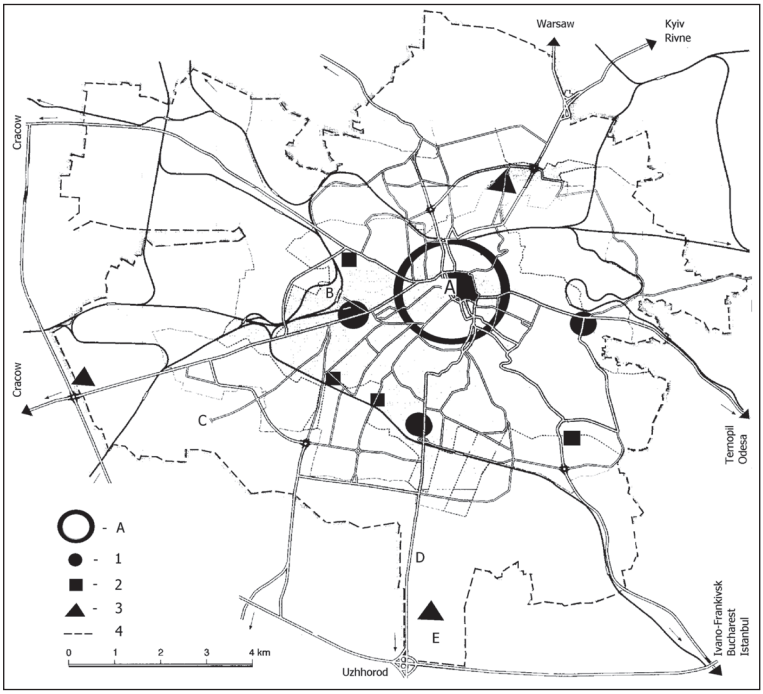

Figure 3.15. Space structure of the city services centres according to the master plan of 2010

A – city core; B – main railway station; C – airport; D – bus station; E – Euro-2012 stadium; 1 – sub-centre (*Master Plan* 1970, 1993); 2 – sub-centre (*Master Plan* 2010); 3 – specialistic sub-centre (*Master Plan* 2010); 4 – city area limit

Source: Mistoproekt, 2010

A new master plan envisages further development of the city core to the north (Chornovil Avenue), west (Gorodotska Street) and south (Stryiska Street). We should note that the entire territory of the city centre is a historical area of 120 ha included in the UNESCO World Heritage List.

Polycentric system of the city centre is also planned to be developed in the northern and southern sectors of the city. Interpretation

of the polycentric system of the city centre gained new emphasis in connection with the preparation of the city to host Euro-2012. Since the area to build a new stadium had been chosen on the southern outskirts of the city near the intersection of the beltway and Stryiska Street, the importance of the southern sub-centre increased. In the master plan of 1996 this sub-centre mainly performed the administrative function, which should develop taking into account new social-economic and city planning conditions.

Today, the eastern part of this territory is partly developed (the building of tax administration, institutes of NAS of Ukraine). Also, the construction of Ukrainian Catholic University has started. However, the main buildings (the building of regional administration and regional council, city hall, justice building, business centre, bank building) are going to be constructed along with the necessary infrastructure in the western part of the sub-centre.

The concept of development of the public sub-centre at Stryiska Street was prepared by Lviv Mistoproekt in 2007. This involves creation of a social and administrative complex and moving here the main organs of the region and cities. Implementation of this concept would have fundamental importance for the development of the city as a whole. Especially relevant is finding solutions to preserve the unique historical and architectural heritage in the central part of the city and improve the conditions of its tourism use and exhibition.

In the northern sector, a large "commercial and business district" will be created by redevelopment of a former industrial site between Zhovkivska, Lypynsky, Bohdan Khmelnytsky streets, while the location of two new "buffer sub-centres" is planned in Luganska Street, and one in Zelena Street. Another sub-centre is planned in the western part of the city at the intersection of Shevchenko–Levandivska streets. Thus, the system of sub-centres is going to be significantly expanded to eight complexes (including three provided for by previous master plans).

It should be noted that the planned sub-centres in Luganska Street are situated among large residential areas near street bridges over railroads and they may include transport and transship units.

The general plan *Lviv-2025* also includes the formation of three specialized sub-centres. They encompass the already mentioned commercial business district, a sports centre at the stadium Euro-2012 and a western sub-centre of wholesale and retail trade at the intersection of Horodotska Street and the beltway. The neighboring areas are in the process of intensive development (new streets, residential neighborhoods, hypermarkets "Epicentre" and "Metro", car parks, gas stations etc.).

The new master plan is expected to result in substantial increase in the population of the city, which was 732 000 in 2010, but in the long run can reach 750 000–760 000. Another 80 000 live in the suburban villages where the population can grow to 120 000–150 000 people (Syrcov 2010, p. 3).

According to the master plan, an area of nearly 138 ha area is allocated for multi-storey housing (table 3.1). The greatest number of buildings is planned in northern and western outskirts of the city.

Table 3.1. Proposed capacity of housing in Lviv's master plan 2010

Title	Sq. ha	Housing area sq. m	Population thous., persons	Density persons/ha
Lysynychi	20.0	124.0	6.2	300
Pidholosko	21.5	150.0	5.4	250
Pivnichnyi	34.7	228.7	11.5	450–246
Riasne 2	24.7	154.3	8.0	390
Pasichnyi	13.0	12.0	5.4	
Separate blocks (neighborhoods)	3.9 6.7 8.3 5.0	30.0 66.7 125.0 27.0	1.5 2.7 4.5 1.1	400 540
Separate buildings		80.0	3.6	
Total	137.8	1 150.7	49.9	

Source: Mistoproekt 2010

A powerful stimulus for spatial development was due to the construction of objects for the football championship Euro-2012. It was necessary to build a new stadium, to reconstruct the stadium for training, rebuild the airport and build new hotels. The stadium is located in the southern part, the exhibition centre and park area are adjacent to the ring road (*Mistobudivnyy kompleks "Yevro-2012"* 2008). In recent years, large shopping facilities are being constructed in the area adjacent to the ring road surrounding Lviv from the south. In addition to a new stadium, the existing stadium has been expanded and rebuilt.

Lviv airport, located in the western part of the city, has been reconstructed according to international standards. Construction of new terminal alongside the existing airport building (built in 1955, according to a typical project) has determined the need for construction of the new Ryashivska Street, which connects the radial directions of the south-western city sector. This street provides a convenient transport connection between the airport, railway station and stadium.

The area before the main railway station, which is an important city transport node, has been reconstructed, too. There are stops of tram routes, urban and long-distance bus routes and parking spaces.

3.11. Conclusions

In conclusion, we may state that currently the city of Lviv has the following specific features. Two, almost independent, townscapes have emerged and coexist on the city territory: historical and contemporary appearance (i.e. of the second half of the 20th century). Luckily, the historical and contemporary areas can be separated visually: the historical town is situated in the Poltva river valley, and the new residential areas occupy the plateau around the valley.

The central part of the city has preserved the historic street network and urban fabric that create its townscape, evolutionally formed during the 13th and first half of the 20th centuries. Around

the historic core, on an elevated plateau, a completely different type of city area was formed during the 1950s–1990s. New urban areas were built up mainly with multi-storey residential and industrial buildings, radically increasing the spatial scale.

During the 1990s (after 1991), the new townscape of the outlying urban territories and the suburban zone started to be formed. These territories are built up with a few-storey houses with plots of land, which results in the diminishing of the spatial scale of the area and gives it a rural-urban character.

The new master plan for Lviv, adopted in 2010, envisions expansion of the area of the city by the nearby settlements, construction of high-rise housing in peripheral areas, and expansion of the polycentric system of the city centre. Development of a new sub-centre in the southern part of the city has begun.

Preparations for Euro-2012 gave new inspiration for spatial development of Lviv. The main objects are located in the western and southern part of the city.

Mariusz Lamprecht

University of Łódź

4. ORIGINS AND SPATIAL DEVELOPMENT OF ŁÓDŹ

4.1. Introduction

Research on the spatial development of Łódź has been performed from various perspectives, including the geographical, historical and urban planning one. Among numerous studies on the issue, Baranowski's (1973, 1974, 1976, 1980a, b), Koter's (1969, 1974, 1980, 2009a, b) and Rosin's (1973, 1975, 1980a, b) works deserve particular attention, as well as many others which contributed to our knowledge about the origins and development of the city, including Berezowski's (1955), Ginsbert's (1962), Kulesza's (1992, 2002), Stępniewski and Szambelan's (2009), Wiśniewska's (2009) and Zajączkowski's (1976) studies. The research performed up to date allows for a fairly detailed analysis of the city's development from the beginning of the 19th century to contemporary times.

In view of Łódź's unique development process, several periods of the city formation may be distinguished. Two of them are particularly characteristic: the agricultural period, i.e. the several centuries of the city's "hibernation", despite the fact that it had had municipal rights since 1423, and the industrial period, which began in the 19th century, when the city developed from a small settlement into a metropolitan

centre, which instantly dominated other cities and towns of the region. The 19th century was a time of special significance for Łódź, which had only just gained urban, and, over time, metropolitan features. The dynamic industrialization and extremely rapid demographic development of the city during that period make Łódź a world-scale phenomenon. Nevertheless, the rapid development of Łódź led to a number of negative consequences, which to this day affect the spatial and functional structure of the city, nowadays, with the population of around 730 000, one of the largest urban settlements in Poland.

4.2. The agricultural period of Łódź's development

Beginning as a rural settlement and over time transforming into a city, Łódź has formed in a location which, due to its natural conditions, was not particularly popular among settlers.[1] The settlement developed at a broad and relatively remote elevation, situated between the lowlands of central and northern Poland and the highlands and mountains located in the south of the country. The area contains a major drainage divide separating two biggest Polish rivers, the Vistula and the Oder. As a result, the territory of today's Łódź, overgrown with wild forests and devoid of navigable waterways, remained poorly populated and economically underdeveloped for a relatively long time, despite the economic development of the neighboring areas. The situation was exacerbated by an overly large number of urban centres in the central part of the country, Łódź's remote location from the main economic centres of its owners (the bishops of Włocławek) and secondary significance of

[1] The first references to the Łodzia settlement appeared in 1337. In 1387, the settlement was reincorporated under the German law, which entailed transforming the village's layout into a new, regular, linear one. At the turn of the 15th century, a trade and crafts settlement developed spontaneously near Łódź, which benefited from the temporarily active traffic route. In 1423, king Władysław Jagiełło granted the settlement municipal rights.

its traffic routes. In consequence, for many centuries Łódź, an open city with no fortification, despite having municipal rights, has looked remarkably like a village.

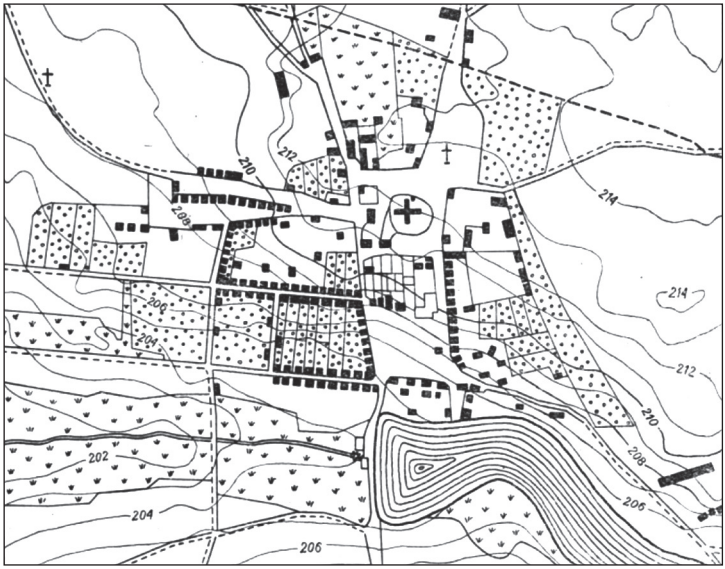

Figure 4.1. Łódź's housing development according to F. Johnney's plan from 1812–1813

Source: Koter (1980), p. 149

Franciszek Johnney's plan from 1812–1813 on a 1:5000 scale, the oldest cartographic image of the town on the banks of a small river called Łódka, offers an idea what the medieval Łódź looked like. As historical sources indicate, the town was economically stagnant and there are no proofs of a thorough rebuilding or a change of the town's location (Koter 2009a, pp. 62–63), it is assumed that any urban planning changes until the 19th century were negligible. As the aforementioned plan shows, at the turn of the 19th century the built-up area of Łódź reached only around 0.2 sq. km, and the settlement looked much more rural than urban.

The buildings were situated mainly around the market square and the roads to the west and south-west from the square. The area directly adjoining the market square consisted of arable fields, orchards and gardens (figure 4.1).

The image of medieval Łódź is not complete without a view of the town's spatial arrangement. The built-up area, located asymmetrically among the plains of fields near the north-eastern border of the town, constituted only a small part of the urban area (figure 4.2).

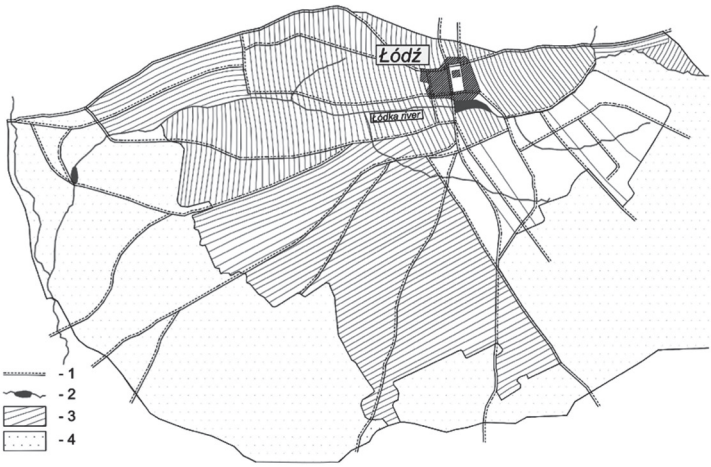

Figure 4.2. Reconstructed image of Łódź's spatial arrangement according to M. Koter
1 – roads; 2 – rivers; 3 – fields; 4 – forests

Source: Koter (1980), p. 151, simplified

In total, about 30 villages and 10 to 20 proto-industrial settlements – water mills, ironworks and forging manufactures, which were gradually incorporated into Łódź and influenced to varying extents the spatial organization of the town – developed in the area of the contemporary Łódź. Their remnants can be still traced in the city plan (Koter 2002).

4.3. The beginnings of the industrialization process in Łódź (up to the mid-19th century)

The 19th century was a new period of Łódź's development. The decision to establish a textile settlement in the city was influenced by a number of factors (Koter 1980, pp. 155–156):

– favorable ownership relations, as wide areas of the city were government property;

– favorable hydrographic conditions due to a large number of small but swift and water-rich rivers and streams, equipped with dams and easy to modify to suit the needs of the industry;

– easily available building materials (wood, bricks);

– the presence of settlers, glassworks workers and textile manufacturers;

– a desire to activate the yet underdeveloped area.

The first textile settlement in Łódź, so-called Nowe Miasto, was established on government grounds south of the existing urban housing development, on the opposite side of the Łódka river (figure 4.3). The settlement's location had been chosen based on ownership relations, urban planning issues (the effort to integrate the old and new part of the town) and transport concerns (Koter 1980, p. 156).

In those times, textiles were manufactured at home, what influenced Nowe Miasto's small size and compact spatial arrangement. The area dedicated to housing development was significantly smaller than the gardens in Nowe Miasto, whose role was to provide food supplies for the residents. The only built-up area accounted for in the plans were four blocks next to the market square and the surrounding belt of building plots situated to the outside of four ring roads, which closed up the layout. Four streets, whose directions referred to the four cardinal points, branched out of the centrally-located octagonal market square. The city's north-south coordinate, which had formed along the pre-existing route to Piotrków Trybunalski, provided means of communication with Stare Miasto.

Its east-west coordinate joined Brzeziny and Konstantynów Łódzki, two small settlements, relatively close to each other, which also had undergone attempts at industrialization in the 1820s. The plan of Nowe Miasto was typically urban, with blocks which could be built up frontally on all sides. The plan reflected the canon prevalent in urban planning, which harked back to the Renaissance theories of urban planning and the "perfect" layouts for Western European cities (Koter 1980, pp. 157–161).

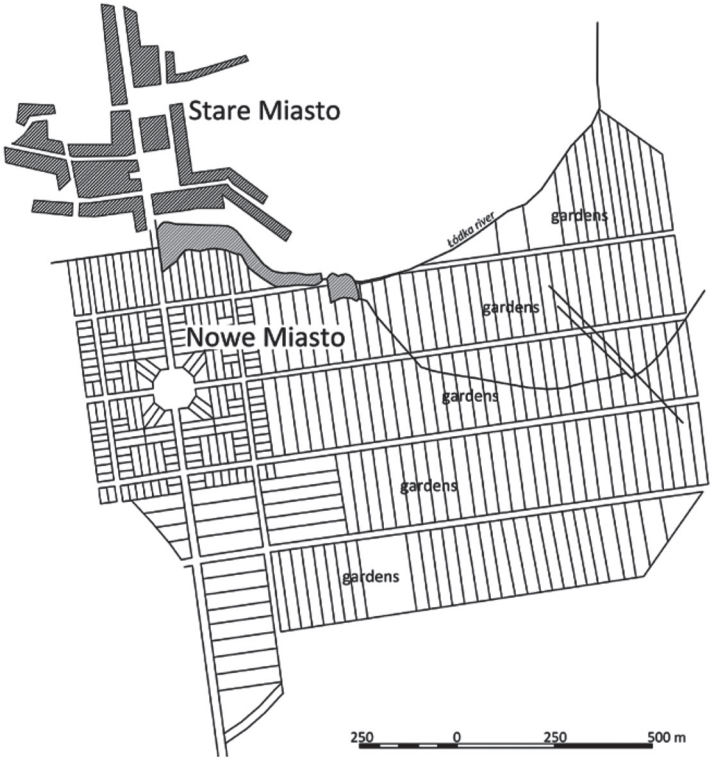

Figure 4.3. Stare and Nowe Miasto textile settlement, an outline of F.D. Viebig's layout from 1823

Source: Koter (2002), simplified

While Nowe Miasto was being developed, Stare Miasto was being reorganized. The changes (regularizing the market square, the church square and streets, imposing designs for new residential buildings) contributed to the city's orderly landscape, and the urban arrangement created in the process has lasted to the contemporary times (figure 4.4).

Figure 4.4. Stare Miasto after the regularization (according to Antoni Brochocki's plan from 1859)

Source: Koter (1980), p. 155

The first half of the 19th century was an idea to establish a large linen-cotton settlement in the vicinity of Łódź. Due to the lie of the land, the numerous watercourses situated near Łódź dropped significantly, which together with their existing hydrotechnical infrastructure created favourable conditions for the establishment

and development of factories with mechanized production lines. Along the Jasien river, located more than 3 km away from Stare and Nowe Miasto, so-called riverside industrial areas were established, i.e. large plots (between 20 and 90 ha) for prospective factories which were to form the settlement's industrial core. The stretch of the new settlement was a result of numerous pieces of equipment needing an appropriate water drop (Koter 1980, pp. 160–161). The riverside industrial areas determined the shape of the residential and handicraft part of the settlement.

The merger of the cotton and linen settlement with the textile settlement created the most peculiar feature of Łódź's plan, i.e. a straight and elongated 5-kilometre long line of urban housing development, for most part limited only to the housing on Piotrkowska Street. It constituted a common axis for the joint complex of three settlements, i.e. Stare Miasto, Nowe Miasto and the Łódka settlement. All of them were genetically different and functionally varied, but at the same time incorporated into the existing natural conditions. Due to the significantly elongated, band-shaped arrangement, the oldest core of the city became extremely peripheral to the urban complex. This was an unusual phenomenon for those times, since most cities have developed concentrically, forming ring-shaped arrangements (Koter 2009a, pp. 93, 164).

At the turn of the 1840s, Łódź became the most important textile industry centre in Poland. It was one of the reasons behind the authorities' decision to expand the area of Łódź and create Nowa Dzielnica on the eastern side of the Łódka settlement. The plan of Nowa Dzielnica was designed to match exactly the rectangular arrangement of Nowe Miasto and the Łódka settlement (figure 4.5). Compared to earlier handicraft settlements, which were functionally uniform, squares in Nowa Dzielnica were assigned to representatives of various trades, not necessarily connected with textile industry. The vast areas in the eastern part of the district were divided into plots for gardens to be bought by factory owners and other settlers.

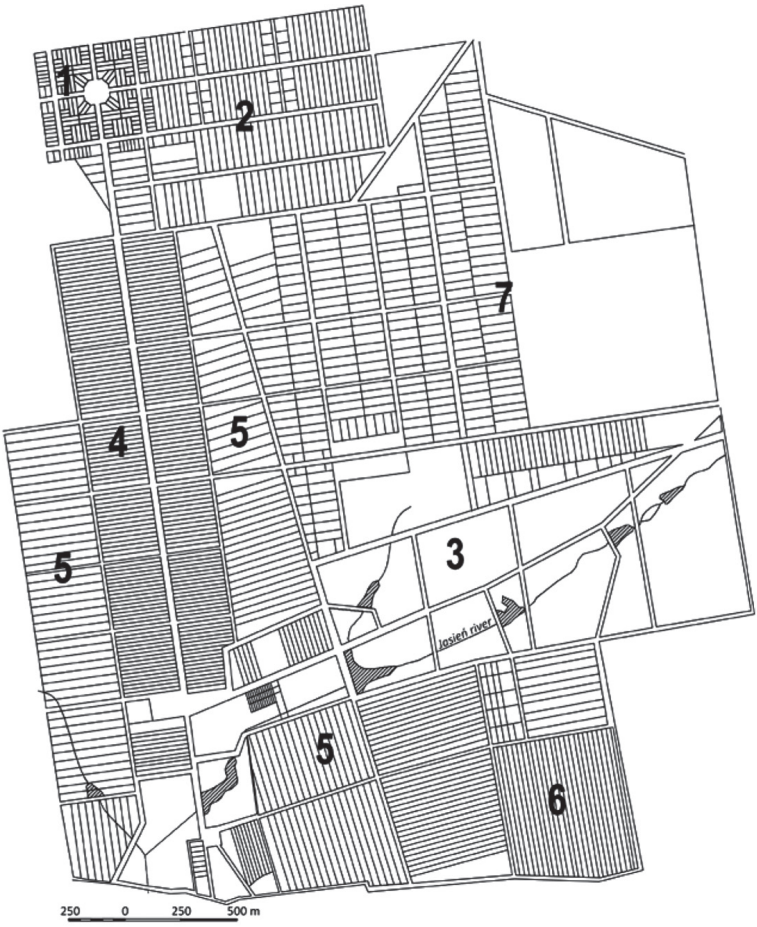

Figure 4.5. Spatial organization of the industrial Łódź around the mid-19th century
1 – Nowe Miasto textile settlement; 2 – Nowe Miasto (textile) gardens; 3 – riverside industry areas; 4 – linen and cotton weavers' settlement; 5 – linen spinners settlements; 6 – linen merchants settlement; 7 – squares and gardens of the functionally diverse Nowa Dzielnica

Source: Koter (1980), p. 174, modified

4.4. The period of the city's rapid growth (from the mid-19th century to 1918)

In the following years, the number of Łódź's factories was steadily growing, which entailed a rapid increase in the number of residents. The city developed "centripetally", as the authorities changed the form of use for particular city areas. It was possible partly thanks to the use of steam engine which eliminated the industry's need for water as a source or energy and partly due to the lack of free government grounds, which impeded the spatial expansion of the city. At first, the city's development in this period was planned. However, as soon as the turn of the 1860s, the existing urban structures reached the limit of their capability to serve the large numbers of immigrants. Łódź's extremely spontaneous growth, uncontrolled by the municipal authorities have resulted in a chaotic and unplanned development of the new areas. In consequence, agrarian elements of the surrounding complex were "stapled" onto the existing geometrical spatial arrangement of the city (Koter 1980, pp. 174–176).

The overpopulation of the Stare Miasto area in 1858–1860 led to the establishment of the first suburb of Łódź (Bałuty Nowe), an urban settlement consisting of 330 building plots. Despite the authorities' attempts to stop its development, it grew at an extremely rapid pace (400 residents in 1860, about 20 000 in 1891, and already about 100 000 in the middle of 1914).

In the years 1870–1890, the textile industry started to develop more intensively. New factories were being built on every free plot for sale, even in the city centre near the densest housing development. Towards the end of the century, the city centre had been thoroughly built-up; in the most extreme cases, over 80% of the area of a plot was developed. The chaotic sprawl inwards made the spatial arrangement from the handicraft period of Łódź unsuitable for the new functions and size of the city and detrimental to its correct development. The factories had been scattered, what destroyed the existing system of industry locations and distorted

the city's model division into clearly separated functional areas. Handicraft centres scattered among tenement houses and hundreds of factories contributed to a new city landscape, completely different from the harmonious and orderly scenery of proto-industrial Łódź. The settlement became a "city of chimneys", chaotically interspersed throughout the area (Koter 1980, pp. 182, 185; Koter, Wiktorowska 1976, p. 25; Stępniewski, Szambelan 2012, p. 16).

Simultaneously, the settlements located on the outskirts of Łódź were undergoing urbanization processes, caused by the development of industry, the granting of land to peasants in 1864, the regulation of ownership issues and the consolidation of the peasants' grounds. As a result, in the 19th and 20th centuries was the development of numerous housing estates of various character and function: factory-sponsored, working-class, holiday and residential ones. Low prices of land also led to the establishment of small factories outside the city area. At the turn of the 20th century, about 15 settlements, including suburban villages, were gradually incorporated into Łódź. Although the city area grew significantly (to 59 sq. km), the newly-incorporated territories had already been subject to rapid and intensive urbanization processes and therefore, had a chaotic spatial and functional structure (Koter 1980, pp. 178–179, 191; Stępniewski, Szambelan 2012, p. 17). Further urbanization processes were propelled by the development of suburban tram lines, which from 1901 to 1924 connected Łódź with eight other cities.

4.5. The city's development in the years 1918–1989

The 1920s and 1930s were a particularly difficult time for Łódź. The human and economic losses incurred during the First World War, the loss of the eastern market, a long-time recipient of the products of Łódź textile industry, after the October Revolution and the Polish-Russian war, the worldwide economic crisis and the war preparations at the end of the 1930s weakened the dynamics of the city's development. As a result, the interwar period was only few

isolated changes to Łódź's spatial arrangement. One of the most important achievements was the improvement of the public services. Sewage and water supply networks were set up, electric and gas networks were developed, Łódź's rivers were channelled and the tram network was expanded. To improve the residents' living conditions, the housing resources were developed, public utility facilities were built and the social infrastructure was enlarged. During the occupation, the Nazi authorities expanded the city area to almost four times its previous size, from 59 sq. km to 226 sq. km. Their decision was based on valid urban planning reasons as well as the desire to strengthen the German element in Łódź by the incorporation of old settlements populated at the end of the 18th century and in the 19th century by German settlers. Nevertheless, as far as urban planning was concerned, the activity of the Nazi German authorities was quite limited. Among their destructive actions, the one which proved to be the most detrimental to the urban fabric was the establishment of the Jewish ghetto, whose area (4.1 sq. km) was subject to an intensive devastation and decapitalization (Koter 2009b, pp. 220–240; Stępniewski, Szambelan 2012, p. 18).

After the occupation, the decisions of the Nazi authorities were cancelled. Nevertheless, as late as 1945, the area of Łódź was expanded to over 212 sq. km. In the following years, Łódź grow to over 214 sq. km and remained this size until 1988. The acquisition of vast, rather poorly developed areas immediately after the war significantly influenced Łódź's urban development, allowing for a fairly unrestrained spatial planning in the new outskirt districts. Despite that, the post-war urban planning initiatives were very limited, because the city, which had avoided serious damages during the war, was allotted restricted means for development. As a result, Łódź's urban development in the first post-war quarter of the century was of a centripetal character, and the actions implemented during that period did not change the existing band-shaped spatial arrangement of the city (in the north-south direction) (Koter 2009b, pp. 240–243; Stępniewski, Szambelan 2012, p. 19).

New projects were limited mainly to the urbanized area. One

of the most important undertakings were the works conducted in the area of the old Jewish ghetto. Their outcome was the new Łódź Stare Miasto, socialist realist in style, the first post-war housing estate (consisting of both adapted tenement houses and stand-alone blocks of flats) and the Staromiejski Park. In the other districts of the city, high-rise housing estates were developed in the form of infill buildings, which filled up the gaps in street housing. The high-rise estates developed at the end of the 1950s and in the 1960s were located further away from the city centre, but still near highly urbanized areas which made it easier to provide the necessary technical infrastructure. The city's spatial development encountered a significant barrier in the shape of the ring road railway line, a railroad ring encircling the city, created in the 19th century to fulfil the needs of the Łódź industry.

During the first post-war decades, individual housing was developing very poorly, usually in the newly-incorporated areas. The houses, often built without the necessary permits, usually blended into the existing rural and suburban settlement complexes. Some of them were established outside the city borders, which contributed to the chaotic sprawl of the Łódź suburban area. Industrial construction, on the other hand, was limited to adaptations of the existing industry concentration zones, rebuilding or expansion of the existing industry facilities and consolidation of smaller businesses into larger companies. Another trend was to close down the factories located in the city centre, which caused a particular nuisance to their neighbors, and to dedicate the post-industrial facilities to trade and management purposes. Until the 1970s, however, industrial construction projects did not exert a visible influence over the spatial arrangement of the city (Koter 2009b, pp. 245–246).

In the 1970s, Łódź's development was to be based on various branches of industry and the expansion of multi-family housing. The city's dynamic development became possible due to financial loans incurred from the Western countries, new technologies and urban planning, and architectural models. It was assumed that the city should develop outwards and evolve towards a relaxed, concentric

layout with a clear division between the districts. The new areas of urban development were to develop as belts, along the main car, tram and, in the future, train routes. They were to include housing estate complexes as well as new job vacancies in the newly-developed "industry and storage parks" (Koter 2009b, p. 251).

The implementation of these guidelines required first and foremost a reorganization of the Łódź transport system. A new inner-city ring road encircling the city centre was created as well as an east-west route, which improved the communication between the eastern and western districts and formed a cross-city connection to the ring road.

As far as family housing is concerned, multi-family housing had a particularly important role to play. It was located along the main directions of intensive urban development. Large panel housing estates were built mainly in the eastern and western city outskirts (Teofilów, Retkinia, Widzew, and later Olechów). Plans for the city centre allowed for more infill buildings and so-called city-centre housing estates. One of the examples of the trend is the City-Centre Housing District, built at the turn of the 1980s and to this day informally called Manhattan. The end of the 1970s was the beginning of the work on the first large-panel single-family housing estate in Łódź. A novel idea was to supplement multi-family housing with single-family houses, which were to be built away from the intensive urban development zones in order to blend in with the existing suburban architectural complexes.

The new residential areas harked back to the American idea of "industry parks". The scattered, geometrical cubes of factory halls, warehouses, pavilions and office buildings created a new industrial layout, significantly different from the existing one. Furthermore, there were plans to supplement selected housing complexes with an industrial area.

In the 1980s, although several housing estates were built, they were small-sized due to the progressing global crisis. Individual housing units developed much more dynamically during that period. They were scattered around the city outskirts, mostly in the form of

shapeless cubes with flat roofs, and they often blended into the spatial arrangements of the old suburban settlements.

In the mid-1980s, although Łódź still had many unoccupied areas, an idea arose to expand the territory of the city to about 150 sq. km. However, after public consultations, only 80 sq. km were added, expanding the administrative area of Łódź from 214 sq. km to about 294 sq. km. Incorporating new eastern and western outskirts gave the city a new rounder shape, but it did not change the band-shaped spatial arrangement of the intensive urban development zone.

Łódź's development in 1945–1989 was marked by a significant expansion of the city area, nationalization of trade and industry, loss of the city land rent system, introduction of the so-called planned economy and industrial methods of house construction as well as the standardization of urban development (Koter 2009b, p. 240).

4.6. Contemporary issues in the city's spatial development

The unique nature of Łódź's urban development allows for the identification of several distinct development types (zones) (Wiktorska 2012, pp. 25–29) (figure 4.6). The central zone includes the oldest part of the city located between the valleys of the Łódka and Jasień rivers, along the city's most important street, Piotrkowska. It has a geometric layout dating back to the early industrial period of Łódź's development and built-up areas of high density, currently possesses a multifunctional character and struggles with severe economic, social and urban planning problems. The zone encircled by the ring road railway surrounds and extends the central zone. It is dominated by the city-centre housing development, multi-family housing estates built in the 1920s and 1930s and the remnants of the old suburbs with dense, unplanned, difficult to regulate housing development. The urban complex zone includes the multi- and single-family housing development complexes situated outside the ring road

railway as well as industrial districts. The outskirts zone consists of areas including arable lands, forests and river valleys, which form the basic elements of Łódź ecosystem. Each of the zones undergoes different urban processes and encounters various problems connected to urban planning.

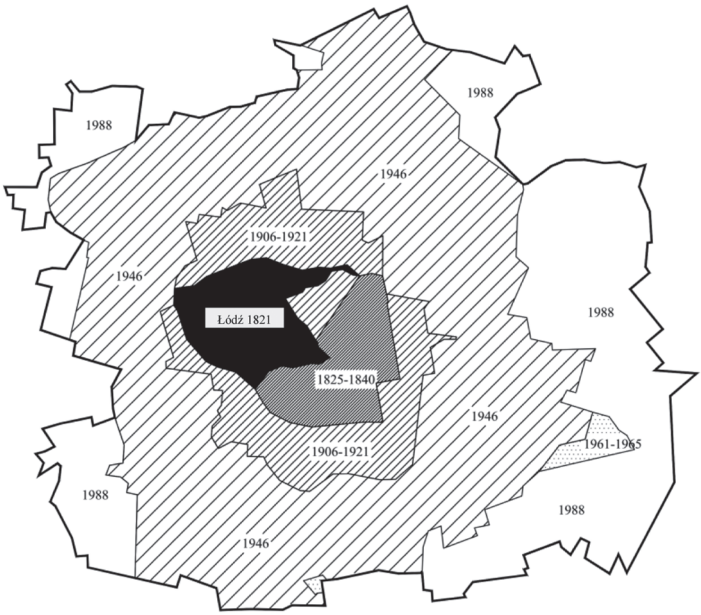

Figure 4.6. Łódź's territorial development and improvement

Source: based on: Stępniewski, Szambelan (2010); Wiktorska (2012), simplified

Many of Łódź's current urban planning problems were catalyzed by the political transformation of 1989. The consequences of the changes in Poland's political system were especially difficult for industrial activity, which had constituted the basis of the city's development. Łódź industry went into a deep economic depression, which affected not only the socio-economic situation of the city but also the urban planning sphere. The downfall of industry was tan-

tamount to the loss of an important city-forming factor. The number of post-industrial areas in the city, which over the course of time underwent a significant degradation, began to grow rapidly. The situation was exacerbated by the fact that Łódź, as a monofunctional space, had lacked any alternative functional programs for vast areas of devastated and decapitalized post-industrial wastelands, often located in the city centre for many years. Poor economic situation of the residents translated into the bad quality of housing resources, especially those situated in the city centre. It should be noted that the demographic situation of Łódź also had a significant influence on the city's status and development: in the years 1989–2010 Łódź lost 112 000 of its residents.

Although the post-industrial areas have gradually undergone the succession of functions (trade activity, entertainment activity, hotels, housing – loft flats, higher education), the scale of the problems which affect the urban planning sphere is enormous.

Łódź's main problem area is the vast 19th century city centre. The decapitalization of the development, lack of green areas and car parks as well as transport issues make these areas unattractive for future residents, contributing to their depopulation or the influx of residents from economically disadvantaged classes. The redevelopment initiatives carried out in the area are too limited to fulfil the needs, most of them are terminated at the scheduling or financing levels (building modernization, chiefly on the main street – Piotrkowska). Isolated projects, such as hotels, colleges, new stand-alone blocks of flats, only scarcely improve the appearance of this part of the city. Comprehensive redevelopment programs (encompassing the industrial areas which belonged to one of the most important 19th century industrialists Izrael Poznański and Karol Scheibler) lead only to the establishment of a few enclaves of quality buildings in an area with a highly degraded material fabric. The situation may be improved by rebuilding the oldest railway station in Łódź, located in the city centre. Relocating both the railway tracks and the station underground will open up broad areas for the development of the Łódź's New Centre project, en-

compassing the area of 90 ha. Although the aim of the project is to activate the city centre of Łódź, it poses the danger of creating another enclave which, just like the other (the so-called Manufaktura Łódzka, located on post-industrial grounds), may deprive the historic centre (Piotrkowska Street) of the basic reasons for its existence.

On the one hand, the industrial areas experience an intensive utilization of easements (especially as far as the post-war industrial areas and parks are concerned), on the other hand, a large number of city-centre industrial areas dating back to medieval times are being torn down. In the latter case, the demolition is carried out against the guidelines of the municipal conservation officer and it destroys culturally valuable objects. The city centre is encircled in a ring of low-standard multi-family housing. A large number of housing estates, which need renovation, new car parks and image regeneration are not integrated into the fabric of the city centre.

Another visible trend is the intensive urbanization of open areas, which results in a loss of their natural and cultural values. The lack of proper control over the development of single-family housing leads to an increasing chaos in Łódź's suburban zone, which sometimes results in a gradual disappearance of very valuable historical rural spatial arrangements (including the oval-shaped arrangement of the Mileszki village and the star-shaped arrangement of the Nowosolna village). The urbanization processes also spread to the areas surrounding Las Łagiewnicki (Łagiewniki Forest), an enormous forest complex (the biggest within the borders of European cities), which is a very attractive urban facility for the tourism and leisure industry.

Oleg I. Shabliy

Ivan Franko National University of Lviv

5. ENVIRONMENTAL DETERMINANTS OF DEVELOPMENT AND PHYSIOGRAPHY OF LVIV

Natural conditions – elements, phenomena, processes and systems of the earth's surface – are the common basis of human life as biological and social beings, and not directly involved in social production. The latter function is performed by *natural resources*, i.e. elements of the earth's shell used for food, raw materials and energy (recently this includes obtaining scientific information and other utilities in the service sector).

Every earthly sphere – litho-, hydro-, atmo-, bio- and anthroposphere – serves as a natural condition or a natural resource. Often one and the same element of the earth's surface may be both a natural condition and a resource.

The components of natural conditions of the earth's surface (including 10-kilometer layers of the lithosphere, hydrosphere and atmosphere) are:

1) structure of the crust – its tectonic and geological features;

2) actual surface, especially land surface – relief (there is also relief of the seabed topography and ice cover in the mountains above the snow line);

3) climate – state of the atmosphere typical of a certain part of the earth's surface (aerotory);

4) internal waters, including linear (rivers, streams) and polygonal (lakes, ponds, reservoirs) water bodies;

5) soils – subsurface layer of fertile substance which forms as a result of a complex interaction of geological rocks, heat and moisture and living organisms;

6) flora and fauna – a set of flora and fauna in their population and territory-associational terms;

7) natural landscapes as territorial (aqua) combination of the part of the landscape cover.

All these components of natural conditions are interconnected, as genetically and functionally different levels of the geospatial community: global, supra-regional (continental), zonal, sub-regional and local. Some scientists believe that the basis for geospatial classification of natural conditions into territorial (aqua) complexes is the tectonic-geological factor, while others believe that such a factor is the climate, still others – river basins (hydrographic factor) etc. Let us consider the above-mentioned natural conditions in the context of their impact on a specific geospatial urban system – Lviv with its immediate surroundings.

Each of these six natural phenomena, elements, components or systems can represent both natural conditions and resources. Thus, the geological structure of many regions of Ukraine contains breed *loess* (unconsolidated non-stratified land which consists of silt-sized particles). They participate in the creation, under certain other conditions, of black soil – in this sense it is a natural condition. But when a soil is the basis for food production, it is the natural resource. Similarly, loess and loess-similar loam, when used for making building bricks, can be considered natural resources.

5.1. Tectonics, geological structure and relief of the city territory

All three aspects of the solid earth envelope are closely linked to each other – genetically, structurally and functionally. In this regard, Lviv could be a kind of model for the study of interaction of the crust with other geospheres, including anthroposphere.

Tectonics as a science investigates the structural components of the earth's crust – tectonic plates and platforms (inactive in the vertical and horizontal directions) and geosynclinal areas (areas with dynamic processes, folding etc.)

There are three major tectonic structures in the region of Lviv: East- and West-European platforms and geosynclines of the Carpathian Foredeep (the latter concentrates a large number of fossil resources – oil, gas, kitchen and potassium salts, wax, natural sulfur and mineral waters of various gas and mineralogical composition). The distance to the boundary line of the East-European Platform and Carpathian Foredeep from Lviv is 40–50 km. The border between the East- and West-European platforms runs 30–40 km north-east of Lviv.

Thus, the territory of the city is on the West-European platform, within the so-called Lviv Paleozoic trough, filled with a thick layer (about 6000–7000 m) of sedimentary rocks of different geological age. Within this deflection of the tectonic structure the so-called Lviv-Lublin trough (depression) is well mapped. It also extends from north-west to south-east with the axis near Lviv. Almost all of it is rich in complex chalk (limestone, marl etc.), with total thickness of 800–900 m.

The territory of Lviv has a complex geological structure. The geological profile is represented by different age sediments, from the Paleozoic and Mesozoic to the Quaternary sediments of the Cenozoic era (figure 5.1).

Only some of them are visible at the surface. In most cases they are covered by the so-called Quaternary deposits, i.e. those that

formed relatively recently because of different erosion processes (planar and line flushing and re-deposition of indigenous and non-indigenous species).

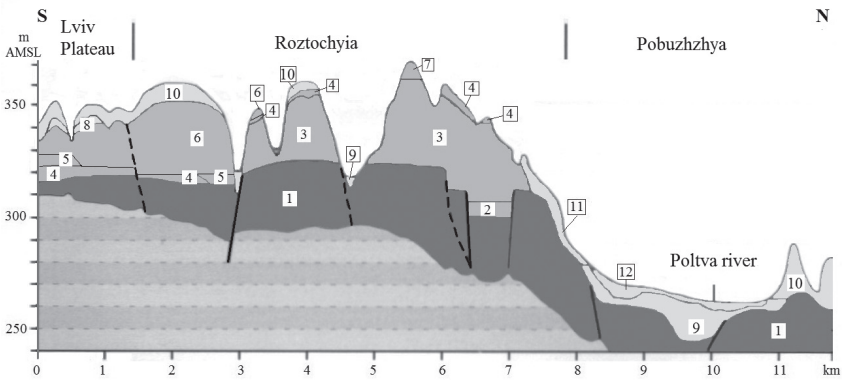

Figure 5.1. Geological cross-section through Lviv area

Cretaceous, Mastricht: 1 – marl; Neogen, Lower Badenian: 2 – lithothamnium limestones; 3 – sands and sandstones; 4 – sands, sandstones and limestones; Middle Badenian: 5 – gypsum and anhydrite; 6 – sands, sandstones and limestones; Upper Badenian: 7 – limestones; Quaternary, Pleistocene: 8 – fluvioglacial sands; 9 – fluvial sands; 10 – aeolian loess; Holocene: 11 – deluvium; 12 – peats and silts

Source: Velikanow (2012), p. 24

It has been already noted that the most plentiful are deposits of the Cretaceous period (Mesozoic era). This is mainly calcium breed – marl, consisting of pyrite, formed through oxidation of iron hydrooxides – *limonite*. Above the marl 0.5–10.0 m thick lies merhelysta clay, as its crust of weathering.

The Upper Cretaceous layer is at a depth not less than 320 m. It is mostly covered by Neogene sediments (Tertiary epoch, Cenozoic era), ranging from 10–20 m to 100 m thick, forming inselbergs in the eastern part of the city – Chat Rock. The best represented here are Badenian tiers, less common – Sarmatian tiers.

The Neogene layer consists of lithothamnium limestone, overlain partly by sandy rocks (mostly 3–5 m thick, sometimes 10–11 m). These bare rocks are observed in the north-western part of Kortumov Mountains and north-eastern side of the High Castle and Lion Mountain.

The Badenian tier consists of sediments described as Branivska, Nicholas, Mykolayiv, Narayivska, Kryvchytska, Tyraska, Ratynska and other layers, while the Sarmatian tier – of Volyn layers. Their lithological composition is presented in table 5.1.

Thus, we have a highly varied lithological composition of layers and tiers. Among them are various types of marl, limestones (including several varieties of lithothamnium limestones), sands, sandstones and clays.

Particularly interesting is the Tyraska (Dniester) layer containing gypsum and anhydrite deposits. The thickness of these rocks reaches 30 m. They lie at the depth of 3–6 m (north-western part of the city) or at 12–15 m in the southern and south-western part.

Scattered throughout the city are well represented Quaternary sediments of the Pleistocene (glacial) and Holocene (post--glacial, "modern" period, which began 10 000–15 000 years ago). The Pleistocene deposits include water-glacial sediments (clay, loam, sand, sand blocks and boulders of sandstone and limestone in the Bilohorshcha-Malchytska valley in the north-western part of Lviv), aeolian sediments (loess), talus (sands, sand-clay rocks Lesia) and alluvial sediments (sand, loam).

Each post-glacial (and interglacial) period, associated with warming and glacier retreat, was accompanied by the formation of soils. Loess was the basis of soil formation. The best types of soil are found in Pobuzhzhya, where loess overlies the chalky surface. Between these two layers are fossil soils, of which the lower tier is called Dubnovskaya, and the upper – Horokhiv. The latter tier contains dark gray and brown humus.

The Holocene deposits were formed in various environments and include sands, loam, silt, peat and rock debris with fragments of older rocks.

Table 5.1. Composite stratigraphic table of Neogene sediments

Period	Epoch	Age		Layer	Groups (characteristic species)
Neogene	Miocene	Sarmatian	Lower (N1s1)		Volyn layers: clay, limestone, sandstone, tuffs
		Badenian	Top (N1b3)	Pronyatynska (Kosovo)	Ternopil segments: lithothamnium limestones, sandstones with lithothamnium, clay Prutska layers: clay, marl, sandstone Verbovetski layers: clay, sandstone, tuffs Kayzervaldski groups: fine-grained quartz-glauconite sands and sandstones
			Middle (N1b2)	Tyraska	Ratynski segments: limestone, sand, sandstone Tyraska (Dniester) layers of gypsum, anhydrite
			Lower (N1b1)	Opilska	Erviliyevi strata (Kryvchytski): limestone, calcareous sandstone with fauna Ervilia Pusilla Narayivski layers: lithothamnium limestonei, organogenic-detrytusovi, carbonate sandstones Nikolaev groups: sands and sandstones with tree trunks Baranivsky segments: lithothamnium limestones, sandstones with carbonate nodule
Cretaceous (K)	Late	Maastricht	Berezinsky	Lvivska	Marl and yellowish blue-gray, fractured

Source: Voloshin (2012).

5.2. Relief

Relief is a surface as a set of topographical irregularities in their mutual relations and genesis. The emphasis on *irregularities* arises from the fact that relief is a function, the result of complex interaction of internal and external forces on the earth's surface. Internal forces cause vertical and horizontal movements of the earth's surface, thereby, forming its makroforms – mountain ranges, plateaus and plains, including lowlands. The gravity as inner force often helps to build microforms, too.

External forces include mainly the action of flowing water (linear and flat erosion), physical and chemical weathering, blocking or stimulating processes in plant and animal life etc. In any case, meso- and microrelief are associated primarily with external forces. This is evident in the relief of the city, its complexity and diversity.

Lviv is located in the western part of Podillia Upland, so its surface has all the general features of its relief. The average height of territory above sea level is 289 m in the city. Average heights of 245–260 m constitute 8.17% of total area, 260–280 m – 6.98%, 280–300 m – 10.74%, 300–320 m – 28.39%, 320–340 m – 26.30%, 340–360 m – 15.55%, 360–380 m – 3.82% and 380–400 m – 0.05%. This shows that more than half of the territory (54.69%) is located at an altitude of 300–340 m above sea level. Above this height is only about 20%, below – about 25%. The difference in heights within Lviv's territory reaches 168 m.

The lowest point of the city is in the valley of the Poltva river at an altitude of 245 m above sea level on the north-eastern border of the city (tract "On the marshes"), while the highest point is the top of an artificial cone of Castle Hill (413 m above sea level). The distance between them is about 4 km.

The main European watershed, which extends from north-west to south-east, runs through Lviv. It is interesting that it does not match the hypsometric highest points of the topographic surface of the city. The highest point of the watershed – 378.5 m – is a point on the south-eastern border of the city where Pasichna Street turns

sharply to the west side of Zelena Street. The lowest point – 312 m – lies near the main railway. The difference between the maximum and minimum height of the watershed in Lviv is 66.5 m.

The watershed slopes down in the city in the north-western direction. At first, it goes from its highest point almost directly west, reaching the crossing of Naukova Street and Knyahynya Olha Street, and from there it goes north to the main railway. Then, it rises to the crossing of Shevchenko and Levandivska streets, goes by the Ridge of Kortumov Mountain, close again to Shevchenko Street, and goes to Roztotskyi spurs of Bryuhovytskyi forest.

But in the eastern and north-eastern part of Lviv (the Baltic Sea basin) there are points higher than the highest points on the watershed (378.5 m above sea level). These points are the High Castle (413 m), Lion Mountain (388 m) and the point between the eastern end of George Washington Street and Pasichna Street (387 m). But there are many "vertex" points which are higher than the minimum watershed altitude: Kortumov Mountain (374 m), Citadel Mountain (326 m), Sviatoyurskyi Mountain (317 m) and others.

The landscape of the city is dominated by the basin formed by the Poltva river, with terraces of tectonic (structural) and erosive origin. The valley is surrounded by numerous inselbergs (being the effect of erosion), some of which look like so-called *residuals.*

Erosional residuals and structural ledges are types of denudational landform. Other landforms within the city include valleys formed by rivers and streams, plains, plateaus, denudational ridges and ravines.

The Poltva river valley is the largest among the river and stream valleys in Lviv region. It is bordered by the Malekhivska Ridge and Roztochyia Hills in the north, and Lysohirska Upland and Vynnykivske Hills in the south.

Lviv basin is surrounded to the west, south and east by several hills (300–320 m above sea level): Klepariv (near the recreation park), Snopkiv, Pohulyanka and Lysohirya. North-west of Vynnyky is the Chat Highland (on the left bank of the Marun'ka river) with Chat

Rock and Ratyn Highland. All of them are in the part of Lviv lying in the Baltic Sea basin.

The southern (Lviv Plateau) and western (Bilohorshcha-Malchytska Valley) parts of the city are in the Black Sea basin. The most north-western outskirt of Lviv is Horodotska-Schiretska plain. All these morphological forms on the territory of the city have different origins, mostly denudational-erosive and accumulative, but there also exist combined forms.

Various geomorphological processes played a role in the formation of the diverse relief of the region of Lviv, such as ravine erosion (especially the ravines cutting across the hills sloping down to Lviv basin and the Poltva river valley in Roztochyia), landslides, Karst (especially in the south-western part of Lviv on the plateau) and periodic flooding (in river valleys).

5.3. Climate

Lviv has a temperate transitional climate – from a temperate maritime western to eastern temperate continental (Mucha 2010). In the opinion of the named author, the climate is shaped by the following conditions:

1) geographic latitude, affecting the received solar radiation, the maximum altitude angle of the sun at noon in June being 64°C and minimum in December –17°C;

2) the effect of barometric pressure centres – the Icelandic low pressure zone, and the Azores, Arctic and Siberian highs;

3) predominance of western, wet Atlantic air masses with their characteristic cloudiness and small amplitude temperature, which causes mild winter and moderately warm summers;

4) location of the central part of the city in a basin surrounded by hills and plateaus, which weakens the ventilation over Lviv and causes topothermic differences between 2°–12°C.

The complex combination of these conditions has an impact on specific climatic indicators. They are presented in table 5.2.

Table 5.2. Meteorological parameters of Lviv, 1969–2007

Index	Degree	Quantity
Pressure, mm Hg. century.	Average	735.4
Wind speed, m / sec	Average	3.5
Temperature, °C	Average	7.3
	Abs. max.	33.7
	Abs. max.	29.2
Number of days with temperature	Less than 0°c	102.0
	Less than –10°ct	17.0
	More than +25°c	28.0
Number of days with temperature	Average	80.5
	Min.	22.9
Clouds, the number of days	Less than 2 points	41.0
Precipitation, mm	Average	715.0
	Max.	946.0
	Min.	393.0
The height of snow cover, cm	Average	14.0
	Max.	37.0
Number of days	Contaminated	146.0
	Snow cover	50.0
	Fog	39.0

Source: Mucha (2012), p. 28.

These figures are derived from analysis of averaged data obtained by instrumental measurements conducted by the Department mentioned above, which is located on the north-western outskirts of Lviv. There are some variations in specific sections of the city area. It is best shown on a map of medium temperatures (observations from 1st February 2007 to 1st February 2008) (Mucha 2010).

The average annual air temperature in Lviv is 7.3°C, with actual temperatures ranging between +33.7°C and –29.2°C. The highest

average temperatures – above 10°C – are recorded in Lviv basin. However, winter temperature inversion is sometimes observed (in the centre of the city the average daily temperature is lower than in the southern fringes). Lviv receives on average 715 mm of rainfall per year (between 946 mm and 393 mm). Low precipitation (35–40 mm) is in January when the average temperature drops to –3.9°C. The highest precipitation (90–95 mm) is in July, when the temperature reaches 18°C. Atmospheric precipitation, naturally, is irregular in the city. It can be expected that slopes with northern, western and south-western exposures receive slightly more precipitation than the southern or south-eastern slopes. Unfortunately, this feature has not been investigated so far.

The distribution of wind directions is associated with the movement of air masses in the city. The frequency of winds from the western direction is about 25%, and from the south-eastern direction – 20%. The least likely are winds from the north-east – only 5%. However, the probability of summer winds from the west is higher than the average for the year, and in winter the frequency of winds from the north-eastern direction increases.

Cloudiness is a characteristic feature of the city's climate. There are 236 cloudy days (66.3%) in a year, with the sky partly or totally overcast. This, in fact, gives two cloudy days in every 3 days. Since almost 150 days a year are days with precipitation, it turns out that 63.6% of all cloudy days are days with precipitation (mostly rain).

Despite this, Lviv's climate is characterized by a high number of days and hours of sunshine: on average, there are 1271 sunny hours (maximum 1563 hours, minimum 1029 hours). As a result, the average square meter of each area receives during the year 3330 MJ.

It is clear that the annual duration of solar radiation and the average values of the radiation balance components are closely related with each other. Their lowest values occur in the winter, and highest – in the summer. However, the number of hours of solar radiation reaches a peak in May and August (respectively, 260 and 245 hours, and the highest value of the radiation balance is in June – 12 cal/sq. cm).

5.4. Hydrography

As was already noted, Lviv is situated on the main European watershed (figure 5.2). The area of the city is drained by rivers whose waters flow through the Poltva, Zech, Bug and Vistula to the Baltic Sea and through the Dniester and its left-side tributaries – Bison and Vereshchytsya – to the Black Sea. The part of the territory which is on the watershed is rich in small natural and artificial lakes, which in many cases are being built over or drained and abandoned, and are gradually losing their retention and recreational functions.

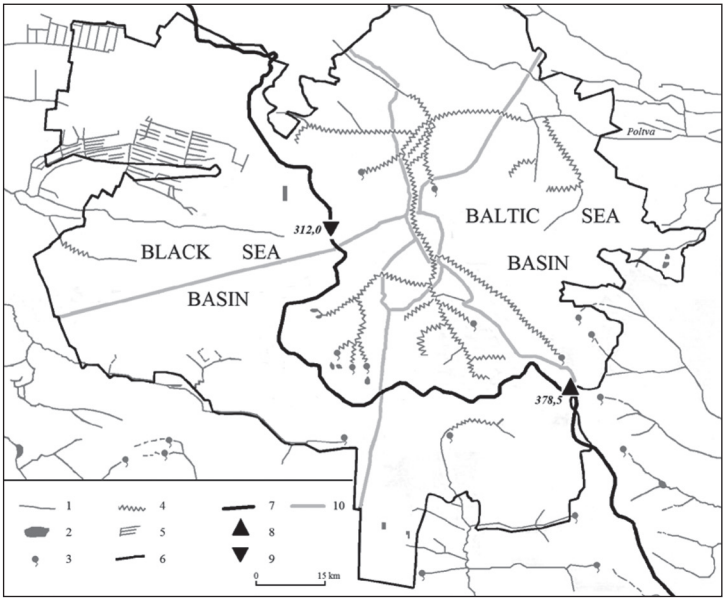

Figure 5.2. Lviv location on the European watershed and hydrographical network
1 – rivers and brooks; 2 – ponds; 3 – springs; 4 – river in underground canals; 5 – drainage ditchs; 6 – town boundary; 7 – the main European watershed; 8 – top point of the watershed; 9 – lowermost point of the watershed; 10 – chosen streets

Source: Kobziak, Mielnik (2012), p. 31

The historical part of the town is drained by an outflow system that feeds the main water artery – the Poltva river. The southern, western and south-western area is drained by right-side upper tributaries of the Dniester – Bison, Salt and Vereshchytsya; the first two flow mainly to the south, the latter – to the west.

The rivers and streams are fed by rainfalls and snowfalls, but some of them flow partly in underground canals. Many sources are silted, and some streams as well as the river Poltva from its intersection with Bohdan Khmelnytsky Street (north-eastern part of the city) flow in pipes or concrete channels.

Identification of the source of the Poltva is problematic, because the streams and creeks that form the middle and lower part of the river are more or less equal in length and water content, so there is no consensus on this issue. Many researchers have decided on the Vuletski stream (in the south-western part of the basin), while others (including the author of this chapter) point to the Soroka stream.

The length of the Poltva within the city reaches about 7.5 km, so the river gradient per 1 km of length is 13.6 m. Especially high gradient is in the first kilometer (from the source to Stus Street): it is two times more than average.

The city area on the watershed is rich in these types of still water, plus a number of artificial water bodies – swimming pools (municipal and departmental) and fountains. Some of them went into decline in the last 20 years, otherswere renovated (like the fountain "Swans" in the Stryisky Park) or re-created (e.g. the fountain in front of the Opera and Ballet House or the swimming pool "Akvaplyazh" in Knyahynya Olha Street).

Particularly interesting are lakes and ponds close to the main European watershed (e.g. between Naukova Street and Vladimir the Great Street) and in the southwestern part in Kars depressions (suffusion lakes are common in this area), and small reservoirs at the foot of the hills in Lviv basin.

The largest of the water bodies within the territory of Lviv City Council is Vynnykivske (former Komsomolskaya) Lake. This is an

artificial reservoir on the Marun'ka river. There was a plan to create another such reservoir in the Poltva valley between Chornovil Avenue and Warsaw Street, but expansion of the city to the north resulted in this area being built up (near Masaryk Street).

Most notable fountains of the city are the fountain "Swans" at the top of Stryisky Park (restored), "Opera" near the Main Railway Station, four fountains at the Rynok Square and many others.

Thus, despite the fact that Lviv is situated on the main European watershed, it has a dense network of streams and water reservoirs, of which some are hidden in underground collectors and their water is unfit to be used by people.

5.5. Soil

The territory of the city and the surrounding area is covered by at least 12 varieties of soil. They are grouped into several types. The most common are so-called urbanozemic soils. This is a special kind of urban soils, which are the result of complex symbiosis of natural soil interactions with superimposed rocks, often with humus. Typically, these soils are combined with reclaimed soils with a thick humus horizon. They are found in the central part of the city, where they constitute 60.9% (after S.P. Poznjak, M.G. Kota, A. Horseshoe). In other words, six out of ten acres of ground are covered by urbanozem. At some places they overlie gray forest soils, which form the background.

Lviv lies in the zone of gray forest soils, which are a natural soil zone in Europe. These are good soils, which surrounded the city in the early 18th century, when its area was confined to the territory within city walls. Since that time, the area of the city has increased tenfold and typical gray forest soils were transformed into urbanozem under the influence of anthropogenic factors. This type of soil is now found within the city only where broadleaf tree stands still exist. Gray forest soils occupy 15.3% of the city. Large stretches are concentrated north of Warsaw and Mazepa streets, i.e. where deciduous forests existed recently or still cover parts of the land.

Podsolic soils acccount for 7.5%, and together with other varieties of sod-podsolic soils are distributed within the city in four compact places: High Castle, Shevchenko's Grove, Kortumova Mountain and Bilohorschskoho Forest.

Other types of soil varieties include meadow, marsh, bog and turf soils on alluvial and deluvial sediments. Grassland and chernozem-meadow soils are found in the Poltva river valley east of Bohdan Khmelnytsky Street, and fen peat – in the northern and western part of Bilohorshcha and in the north-western part of the city. Loess like loam and black ash predominate near the airport and the city stadium.

5.6. Flora and fauna

In the system of geobotanical regionalization, Lviv is situated in the European broadleaf zone, which consists of two provinces – the Central European Province and East European Province. The first one is represented by the Baltic subprovince, and the second – by the Polesia and West Ukrainian subprovinces. Lviv is situated at the junction of these three subprovinces. The Baltic subprovince is represented by the Nemirovskii-Maherovsky area in the western and north-western part of the city, the Polesia Subprovince – by the Kamyansko-Vynnykivske area in the north-east, and the West Ukrainian Subprovince comprises the southern and southeastern part of Lviv. It is comprised of three geobotanical divides: Holohorny-Voronyatsky, Nikolaeva-Berezhany and Schiretskay. Thus, the flora of the city belongs to five geobotanical areas, combined in a specific geographical floristic unit, characterized by complexity and diversity, and therefore, unique.

Before the development of urban settlements, almost the entire territory of the future city (except the waterlogged valley of the Poltva river and individual inselbergs) was covered with deciduous forests, which are now partially preserved on the outskirts of

the city in a substantially changed form. These are mainly beech and hornbeam, pine-oak, oak and hornbeam-oak, hornbeam and birch forests and other derivatives.

A special intrazonal ecosystem is the pine (pine-oak and pine-birch in some sections) forest plantation "Lviv Sahara" – a unique natural complex in the extreme northern edge of the city and beyond its limit. This complex grows on a 30–40-centimeter thick layer of sod-podzolic soil formed on a 2-meter thick stratum of Badenian sands.

Boggy formations are mostly found in negative relief forms, which are usually wet (or even filled with water most of the year). They comprise multi-species varieties of grass-versigrass meadows, versigrass-fen meadows, marshy meadows, steppe and xerophytic groups, coastal-water groups, ruderal stretches with fragments of natural vegetation and cultivated areas. Ruderal vegetation (thistle, couch etc.) is found on the left bank of the Poltva between the river and Bohdan Khmelnytsky Street. Boggy river valleys, e.g. Levandovka Bilohorshcha-Malchytskiy entrance valley, are overgrown with sedge, reed, rush etc.

The main areas of greenery in the city include public gardens, parks and forests. Particularly large areas of public gardens are in the northern and north-eastern part of the city, between Khmelnytsky, Shevchenko and Horodotska streets.

Park and forest areas of trees and shrubs are commonly found on the outskirts and in the central part of the city (Stryisky, Pohulyanka, Franko, Bohdan Khmelnytsky parks, Shevchenko's Grove and Zalizna Voda). Among them Stryisky Park is especially rich in non-native plants, brought from other climatic and floristic regions, such as Tertiary flora (*Ginkgo Biloba*), subtropical flora (*Magnolia sp.*, *Tsuga sp.*, *Sophora japonica* etc.) and tropical flora (e.g. *Arecaceae sp.*).

On the territory of the city, especially on its outskirts, many rare herbaceous plants have been preserved. These include: *Huperzia selago, Cephalanthera damasonium, Neottia nidus-avis, Telekia spe-*

ciosa, Linum flavum, Carex hartmanii, Carex davalliana, Pedicularis palustris and many others.

There are three types of green areas in the city, which can be classified as general purpose (parks, forest parks, public gardens and boulevards), specialized purpose (botanical and dendrological gardens) and limited use (greenery in hospitals, campuses etc.), which constitute, respectively, 51%, 20% and 29%. Thus, half of all green areas is for general use and this type of green spaces tends to increase, particularly on the outskirts of the city.

Green areas are particularly sensitive to human activity, especially to air pollution by road transport. Studies carried out by I. Voloshin (July–August 2005) show that the greatest damage (51–65%) has occured in the southern and south-western sector of the city, which belongs to the Black Sea basin.

It is not as diverse as the flora, which is understandable: the survival of its representatives is difficult in the urban environment. Some species of beetles occur throughout the city. The species found in residential areas, near human dwellings, include mice, rats, pigeons and sparrows (*Mus musculus*, *Rattus norvegicus*, *Columba oenas*, *Streptopelia decaocto*, *Passer domesticus*), which, however, are decreasing in number in recent years.

A. Bokotey has identified five major biotypes in the city: high-density housing in the central part (species occurring here are *Fringilla coelebs*, *Apus apus*, *Corvus frugilegus*), multi-storey modern buildings (*Delichon urbica*), country houses (*Coronella austriaca*, *Podiceps ruficolles*, *Talpa europaea*, *Pica pica*, *Hyla arborea*), ruderal industrial areas (*Apodemus agrarius*, *Phoenicurus ochruros*, *Rana temporaria*, *Bufo bufo*, *Natrix natrix*) and forests, parks, public gardens and cemeteries (*Apodemus flavicollis*, *Sciurus vulgaris*, *Talpa europaea*, *Fringilla coelebs*, *Turdus merula*, *Sturnus vulgaris*, *Parus major*, *Natrix natrix*, *Lacerta agilis*, *Bufo bufo*, *Rana temporaria* etc.). The best preserved fauna is at the fringes of forests and gardens.

Rare species of terrestrial vertebrates found in the city include bats (*Myotis bechsteini*, *Myotis nattereri*, *Myotis dasycneme*, *Barbastella barbustella*), amphibians (*Bufo viridis*, *Emys orbicularis*), mammals (*Mustela erminea*) and birds (*Ixobrychus*, *Podiceps cristatus*, *Crex crex*, *Columba oenas*, *Tyto alba*, *Corvus corax*, *Carpodacus erythrinus*, *Cerchneis tinnunculus*, *Certhia familiaris*).

Elżbieta Kobojek

University of Łódź

6. ENVIRONMENTAL DETERMINANTS OF DEVELOPMENT AND PHYSIOGRAPHY OF ŁÓDŹ

The history of the city of Łódź dates back to the 15th century. The oldest section of the city was set on a flat area in the valley of the Łódka river, near the route between Łęczyca and Piotrków Trybunalski. For the next three centuries, though, Łódź was a poor town of farmers. Even at the end of the 18th century, most residents farmed land and raised stock (Flatt 1853, pp. 9–17). Poor soil in the surrounding land did not help farming, which is why the town was surrounded by extensive woods. At last, with the development of the textile industry in the 19th century, the city boomed. In just 50 years, the population grew nearly 100 times, from 190 people in 1793 to 18 190 in 1851 (Flatt 1853, p. 47). At both stages of the expansion, the natural environment was very important. However, the agricultural period and the industrial period used its different elements. Farmers used best quality soil, while the location for the industry was determined by easy access to extensive woods and sufficient supply of surface water. Intensive industrial development resulted in bigger transformation of the natural environment than during all three previous centuries of farming. Plant and animal life as well as water relations underwent the biggest transformation. Today, the biggest problems

of the city are to ensure sufficient water supply and to manage overflow water in the streets during intensive rainfall. These problems are, of course, a result of this big city being located on a drainage divide.

6.1. Geological composition

Geological foundation of the Łódź region is composed of high-thickness Mesozoic formations. The city is located on the borderline of two important geological units: Central-Polish Anticlinorium and the Łódź Basin (Stupnicka 1989, p. 14). The borderline, spanning from north-west to south-east, lies in the eastern section of the city (figure 6.1). The anticlinorium is composed mainly of Jurassic formations (limestone and marlstone), Triassic formations (sandstone, mudstone) and Permian formations (limestone, gypsum and salt). These rocks are rich in useful minerals: rock salt, iron ore, marlstone and limestone. They had significant influence on the economic development of the region. In the area there are also mineral and thermal waters (e.g. found in Rogoźno near Łódź). The Łódź Basin is composed of Cretaceous formations: marlstone, limestone, clay and sand, distributed along the arch of Jurassic formations. The highest thickness of these formations is found within the basin's axis, where it exceeds 1000 m. In Łódź, nearest to the surface is limestone in Śródmieście at 25 m (Ziomek et al. 2002, table VII; Ziomek 2008). They surface near Dobroń and Mogilno, ca. 17 km south-west from the city. The basin distribution of rock formations is a result of a high concentration of subartesian waters, which have been used since the 19th century.

Mesozoic layers include younger rocks: Cenozoic, mainly Neogenic and Quaternary. Neogenic formations (Miocene and Pliocene) are placed, while in the centre of the city Quaternary deposits are located directly on top of Mesozoic formations. Miocene deposits, sand and clay contain lignite inserts. Larger documented lignite deposits

are located in Rogoźno, less than 20 km north of Łódź. They have never been exploited because of unfavourable geological conditions.

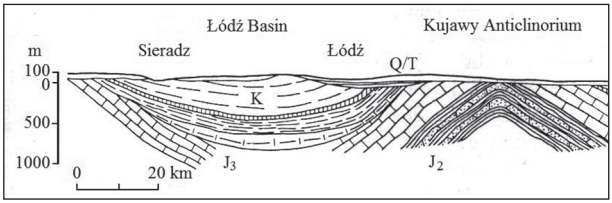

Figure 6.1. Geological section across the Łódź Basin and Kujawy Anticlinorium: J_2 – Middle Jurassic deposits; J_3 – Upper Jurassic deposits; K – Cretaceous deposits; Q/T – Quaternary and Tertiary deposits

Source: Dylikowa (1973)

Quaternary deposits are common in Łódź and the entire area. Their thickness varies, however, it gradually descends in the south-western direction. Highest values of 150–100 m have been recorded in Łagiewniki, Stoki and Janów (Klatkowa 1972a, pp. 37–38). In the central part of the city, the thickness falls in the range of 60–80 m. Glacial deposits are dominant in Quaternary formations. Warta Stage fluvioglacial sand and till can be found at the surface, while Vistulian sand and Holocene mud aggregate in the valleys (figure 6.2). Larger areas composed of till can be found in the centre and in the southern part of the city. Sand and gravel, some till, mudstone and clay in end moraines are characteristic of the northern part of the city.

Glacial formations have been widely used because of their high availability. Clay and till were already used in Łódź at the beginning of the 18th century. Sand and fluvioglacial gravel, at various locations reaching the thickness of 100 m, were used even more. Extensive mines operated in the southern and north-eastern part of the city.

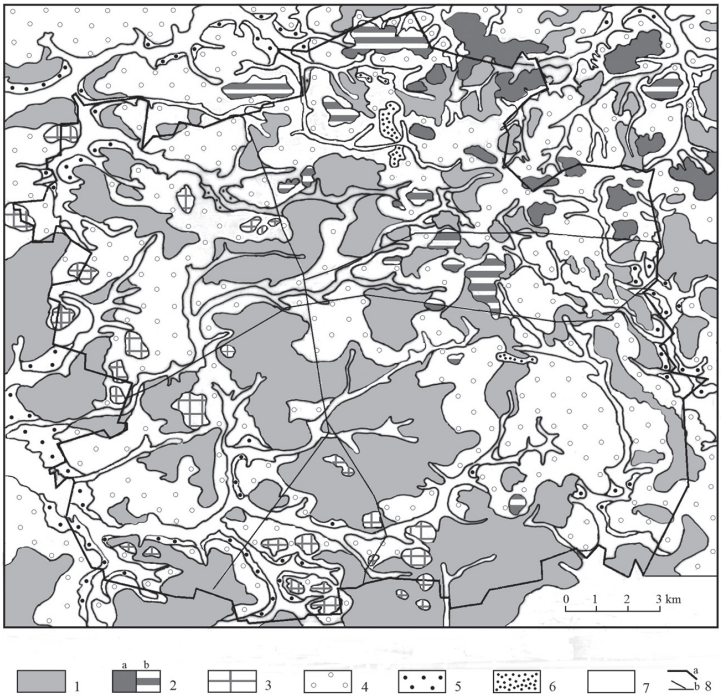

Figure 6.2. Lithology of the surface deposits
Warta Glaciation: 1 – till, 2 – sand, gravel and till: a – end moraines, b – push moraines, 3 – gravel and sand, some silt in kames, 4 – fluvioglacial sands; Upper Plenivistulian: 5 – sands, gravel and silts in river terrace; Late Vistulian: 6 – aeolian sand; Holocene: 7 – fluvial sand, mud and peat, 8a – town boundary, 8b – main streets

Source: based on Ziomek et al. (2002)

6.2. Land relief

The most important elements of the relief were formed by glacial and fluvioglacial processes during the Warta Stage. Later, in periglacial environment and temperate climate, they were slightly transformed. Highest elevations are located in the north-eastern part of

the city and they gradually descend towards the south-west (figure 6.3). Along the north-east and south-west axis, land elevation decreases from 276.6 m to 170 m above sea level. Within just 14 km, the difference in elevation is 107 m. It exceeds maximum relative altitude of the administrative areas of Warsaw, Poznań and Wrocław, which are territorially larger than Łódź.

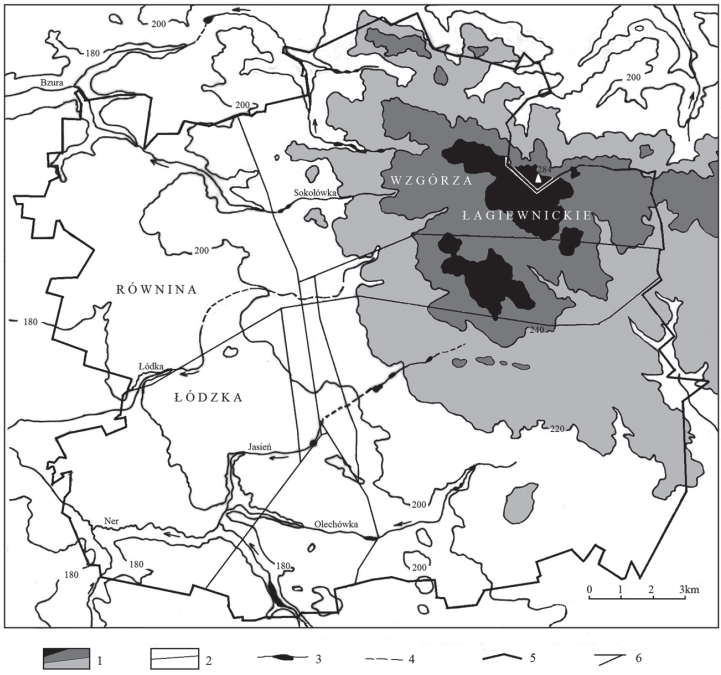

Figure 6.3. Land relief and river network

1 – Łagiewniki Hills 220–284 m above sea level; 2 – Łódź Plain 180–220 m above sea level; 3 – rivers; 4 – rivers in canals; 5 – town boundary; 6 – main streets

Source: based on Goździk, Wieczorkowska (2002)

Two main geomorphological units have been identified within city limits: Wzgórza Łagiewnickie (Łagiewniki Hills) and Równina Łódzka (Łódź Plain) (figure 6.3). Wzgórza Łagiewnickie, located

in the north-eastern part of the city, have diverse relief. The eastern section has large relative altitudes of 30–60 m and the highest absolute altitude in the mezo-region. The highest point measuring 284.1 m AMSL (so-called "Radars" Hill) is located just outside city limits, near the village of Dąbrowa. Within city limits, the highest elevations reach 250–276.6 m AMSL and they are located in Stoki. A dominant element of the relief is an extensive hill composed of high-thickness fluvioglacial sand and gravel. It is the local section of the major watershed of the Vistula and the Oder. Almost every river of Łódź has its source at the feet of the formation. Flat surfaces, dry basis, poor soil and better aeration are favourable conditions for urban development in this zone.

Hills and knolls composed of fluvioglacial gravel and sand as well as clay (figures 6.2–6.3) are the most characteristic elements of the northern part of Wzgórza Łagiewnickie. Those are mostly terminal moraines, some accumulated glacio-tectonically (Klatkowa 1972b, p. 252). They form a beautiful landscape belt of 3–5 km in width with relative altitudes reaching 100 m. The slope gradient of the rivers which cut through here reaches 3–7‰ and their valleys are carved deep. Diverse relief and low agricultural usefulness of soil are the reasons why this area is thickly covered with woods. This is the largest park and forest area within city limits called Las Łagiewnicki (Łagiewniki Forest) often visited by the local population. It includes various walking, bicycle and even ski routes.

Równina Łódzka is located at a lower elevation and its relative altitudes and relief are less diverse (figure 6.3). It includes plain or undulating terrain of ground moraine, with additional kame hills at various locations (western and southern districts). The oldest part of the city and the dense urban development of Śródmieście are located on an extensive flattening at 190–210 m AMSL called Stopień Śródmiejski (Śródmieście Step). In the 19th–20th centuries, this is where most levelling of the terrain took place: hills were reduced in height, many valleys and marshes were levelled. The lowest elevation (180–170 m AMSL) and, because of this, the most monotonous

area is located in the south-western part of the city. It includes fluvial terrace of the valley of the Ner river.

River valleys are important formations in the city's landscape. Their relief changes along the rivers' run. Upper sections of the valleys located within Wzgórza Łagiewnickie are deep, narrow and steep. At today's Śródmieście, the valleys used to be wider with more gentle slopes. Meadows and marshes existed within valley floors. Today, they are the most transformed sections of the entire area. They are difficult to spot as they have been levelled and covered with urban development. In the western part of the city, the rivers would meander and the valley floors used to be flooded each year in spring. These areas were not suitable for development, which is why at the beginning of the 20th century in the valley of the Łódka and the Bałutka rivers was established Park Ludowy (People's Park), today known as Park Józefa Piłsudskiego (Józef Piłsudski's Park).

In Łódź, like in any other highly urbanized areas, land relief of certain areas has been extensively redeveloped. Many new anthropogenic formations were created, while various natural ones were transformed. Anthropogenic formations mostly include mining sites for minerals for the construction industry. Until the 1970s, the brick was the main building material. Till, necessary for its production, was exploited in all parts of the city. Brickyards and extensive but shallow clay-pits would be opened at the outskirts. By the second part of the 19th century and at the beginning of the 20th century, there were at least 35 clay exploitation sites (Koter 1988, p. 25). Post-exploitation pits are no longer visible in the city's landscape. One of the older clay-pits, now rehabilitated, houses a market place (at the section of Jaracza and Kilińskiego streets). On Radogoszcz, the rehabilitated land has been occupied by housing developments. Between the 1960s and 1970s, large panel was introduced in housing construction. Its production required large amounts of sand and gravel. Extensive and deep gravel-pits were thus created. The largest gravel-pits operated in Stoki, in the north-eastern part

of the city. There is still a 70 m deep open-cast pit. In the southern and south-eastern parts of the city, 6–30 m hills served as a source of sand and gravel. As a result of intensive aggregate mining, some smaller hills have completely disappeared from the landscape. Open-cast pits in large hills, on the other hand, have been filled with urban waste and covered with earth. Thanks to land rehabilitation, the landscape still includes formations whose height is similar to the natural ones. In one instance, the current formation (Rudzka Góra) is 22 m higher than it used to be. It has been redeveloped for recreational purposes. It now includes a ski jumping hill (max. jump length: 18 m), a luge track (580 m), a restaurant and a bar. Smaller gravel-pits inside city limits have undergone land rehabilitation and now include housing developments or parks, e.g. Park Poniatowskiego (Poniatowski's Park). In 1966, it was a place of sand and gravel exploatation. After regeneration works, the hill is now 22 m higher then it used to be.

A large area of the city is occupied by excavations and mounds along the railway line and roads, helping to level the areas of greater land relief diversity. The process of reshaping land relief is still under way at the outskirts of the city. After 1989, there has been a rising interest in urban development of suburban areas. This phenomenon has been observed e.g. in Las Łagiewnicki. This forest area has become an attractive area for people wanting to settle away from the centre of Łódź. Thus, many new houses have been built in Łagiewniki, even on the steep slopes and on valley floor. Upper-class residential developments required declining the steep slopes. Most often, the developers would add material and thus create artificial terraces (figure 6.4B). In the valleys, sections of marshy floor were covered with rubble and earth to form dry and even surface for housing developments (figure 6.4A).

This resulted in the change of the valley floor morphology. For example, the Bzura river now runs in a deep ditch where it used to form a wide, marshy fluvial terrace.

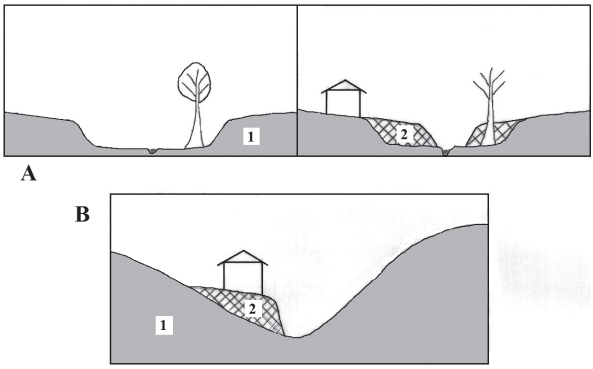

Figure 6.4. Anthropogenic transformation of the valleys in Las Łagiewnicki
A – covered marshy valley floor; B – artificial terraces in dry valley; 1 – natural landform; 2 – artificial form

Source: own elaboration

6.3. Climate

Łódź is located in the temperate climate zone, in between its continental and oceanic types. Long-term mean meteorological values are similar to the values characteristic of Central Poland, however, the city's climate displays some distinct characteristics resulting from a slightly higher elevation and the influence of a large city.

Mean annual temperature in Łódź in the period of 1931–1998 was 7.9°C. Of course, this value varied during individual years. The lowest annual temperature of 6°C was recorded in 1956, while the highest annual temperature of 9.6°C in 1989. July is usually the warmest month of the year, with average temperatures reaching 18°C. January is usually the coldest month, with average temperature reaching –2.9°C. The lowest temperature ever recorded in Łódź was registered on 17 January 1963 when the temperature plummeted to as low as –31°C. The highest temperature of 36.8°C was recorded on 29 August 1992 (Kłysik et al. 2002).

Mean annual precipitation between 1931–1998 was 560.6 mm. The highest volume of precipitation reaching 780.6 mm was

recorded in 1931, while the lowest of only 363.9 mm was recorded in 1959. Precipitation in Łódź is characteristic of continental climate. Spring-summer precipitation (ca. 354 mm) is usually higher than autumn-winter precipitation (210 mm). The highest volume of daily precipitation was recorded in 1939 (103.5 mm) and in 1980 (99.8 mm). As of 2010, no significant rising tendency of total annual precipitation was registered, however, in the last few years, the amount of torrential rain has increased, which often causes numerous local urban floodings.

A big city's climate also has some peculiarities. Dense urban development, tall buildings and large area of roofs, sidewalks and streets influence the temperature, humidity and wind speed. Łódź has a clear urban structure. Today's central part of the city was developed in a relatively short time at the turn of the 19th century, and it is characteristic for its dense urban development and a significant share of man-made surfaces. At some sections, roofs, sidewalks and asphalt constitute more than 90% of the entire area. Industrial districts, even if their function has changed, are also characteristic for their considerable share of man-made surfaces. The second stage of the rapid growth of the area of urban development took place after the Second World War, when new residential districts were created at the edges of the "old", 19th century industrial and residential developments. Those districts are often located next to fields and grasslands.

Artificial heat emitted to the city's atmosphere as a result of use of different forms of energy (heating, electricity, transport) is a very important climate-changing factor. In winter time, the amount of heat emitted to the atmosphere as a result of human activity is bigger than the amount of solar heat reaching the surface. In summer time, artificial heat plays a less significant role in altering the climate. In the city centre, within dense urban development, emissions of anthropogenic heat during winter time reach 70–100 W/sq.m, while in summer time – 20–30 W/sq.m (Kłysik et al. 2002). Within single-family urban developments, artificial heat stream is much lower, reaching 4–2 W/sq.m, respectively in January and July. The amount of artificial heat emissions in Łódź is similar to the amount of heat

emissions in other large European cities located in the temperate climate zone (Kłysik 1996).

The biggest peculiarity of the city's climate is the existence of a heat island, i.e. a heat overflow within the city in relation to the temperature of non-urban areas. This urban heat island occurs usually at 75% of all nights in a year (Kłysik et al. 2002). Its character varies, depending on meteorological conditions. In windless (0–1 m/s) and cloudless conditions, heat spots (cells) form within the city; their area overlaps the areas of high-density apartment-block residential districts. Undeveloped areas between those districts (parks, gardens, railway premises) become areas of coldness. At locations where apartment block developments border with farmland, temperature gradients are high, reaching 3–4°C per 100 m. The most distinct instance of heat island in Łódź (windless and cloudless conditions) was recorded on the night of 5 February 1996. Temperature differences between the city centre (–7°C) and peripheral fields near Konstantynów (–19°C) reached 12°C (Kłysik et al. 2008). Such record differences have been recorded in just a few cities around the world. It is more common for heat islands to occur during weak wind conditions (2–4 m/s) – then temperature differences between the city and its edges reach 3–4°C. One must remember that high night-time temperature differences (usually 2–4°C) occur in summer, when weather conditions produce favourable thermal conditions within the city. Daily temperature differences between the city centre and the outskirts are low, seldom exceeding 1°C. The warmest area of a city always overlaps with highest density urban areas.

Higher temperature in the city centre is a result of lower humidity than on the outskirts. The highest differences during summer time can reach 30–40%. During day-time, positive as well as negative differences may occur, reaching 5–10%. Within extensive urban developments, a common phenomenon is decrease of wind speed. Measurements in Łódź confirm a decrease of wind speed in winter time by up to 50% (Fortuniak, Kłysik 2008). It has been observed that in summer time wind speed within the city centre is higher than on the outskirts. It is a result of varied surface in the city centre.

Therefore, in the centre of Łódź, within tall urban development, winds of 4 m/s or less are predominant, which significantly hinders proper ventilation. Latitudinal distribution of the valleys of the Łódka, the Jasień and the Olechówka rivers would be perfect for ventilating the city, as most winds arrive from the west. Unfortunately, they are also covered with urban developments.

Living conditions are further worsened by air pollution caused by the industry and transportation. In high concentration, it is strenuous for the respiratory system, especially of elderly people and children. Still in the 1980s, Łódź was one of the most polluted cities in Poland. In 1970, the concentration of SO_2 was measured at 175 μg/cubic m, while the concentration of dust at 260 μg/cubic m (Rembowski, Fokczyński 2002a). Since then, however, there has been a significant change for the better, which must be associated with the demise of the city's industry and the change of the city's economic profile. Today, highest concentration of pollution occurs in the city centre: 15 μg SO_2/cubic m, 40 μg NO_2/cubic m and 59 μg dust/cubic m (Rembowski, Fokczyński 2002b). Average concentration of SO_2 and NO_2 is lower than that of acceptable norms, however, dustfall exceeds acceptable values. Concentration of pollution caused by higher traffic also rises, which in combination with poor ventilation of the city centre becomes a serious ecological problem.

6.4. Surface waters and flooding

Availability of surface water and groundwater influences the development of cities. Usually, large cities are situated on big rivers. The history of Łódź in this respect is exceptional. Łódź is located at a borderline zone between two watersheds – it runs through northern and eastern parts of the city. That is why the layout of the hydrographic network is radiating (figure 6.3). Most rivers and streams have their sources at the foot of the hill in the north-eastern part of the city. The Bzura and the Moszczenica run north, the Miazga runs south. The central and south-western part of the city is drained by

smaller streams: the Jasieniec, the Łódka with the Bałutka, the Jasień with the Karolewka and the Olechówka. They run south-west towards the Ner.

When at the beginning of the 19th century urban planners decided to build an industrial centre in Łódź, among its many advantages they would emphasise large availability of surface waters: rivers and springs. Riverbeds were narrow (1–2 m) and not too deep (0.3–1 m) (Bieżanowski 2001). The streams could not serve as communication and transportation routes, but they provided water for the city's and the industry's development. When industrial plants were being constructed, small streams did not pose any technical problems – sections of their beds would be dislocated outside the premises of new factories and palaces. Today, this is a reason of many problems during humid years. It is not unusual, after high rainfall, for water to run through basements of today's building, i.e. relating to old natural riverbeds.

During the industrial development period, rivers served as waste dumps, which in time caused a sanitation threat. But it was as late as in 1925 that the construction of the city's sewer system designed by William H. Lindley was begun. The sewer system utilised riverbeds as receiver canals for human and industrial waste together with water from precipitation collected through street inlets. Most rivers were directed through underground canals. Today, the old streams function only thanks to rare surface supply and discharge from the rainfall receiver system. Various short streams and springs vanished from the face of Łódź as the level of groundwater dropped by a few to almost 20 m. They only remain in street names (Źródłowa) and park name (Źródliska).

Today, 18 small named rivers run through Łódź and their total length within city limits reach 126 km (Bieżanowski 2001). This network is supplemented by 11 nameless streams with total 26 km in length. None of them plays an important role in the life of the city, apart from the receiver role of rainfall waters and sometimes of overflow urban waste. Within high-density areas of the city, they have been enclosed in canals and they run beneath the streets.

Channels of two rivers strictly bound with Łódź (the Łódka and the Jasień) have been considerably altered. The Łódka, in its upper section, runs in an open ditch, in Śródmieście for 5.3 km in an enclosed canal, and it surfaces again in the park at Zdrowie and runs further in a concrete channel. The Jasień is in a similar situation, running in an uncovered and enclosed channel respectively. An important element of the landscape is anthropogenic reservoirs differing in size and function: recreational, farming, fire preventive. Most reservoirs were created on the Bzura – within city limits there are 20 reservoirs the area of which ranges from 0.01 to 3 ha.

Contemporary cities, with their high-density urban developments and leakproof surfaces, struggle with the problem of draining rain water. In Łódź, this problem emerges periodically and with high intensity. The city never faces a typical flood resulting from an overflow of a river. In Łódź, more typical is an urban flood caused by exceptionally high rainfall (intensive phase lasting over 15 minutes). For this to happen, rainfall must occur in the sealed catchment area. Usually, the same areas located in the city centre are flooded. Even intensive rainfall in the suburbs does not cause floodings. Another characteristic feature is repeated flooding of the lowest sections of the city in specific parts of the city, which usually overlap with valleys' basins.

Main reasons of urban flooding in Łódź include: inability to drain overflow water from rainfall caused by non-drainable surfaces; too few street inlets, which often become blocked during violent rainfall; some inlets and engineered channels are too small. The sewer system can successfully decrease the scope of flooding only when it works properly and if it is adjusted to potential water flow. There may also be a problem with other calculations of torrential rainfall used by W.H. Lindley when he was designing the system. Therefore, proper distribution of street inlets and reconstruction of retention on urban streams may limit unfavourable hydrological phenomena, an example of which is the construction of the cascade on the Sokołówka. As part of renaturalization work of the Sokołówka, construction of 11 reservoirs ranging from 0.1 to 2 ha (6 already operating) and 8 meanders is planned.

6.5. Groundwater

Geological composition of the Łódź region favors large variety and high volumes of groundwater which are distributed at several aquifer levels. They occur in Jurassic, Cretaceous, Tertiary and Quaternary sediments.

Post-glacial high-thickness Quaternary sediments include several aquifer levels: super, inter- and sub-moraine. In the 19th century, the growing city would first exploit water located at depths ranging from a few to 40 m. Today, the depth of wells exploiting Quaternary levels ranges from a few to over 130 m BGL and it is estimated that throughout Łódź, there are 3000 such wells (Burchard, Nalewajko 2000, p. 37).

However, the city's biggest asset is a Cretaceous basin which is a huge reservoir of subartesian water. Cretaceous waters are very efficient and high quality. They are usually exploited from highly-sealed levels of Upper Cretaceous marl and limestone at the depth of 200–300 m. Intensive growth of textile factories resulted in rapid depletion of surface waters and forced investors to seek groundwater. In 1890, the first 11 deep wells exploiting Upper Cretaceous levels were drilled for industrial purposes (Jokiel, Maksymiuk 2002). Construction of the city's waterworks begun as late as in 1934; the network was supplied by Lower Cretaceous level waters. In consecutive years, new wells would be commissioned. In the years 1890–1972, 200 deep wells reaching 100–350 m BGL were established in Łódź; they would extract Upper Cretaceous water – this is the biggest system of deep wells in Poland (Burchard, Nalewajko 2000, p. 37). The highest usage of deep well water was recorded in the years 1960–1961. At that time, 118 wells would extract Upper Cretaceous water and less than 20 Lower Cretaceous water. Operations of a large number of wells resulted in exceeding by over 50% the acceptable usage of Upper Cretaceous water. As a result, a depression crater formed, which at the beginning of the 1970s reached 100 m in depth, spanning over a huge area of

the city and the entire greater Łódź area. By supplying water from the Pilica via a pipeline (1953) from Tomaszów Mazowiecki and in 1973 from Zbiornik Sulejowski (Sulejów Reservoir), it was possible to limit the usage of Upper Cretaceous water and it positively influenced a gradual reconstruction of groundwater supply. After 1989, the positive tendency was strengthened by limiting water usage for industrial purposes, as a result of economic crisis and introduction of water usage economy. In 1999, 57% of water used by the city came from deep wells and 43% from surface water of the Pilica intake, located 50 km from the city.

Today, groundwater is once again the dominant source of water for the city, while surface water plays a minor role. Almost no household receives water from the Pilica any more. Since 2005, 85% to 100% (southern part of the city) of tap water has come from one of the 60 deep wells. Water comes from Quaternary deposits, Upper and Lower Cretaceous, from the depth of 120–900 m Grodzisko, in south-eastern part of the city, possesses the deepest drinking water wells in Central Poland. Apart from investing in continuing development of deep wells, the city is constantly refining the process of water purification, which is why Łódź has the best tap water in Poland among other big cities.

Water supply for the city is one of the most important and, at the same time, the most difficult problems. The main reason for the lack of local surface water is, of course, the location of this large residential and industrial complex on the borderline of two watersheds. Intensive use of groundwater may one day bring back the dangerous depletion of Cretaceous water.

6.6. Soil

The soil within Łódź city limits and its vicinity differs. In the centre, geological basis is covered with urban developments, streets and sidewalks; anthropogenic soil can only be found within small parks. The further one goes away from the centre, the more uncovered area

there is. Native rocks of the city's soil are mainly post-glacial (fluvio-glacial rocks and till) and, to a lesser extent, aeolian, alluvial and organogenic sediments. Sand formations are the most predominant form of sediments, constituting 55–76% of total area of individual districts. Soil formed on clay is the second most predominant form, located mainly in eastern and western outskirts. Dust-formed soil occurs in the eastern and north-eastern part of Łódź. Organogenic soils (peat, muck) can be observed in lower areas and valley floors.

The soil within city limits is mostly of the brown and spodosols types. It is highly acidic, especially at peripheral zones, which is why it requires liming. It lacks macro-elements: phosphorous, potassium, magnesium. A significant amount of sand soil is periodically too dry. Most soils belong to lower classifications and agricultural utility complexes (Kobojek 1996).

The best soils, of the good wheat complex and the very good rye complex (3rd class), are located in the western and southern outskirts of Łódź, while lower value soils, usually 5th and 6th class soil, are common in the eastern and northern parts of the city. Areas which are mostly in danger of denudation are located in the northern part of the city, which is characteristic for its high relief diversity. Additionally, distribution of groundwater deep underground does not help farming in this zone.

6.7. Plant life

The city's plant life has been subject to considerable anthropogenic transformation. At the end of the 18th century, large expanses currently occupied by the city were still covered by a forest called Puszcza Łódzka (Łódź Wilderness), while fields and villages were in clearings by fields and villages. In the years 1793–1796, forests and marshes occupied 76% of the area of today's city (Koter 1988, p. 50). Because of the area's diverse land relief, geological composition and the level of groundwater, various forms of forest existed, from dry forest and temperate broadleaf forest to riparian

and alder forests. However, mixed forest was the dominant type. Settlement expansion and the city's industrial development caused the decrease of forest area and impoverishment of natural biodiversity. From the nature's point of view, today's city is a completely new man-made ecosystem. Today, 19.7% of the total area of the city is occupied by plant life (Hereźniak et al. 2002). This consists of: forests (41.1%), parks (11.8%), lawns, parks within residential complexes and other green areas (31.4%), in-city allotment gardens (12.2%) and cemeteries (3.5%) (figure 6.5). As a result of spatial expansion of Łódź, new areas of often considerable natural value would be merged into the city. Today, they serve not only as mainstays of natural environment, but also as educational and recreational areas.

The most valuable natural areas are located in the outskirts of Łódź. The biggest forest complex is located in the city's northern part. It is known as Las Łagiewnicki and with an area of 1245 ha it is one of the biggest forests within a city in Europe (Kurowski et al. 2009a, p. 17). It covers gravel and sand hills of 250 m AMSL and it is a remnant of the old wilderness. It includes nearly 220-year-old oak stands and valuable spruces, firs and beeches. In 1996, in the central section of the forest, a nature preserve of 69.85 ha was established to retain the mosaic of the most valuable forest areas: temperate broadleaf forests and thermophilous oak forests. Entire Las Łagiewnicki is included in the Park Krajobrazowy Wzniesień Łódzkich (Łódź Hills Landscape Park), which stretches over extensive area of the borderline zone of Wzniesienia Łódzkie (Łódź Hills) in the north-eastern section of the city. The most important objective of Park Krajobrazowy Wzniesień Łódzkich is to preserve the natural and the cultural heritage of this area.

In the western part of the city, near the city's centre, there is Park im. Marszałka Józefa Piłsudskiego. It is a flat area at an elevation of 183–202 m AMSL and the predominant form within the park is a section of the extensive valley of the Łódka. The park includes a nature reserve called Polesie Konstantynowskie (Konstantynów Forest Area), founded as early as in 1930. It was the first Polish nature reserve established within a city. It offers a great chance for

observing human influence on the natural environment. One of the main goals of the reserve was to retain fir stand, which occurs in the northern edge of its geographical range. At that time, it included 781 spruces and 229 firs (Kurowski 2009, p. 14). Today, both species are nearly extinct from the reserve. Main reasons of this situation include a drastic drop in the level of groundwater and the constant rise of air pollution. Once situated in the outskirts of the city, the reserve is now located inside the city, one of its borders being a busy traffic route. Therefore, in 1954, it was decided that Polesie Konstantynowskie will include a protected area which consists of a fragment of natural forest. It occupies an area of 9.8 ha and it is a partial reserve. A dominant form there is an oak and hornbeam forest *Tilio-Carpinetum*. Botanically interesting is common ivy *Hedera helix*, which covers most of the forest floor and climbs surrounding trees. It is a species characteristic of humid warm subatlantic climate; it grows here at the eastern border of the forests geographic range.

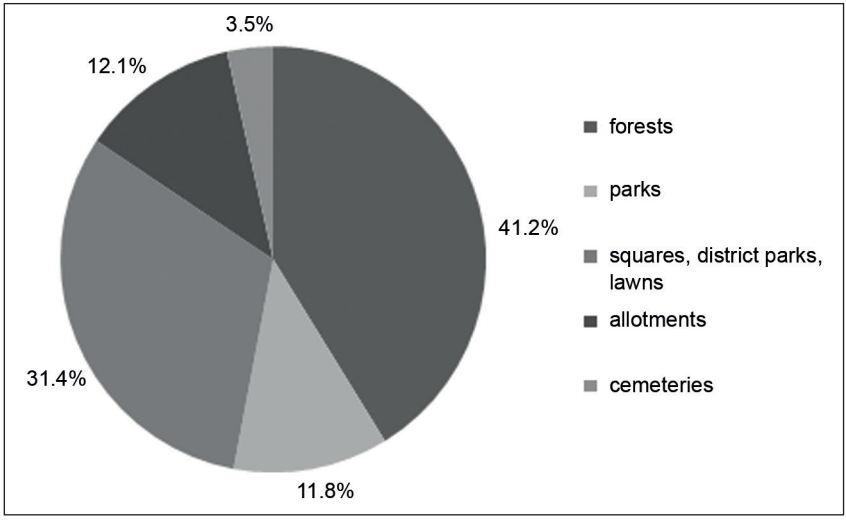

Figure 6.5. Kinds of plant life in Łódź

Source: based on Hereźniak et al. (2002)

The city also includes organized managed plant life, which consists of city parks, parks located near former industrial tycoons' residences, a botanical garden and cemeteries. Remnants of former forest plant life still exist in some parks, which were established in the place of cut down forests, e.g. Park Źródliska (Źródliska Park), Park 3 Maja (3rd of May Park). Park Źródliska, which spans over an area of 2 ha, was the first public park in Łódź; it was founded in 1840 in place of swamps and springs (Flatt 1853, p. 24). The most valuable specimens there are oaks measuring 2.2–4.3 m in circumference (Olaczek 1971, p. 162). The remnants of the agricultural landscape of Łódź are old trees growing by old roads, mansions and settlements. They usually include large oaks and limes (lindens), even from the 19th century. In Łódź, considering its tightly developed centre, one might find a considerable number of natural monuments.

The most meagre and transformed plant life can be found in the city's centre. This is a result of the degree of urbanization of the area. It includes as little as 100 species per 1 sq. km, while the transitional zone between the urban and suburban areas comprises 330 species per 1 sq. km. The share of alien synanthropes in plant life increases with the intensification of urban development, from 3% in suburban areas to more than 45% in the city's centre (Hereźniak et al. 2002). Areas of dense urban development are mostly inaccessible for plants. In the city centre, over 90% of the area is covered with non-permeable material (asphalt, concrete). Plants grow in small areas, mostly lawns.

Łódź of today has many faces. The city's centre is dominated by residential developments and post-industrial structures, while the outskirts consist of farmlands absorbed by the city in 1988. Non-urbanized part of the city constitutes 50% of its total area (Kurowski et al. 2009b). It is a huge asset and a chance for development. Today, within city limits, there are 2 nature reserves, Park Krajobrazowy Wzniesień Łódzkich, 8 ecological sites and a natural-landscape complex, and plans for new units are currently being developed. All water areas and marshes, which possess the highest

biodiversity, deserve special protection. It is particularly important in areas where the level of groundwater dropped. The main goal is to create 31 protected areas (including those which already exist) of total area of 4422 ha, i.e. 15% of the total area of the city (Kurowski et al. 2009b, p. 10). They all will form the city's ecosystem called "Zielone skarby Łodzi" (Green Treasures of Łódź).

6.8. Animal life

The rich diversity of plant life of the 18th century was filled with rich animal life. Forests were full of deer, boars, foxes and other animals. Trouts would occupy rivers and flourmill-ponds. Unlike plant life, animal life has been depleted more quickly. Based on a description of city forests, in 1861, there were no boars or deer anymore, only hares and partridges in the fields. In winter-time, people would see wolves, foxes and hawks (Koter 1988, p. 53).

Based on research conducted in 1995–2001, we know that in Łódź there are 179 species of land vertebrates: 11 amphibians, 4 reptiles, 125 nesting birds and 39 mammals (Markowski et al. 1998). Most species of mammals live in the peripheral zone, mostly in forests and parks. Carnivora such as the European polecat, the least weasel and the fox live at the borderline between dense and scattered development. Deer can be found in the forests and fields. Some species, such as the hedgehog, the squirrel and the mouse live in central parks. The beech marten, formerly indigenous for the mountains, lives in Łódź in abandoned industrial buildings, attics and garages both in the city's centre and in the outskirts. Synanthropic species live in the city's centre, e.g. the brown rat, the house mouse and bats in attics. Squirrels, which were still present in the 1970s, have disappeared from green areas of central Łódź. Currently, they can be found in large suburban parks and in the outskirts.

The majority of birds' nest is in Las Łagiewnicki. The number of meadow and marsh birds is falling. On the other hand, the number of other species of birds in the city's centre, including forest

birds, is growing. There are also species indigenous to remote geographic areas, e.g. forest steppe (the European magpie, the rook, the common starling and the common kestrel). They came to Łódź at the beginning of the 1960s. There are also species indigenous to the mountains, which substituted natural rock formations for apartment block formations. Among introduced species in Łódź there is the rock pigeon *Columba livia*, which was introduced in the city in 1955–1956 in the amount of 200 birds (Markowski et al. 2002). Since then, they have spread around the city. At locations of tall and dense urban developments, they reach high concentrations of over 500 couples per sq. km, which creates sanitary problems.

Bibliography

Badziak K. (2009), *Województwo jako jednostka podziału administracyjnego i władza administracyjna II stopnia w okresie międzywojennym*, [in:] Badziak K., Łapa M. (eds.), *Województwo łódzkie 1919–2009. Studia i materiały*, Polskie Towarzystwo Historyczne, Oddział Łódzki, Łódź, pp. 61–84.

Badziak K., Baranowski J., Polit K. (2009), *Powstanie i główne kierunki aktywności administracji województwa łódzkiego w okresie powojennym*, [in:] Badziak K., Łapa M. (eds.), *Województwo łódzkie 1919–2009. Studia i materiały*, Polskie Towarzystwo Historyczne, Oddział Łódzki, Łódź, pp. 85–102.

Badziak K., Łapa M. (eds.), (2009), *Województwo łódzkie 1919–2009. Studia i materiały*, Polskie Towarzystwo Historyczne, Oddział Łódzki, Łódź.

Baranowski B. (1973), *Łódź rolnicza (od połowy XVI do początku XIX w.)*, Prezydium Łódzkiego Komitetu Frontu Jedności Narodu, Łódź.

Baranowski B. (1974), *Zmiany w sieci osadniczej na obszarze obecnej Łodzi od końca XVI w. do roku 1820*, [in:] *Materiały i Studia*, No. 3, Rada Naukowa przy Prezydencie Miasta Łodzi, Łódź.

Baranowski B. (1976), *O dawnej Łodzi*, Wydawnictwo Łódzkie, Łódź.

Baranowski B. (1980a), *Łódź i okolice na przełomie XVIII i XIX w.*, [in:] *Łódź. Dzieje miasta*, PWN, Warszawa–Łódź, Vol. 1, pp. 135–148.

Baranowski B. (1980b), *Łódź i okolice od końca XVI do końca XVIII w.*, [in:] *Łódź. Dzieje miasta*, PWN, Warszawa–Łódź, Vol. 1, pp. 110–133.

Berezowski E. (1955), *Rozwój terytorialny Łodzi w XIX w.*, [in:] *Przegląd Geodezyjny*, Nos. 2, 4, 8.

Bieżanowski W. (2001), *Łódka i inne rzeki łódzkie*, Towarzystwo Opieki nad Zabytkami, Oddział Łódzki, Zora, Łódź.

Bilokon Y. (2005), *Suchasni tendenciyi u rozrobi generalnych planiv velykykh mist*, [in:] Bilokon Y. (ed.), *Dosvid ta perspektyvyrozvytkumist Ukrainy*, Dipromisto, Kyiv.

Biryulyov Y. (ed.), (2007), *Lviv. A Guidebook for the Visitor*, Centre of Europe Publishing House, Lviv.

Biryulyov Y. (ed.), (2008), *Arkhitektura Lvova. Chas i styli. XIII–XXI st.*, Centr Evropy, Lviv.

Bryk M.V. (ed.), (1986), *Istoria Lvova v dokumentach i materialach*, Naukova Dumka, Kyiv.

Burchard J., Nalewajko J. (2000), *Indywidualność środowiska przyrodniczego województwa łódzkiego i jego antropogeniczne przeobrażenia*, [in:] Sobczyński M., Michalski W. (eds.), *Województwo łódzkie na tle przemian administracyjnych Polski*, PTG, Łódź, pp. 23–49.

Cherkies B. (1999), *Stalinskie planuvannia Lvova*, [in:] Cherkies B. (ed.), *Visnyk DU "Lvivska Politekhnika"*, *Arkhitektura*, No. 379, pp. 99–104.

Czerner O. (1997), *Lwów na dawnej rycinie i planie*, Zakład Narodowy im. Ossolińskich, Wrocław.

Dadlez R., Marek S., Pokorski J. (2000), *Mapa geologiczna Polski bez utworów kenozoiku w skali 1:1 000 000*, Wydawnictwo Kartograficzne PAE, Warszwa.

Derzhawni budiwelni normy (1992), *Mistobuduwannia. Planuwannia i zabudowa miskych i silskich poselen*, DBN 360–392, Ukrarchbudinform, Kyiv.

Drexler I. (1920), *Wielki Lwów*. *Le Grand Leopol*, Lwów.

Dylik J. (1947), *Indywidualność geograficzna okolic Łodzi*, [in:] *Czasopismo Geograficzne*, No. 8, pp. 238–246.

Dylik J. (1971), *Województwo ze stolicą bez antenatów. Geografia historyczna województwa łódzkiego*, Łódzkie Towarzystwo Naukowe, Łódź.

Dylikowa A. (1973), *Geografia Polski. Krainy geograficzne*, Państwowe Zakłady Wydawnictw Szkolnych, Warszawa.

Dylikowa A. (1974), *Niziny Środkowopolskie*, [in:] Augustowski B., Baraniecki L., Dylkikowa A., Lijewski T., Samsonowicz H., *Polska. Przyroda, człowiek, gospodarka*, PWN, Warszawa, 144–178.

Flatt O. (1853), *Opis miasta Łodzi pod względem historycznym, statystycznym i przemysłowym*, Drukarnia Gazety Codziennej, Warszawa.

Fortuniak K., Kłysik K. (2008), *Osobliwości klimatu miast na przykładzie Łodzi. Singularities of Urban Climate – Łódź Case Study*, [in:] Kłysik K., Wibig J., Fortuniak K. (eds.), *Klimat i bioklimat miast*, Wydawnictwo Uniwersytetu Łódzkiego, Łódź, pp. 477–488.

Ginsbert A. (1962), *Łódź. Studium monograficzne*, Wydawnictwo Łódzkie, Łódź.

Goździk J., Wieczorkowska J. (2002), *Plansza VIII: Rzeźba terenu*, [in:] Liszewski S. (ed.), *Atlas miasta Łodzi*, Łódzkie Towarzystwo Naukowe, Urząd Miasta, Łódź.

Hallbauer W. (1944), *Stadtbaukunst im Generalgouvernement*, [in:] *Das Generalgouvernement*, Zeitungsverlag, Krakau–Warschau, No. 1.

Hereźniak J., Kurowski J.K., Olaczek R., Witosławski P. (2002), *Plansza XI*: *Dziedzictwo przyrodnicze, Szata roślinna,* [in:] Liszewski S. (ed.), *Atlas miasta Łodzi*, Łódzkie Towarzystwo Naukowe, Urząd Miasta, Łódź.

Istoria mist i sil URSR. Lvivska oblast (1968), Holovna Redakciya Ukrainskoyi Radianskoyi Encyklopedii, Kyiv.

Jarno W. (2009), *Terytorialne władze wojskowe szczebla okręgowego na Ziemi Łódzkiej w latach 1918–1946*, [in:] Badziak K., Łapa M. (eds.), *Województwo łódz-*

kie 1919–2009. Studia i materiały, Polskie Towarzystwo Historyczne, Oddział Łódzki, Łódź, pp. 169–180.

Jokiel P., Maksymiuk Z. (2002), *Plansza IX: Wody*, [in:] Liszewski S. (ed.), *Atlas miasta Łodzi*, Łódzkie Towarzystwo Naukowe, Urząd Miasta, Łódź.

Kaczmarek R. (1962), *Zarys historii miasta*, [in:] Rosset E. (ed.), *Łódź w latach 1945–1960*, Towarzystwo Przyjaciół Łodzi, Łódź, pp. 3–17.

Kasiński M. (2009), *Reforma samorządowa 1998 roku a nowe województwo łódzkie*, [in:] Badziak K., Łapa M. (eds.), *Województwo łódzkie 1919–2009. Studia i materiały*, Polskie Towarzystwo Historyczne, Oddział Łódzki, Łódź, pp. 233–253.

Klatkowa H. (1972a), *Paleogeografia Wyżyny Łódzkiej i obszarów sąsiednich podczas zlodowacenia warciańskiego*, [in:] *Acta Geographica Lodziensia*, No. 28.

Klatkowa H. (1972b), *Region łódzki*, [in:] Galon R. (ed.), *Geomorfologia Polski*, Vol. 2: *Niż Polski*, PWN, Warszawa, pp. 240–270.

Kłysik K. (1996), *Spatial and Seasonal Distribution of Antropogenic Heat Emission in* Łódź, [in:] *Poland. Atmospheric Environment*, Vol. 30 (20), pp. 3397–3404.

Kłysik K. (1999), *Cechy miejskiej wyspy ciepła w* Łodzi, [in:] *Nauki geograficzne a edukacja społeczeństwa*, Vol. 2: *Region* łódzki, materiały Zjazdu PTG, Łódź, pp. 55–64.

Kłysik K., Wibig J., Fortuniak K. (2008), *Klimat i bioklimat miast*, Wydawnictwo Łódzkie, Łódź.

Kłysik K., Wibig J., Fortuniak K., Rembowski K., Fokczyński J., Podstawczyńska A. (2002), *Plansza X: Klimat*, [in:] Liszewski S. (ed.), *Atlas miasta Łodzi*, Łódzkie Towarzystwo Naukowe, Urząd Miasta, Łódź.

Kobojek S. (1996), *Uwarunkowania przyrodnicze rozwoju Łodzi*, [in:] Michalski W. (ed.), *Transformacja społeczno-gospodarcza Łodzi na tle regionu*, Centralny Urząd Planowania, Łódź, pp. 7–13.

Kobziak R., Mielnik I.W. (2012), *Hydrographic Network*, [in:] Shabliy O. (ed.), *Lviv*, Kartografiya, Kyiv.

Kondracki J. (1998), *Geografia regionalna Polski*, PWN, Warszawa.

Koter M. (1969), *Geneza układu przestrzennego Łodzi przemysłowej*, [in:] *Prace Geograficzne*, No. 79, Instytut Geografii PAN, Warszawa.

Koter M. (1974), *Zagospodarowanie przestrzenne obszaru obecnej Łodzi u schyłku okresu przedprzemysłowego*, [in:] *Materiały i Studia*, No. 4, Rada Naukowa przy Prezydencie Miasta Łodzi, Łódź.

Koter M. (1980), *Rozwój przestrzenny i zabudowa miasta*, [in:] *Łódź. Dzieje miasta*, PWN, Warszawa–Łódź, Vol. 1, pp. 148–191.

Koter M. (1988), *Warunki naturalne*, [in:] Rosin R. (ed.), *Łódź. Dzieje miasta*, PWN, Warszawa–Łódź, Vol. 1, pp. 18–56.

Koter M. (2002), *Plansza IV*: *Łódź i okolice w I połowie XIX w.,* [in:] Liszewski S. (ed.), *Atlas miasta Łodz*i, Łódzkie Towarzystwo Naukowe, Urząd Miasta, Łódź.

Koter M. (2009a), *Kształtowanie się tkanki miejskiej Łodzi do 1918 r*., [in:] Liszewski S. (ed.), *Łódź. Monografia miasta*, Łódzkie Towarzystwo Naukowe, Łódź, pp. 62–112.

Koter M. (2009b), *Tkanka miejska Łodzi w latach 1918–1989 r.*, [in:] Liszewski S. (ed.), *Łódź. Monografia miasta*, Łódzkie Towarzystwo Naukowe, Łódź, pp. 218–264.

Koter M., Kulesza M., Puś W., Pytlas S. (2005), *Wpływ wielonarodowego dziedzictwa kulturowego Łodzi na współczesne oblicze miasta*, Wydawnictwo Uniwersytetu Łódzkiego, Łódź.

Koter M., Wiktorowska D. (1976), *Proces przemian morfologicznych śródmieścia Łodzi (w granicach byłej kolonii tkackiej) pod wpływem kształtowania się ogólnomiejskiego centrum usługowego*, [in:] *Zeszyty Naukowe Uniwersytetu Łódzkiego*, Ser. II, No. 7, pp. 41–88.

Krypiakevych I. (1932, 1991), *Istorychni prokhody po Lvovi*, Lviv.

Kulesza M. (1992), *Z dziejów Widzewa (do pocz. XX w.)*, [in:] *Kronika Miasta Łodzi*, No. 1, pp. 119–130.

Kulesza M. (2002), *Zmiany w przestrzeni miejskiej wschodnich obszarów Łodzi po drugiej wojnie światowej*, [in:] Jażdżewska I. (ed.), *Współczesne formy osadnictwa miejskiego i ich przemiany, XV Konwersatorium Wiedzy o Mieście*, Wydawnictwo Uniwersytetu Łódzkiego, Łódź, pp. 67–78.

Kurowski J.K. (2009), *Polesie Konstantynowskie*, [in:] Kurowski J.K., Witosławski P. (eds.), *Zielone skarby Łodzi – relikty naturalnej przyrody miasta*, Uniwersytet Łódzki, Urząd Miasta, Łódź, pp. 13–16.

Kurowski J.K., Andrzejewski H., Mamiński M. (2009a), *Las Łagiewnicki*, [in:] Kurowski J.K., Witosławski P. (eds.), *Zielone skarby Łodzi – relikty naturalnej przyrody miasta*, Uniwersytet Łódzki, Urząd Miasta, Łódź, pp. 17–22.

Kurowski J.K., Andrzejewski H., Witosławski P. (2009b), *Zielone skarby Łodzi – projekt inwentaryzacji i waloryzacji reliktów przyrody naturalnej miasta*, [in:] Kurowski J.K., Witosławski P. (eds.), *Zielone skarby Łodzi – relikty naturalnej przyrody miasta*, Uniwersytet Łódzki, Urząd Miasta, Łódź, pp. 7–12.

Kurowski J.K., Witosławski P. (eds.), (2009), *Zielone skarby Łodzi – relikty naturalnej przyrody miasta*, Uniwersytet Łódzki, Urząd Miasta, Łódź.

Lozynskyy R. (2005), *Etnichnyy sklad naselennia Lvova*, Vydavnychyy Centr Lvivskoho Nacionalnoho Universytetu imeni Ivana Franka, Lviv.

Lviv (1990), Informaciya, Komitet OON.

Machlański P. (2009), *Rys historyczny ziem obecnego województwa łódzkiego w średniowieczu i okresie staropolskim*, [in:] Badziak K., Łapa M. (eds.), *Województwo łódzkie 1919–2009. Studia i materiały*, Polskie Towarzystwo Historyczne, Oddział Łódzki, Łódź, pp. 19–33.

Markowski J., Hejduk J., Janiszewski T., Kowalczyk J.K., Wojciechowski Z., Zieliński P. (2002), *Plansza XII*: *Dziedzictwo przyrodnicze. Fauna*, [in:] Liszewski S. (ed.), *Atlas miasta Łodz*i, Łódzkie Towarzystwo Naukowe, Urząd Miasta, Łódź.

Markowski J., Wojciechowski Z., Kowalczyk J.K., Tranda E., Śliwiński Z., Soszyński B. (1998), *Fauna Łodzi*, Fundacja Człowiek i Środowisko, Łódź.

Markowski T., Kudłacz T. (2002), *Zintegrowany rozwój aglomeracji jako podstawa budowania konkurencyjności polskiej przestrzeni społeczno-gospodarczej*, [in:] *Studia Regionalne i Lokalne*, No. 2–3, pp. 15–36.

Mazur T., Posatskyy B. (2010), *The Industrial Function in Urban Space on the Example of Lviv*, [in:] Habrel M., Marszał T. (eds.), *Economic and Social Functions of Polish and Ukrainian Big Cities at the Beginning of the 21st Century*, Łódź University Press, Łódź.

Mistobudivnyy kompleks "Yevro – 2012" (2008), [in:] *Ye – arckhitektura budivnytstvo mystetstvo*, No. 2.

Mohytych R. (1996), *Kniazhyy Lviv*, [in:] *Halytska Brama: Centr Yevropy*, No. 12.

Mucha B.P. (2012), *Meteorological Parameters of Lviv. 1967–2007*, [in:] Shabliy O. (ed.), *Lviv*, Kartografiya, Kyiv.

Olaczek R. (1971), *Przewodnik po województwie łódzkim*, Liga Ochrony Przyrody, Warszawa.

Olejnik L. (2009), *Województwo łódzkie w latach 1945–1975*, [in:] Badziak K., Łapa M. (eds.), *Województwo łódzkie 1919–2009. Studia i materiały*, Polskie Towarzystwo Historyczne, Oddział Łódzki, Łódź, pp. 209–221.

Pielesiak I. (2012), *Spójność terytorialna Łódzkiego Obszaru Metropolitalnego w świetle powiązań infrastrukturalnych*, PhD thesis, Faculty of Geographical Science UŁ, Łódź.

Posatskyy B. (2001), *Osnovy Urbanistyki*, Vydavnytstvo NU "LvivskaPolitekhnika", Lviv.

Posatskyy B. (2002), *Nimetskyy plan perebudovy centralnoho ansamblu Lvova u 1943–1944*, [in:] Pavliuk S. (ed.), *Narodoznavchi Zoshyty*, Nos. 1–2, pp. 118–126.

Posatskyy B. (2007), *Problemy urbanistyczne metropolitalnego obszaru Lwowa*, [in:] Makiela Z., Fedan R. (eds.), *Procesy metropolizacji w regionie podkarpackim, Rzeszów–Lwów*, [in:] *Biuletyn KPZK PAN*, No. 230.

Posatskyy B. (2010), *Genesis and Problems of Spatial Development of the Big City in Ukraine (Example of Lviv)*, [in:] Habrel M., Marszal T. (eds.), *Spatial Development of Polish and Ukrainian Big Cities at the Beginning of the 21st Century*, Łódź University Press, Łódź.

Przybysz M. (2009), *Podziały administracyjne kościoła rzymskokatolickiego na ziemiach Polski Środkowej po 1918 r.*, [in:] Badziak K., Łapa M. (eds.), *Województwo łódzkie 1919–2009. Studia i materiały*, Polskie Towarzystwo Historyczne, Oddział Łódzki, Łódź, pp. 181–186.

Rembowski K., Fokczyński J. (2002a), *Plansza X: Klimat. Średnie stężenie SO_2 w Łodzi w latach 1981–1985 (na podstawie pomiarów WSSE),* [in:] Liszewski S. (ed.), *Atlas miasta Łodzi*, Łódzkie Towarzystwo Naukowe, Urząd Miasta, Łódź.

Rembowski K., Fokczyński J. (2002b), *Plansza X: Klimat. Średnie stężenie NO_2 w Łodzi w latach 1996–2000 (na podstawie pomiarów WSSE),* [in:] Liszewski S. (ed.), *Atlas miasta Łodzi*, Łódzkie Towarzystwo Naukowe, Urząd Miasta, Łódź.

Rosin R. (1973), *Początki miasta Łodzi*, [in:] *Rocznik Łódzki*, Vol. 17 (20), pp. 9–21.

Rosin R. (1975), *Geneza* Łodzi *(XV–XIX–XX w.)*, [in:] *Annales Academiae Medicae Lodziensis*, Vol. 16, Suplement 13, pp. 11–30.

Rosin R. (1980a), *Miasto Łódź i wsie podłódzkie od początku XV do schyłku XVI w.*, [in:] *Łódź. Dzieje miasta*, PWN, Warszawa–Łódź, Vol. 1, pp. 77–109.

Rosin R. (1980b), *Obszar Wielkiej Łodzi do przełomu XIV i XV w.*, [in:] *Łódź. Dzieje miasta*, PWN, Warszawa–Łódź, Vol. 1, pp. 57–76.

Sekretariuk V. (ed.), (1984), *Istoria Lvova*, Naukova Dumka, Kyiv.

Shular V. (ed.), (1997), *Lviv*, *Arkhitekturnyy Visnyk*, No. 2–3.

Sobczyński M. (2000), *Historia powołania i przemiany administracyjne województwa łódzkiego*, [in:] Sobczyński M., Michalski W. (eds.), *Województwo łódzkie na tle przemian administracyjnych Polski. W osiemdziesiątą rocznicę utworzenia województwa*, Polskie Towarzystwo Geograficzne, Oddział Łódzki, RCSS – Biuro Rozwoju Regionalnego, Łódź, pp. 7–21.

Statystychnyy chorichnyk (1998), *Lvivska Oblast'*, Lviv.

Stępniewski M., Szambelan Z. (2009), *Rozwój terytorialny Łodzi w świetle dokumentów i źródeł kartograficznych*, [in:] *Rocznik Łódzki*, Vol. 56, pp. 37–50.

Stępniewski M., Szambelan Z. (2010), *Rozwój terytorialny Łodzi*, Urząd Miasta, Łódź (mapa).

Stępniewski M., Szambelan Z. (2012), *Rozwój Łodzi po roku 1821*, [in:] *Profil miasta Łodzi*, Miejska Pracownia Urbanistyczna, Urząd Miasta, Łódź.

Straszewicz L. (1962), *Łódź jako ośrodek gospodarczy*, [in:] Rosset E. (ed.), *Łódź w latach 1945–1960*, Towarzystwo Przyjaciół Łodzi, Łódź, pp. 103–125.

Stupnicka E. (1989), *Geologia regionalna Polski*, Wydawnictwa Geologiczne, Warszawa.

Syrcov O. (2010), *Lviv bez mezh*, [in:] *Lvivska Hazeta*, Vol. 24 (569), p. 3.

Szafer W. (1972), *Szata roślinna Polski Niżowej*, [in:] Szafer W., Zarzycki K. (eds.), *Szata roślinna Polski*, PWN, Warszawa, Vol. 2, pp. 17–168.

Trehubova T.O., Mykh R.M. (1989), *Lviv. Arhitekturno-istorychnyj narys*, Budivelnyk, Kyiv.

Velikanow W.A. (2012), *Tectonic Map of the Lviv Area*, [in:] Shabliy O. (ed.), *Lviv*, Kartografiya, Kyiv.

Voloshin P.K. (2012), *Geological Map*, [in:] Shabliy O. (ed.), *Lviv*, Kartografiya, Kyiv.

Vujcyk V.S. (1991), *Derzhavnyji storyko-architekturnyj zapovidnyk u Lvovi*, Kameniar, Lviv.

Walicki J. (2009), *Prehistoria województwa łódzkiego: władze i podziały administracyjne w okresie zaborów*, [in:] Badziak K., Łapa M. (eds.), *Województwo łódzkie 1919–2009. Studia i materiały*, Polskie Towarzystwo Historyczne, Oddział Łódzki, Łódź, pp. 35–60.

Wiktorska M. (2012), *Dzisiejsza struktura przestrzenna*, [in:] *Profil miasta Łodzi*, Miejska Pracownia Urbanistyczna, Urząd Miasta, Łódź.

Wiśniewska W. (2009), *Przebudowa przestrzenna i funkcjonalna Łodzi po 1989 r.*, [in:] Liszewski S. (ed.), *Łódź. Monografia miasta*, Łódzkie Towarzystwo Naukowe, Łódź, pp. 432–482.

Zajączkowski S.M. (1976), *Studia z dziejów osadnictwa na obszarze Łodzi do końca XVI w.*, Łódzkie Towarzystwo Naukowe, Łódź.

Założenia do projektu ustawy metropolitalnej przedłożone przez Ministra Spraw Wewnętrznych i Administracji (2012), http://www.mswia.gov.pl/portal/ pl/2/5052/, Zalozenia_do_projektu_Ustawy_Metropolitalnej.html (10.09.2012).

Zapasko Y.P. (1989), *Katalog hraviur 17–20 st. (Architektura Lvova)*, Naukova Dumka, Kyiv.

Ziomek J. (2008), *Budowa geologiczna Łodzi i regionu*, Wydawnictwo Uniwersytetu Łódzkiego, Łódź.

Ziomek J., Iwańcz T., Laskowski S. (2002), *Plansza VII: Geologia i gleby*, [in:] Liszewski S. (ed.), *Atlas miasta Łodzi*, Łódzkie Towarzystwo Naukowe, Urząd Miasta, Łódź.