

## Conclusions

The submitted book is a conclusion of a three-year long research project “The process of industrialization and landscape changes in the Industrial Zone of Ostrava in the 19<sup>th</sup> and 20<sup>th</sup> century”, which was funded by the Czech Science Foundation (GA ČR). The main research task was to identify landscape change in the Ostrava-Karviná coal mining district in the processes of capitalist and socialist industrialisation.

Particularly distinctive changes in the land use occurred in industrialisation centres, the existence of which was related to material and technological changes in the social life, in the 19<sup>th</sup> and 20<sup>th</sup> century. Mainly those parts of Europe where natural resources were exploited – primarily coalfields – were affected in this way. The process of industrialisation shaped the Ostrava-Karviná mining district into a forefront coalfield of European importance. This coalfield represents the main black coalfield in the Czech Republic containing 90% of local deposits of black coal. As early as under the Habsburg Monarchy, it created one of the fundamental industrial regions of the empire and it was a stronghold for all metallurgical industry in the interwar era. The strategic importance of the coalfield played a key role in the socialist industrialisation of Czechoslovakia after 1945. The process of capitalist and socialist industrialisation was demonstrated in the Ostrava-Karviná mining district not only through altered basic demographic, social and economic characteristics but also through the altered basic interaction between man and the nature which marked the landscape of this mining district and its use in an essential way.

The authors attempted to answer the question what objective processes were taking place in the Ostrava-Karviná mining district during the 19<sup>th</sup> and the 20<sup>th</sup> century. The research observed the impact of human activity caused by the process of industrialisation in a long-term view, specifically from the 1830s up to the beginning of the 21<sup>st</sup> century. In connection to the spatio-temporal landscape change, the authors performed a detailed analysis of the landscape development in 28 cadastral areas, covering almost 200 km<sup>2</sup>. This analysis focused at four periods. Based upon a microanalytical approach, it was possible to establish individual geographic areas within the Ostrava-Karviná mining district which differ due to their landscape development. This analysis enabled to detect basic processes which took place in the landscape of the Ostrava-Karviná mining district through the course of the 19<sup>th</sup> and 20<sup>th</sup> century. Further, it was possible to indicate

the directions, intensity and speed of landscape change in individual stages of the industrialisation process. On the level of methodology the project enabled to design a feasible model of microanalysis for the landscape development within industrial areas affected by underground coal mining. This model takes into account the specific features of such areas.

Based upon the performed analyses we can define several essential findings concerning the landscape development of the Ostrava-Karviná mining district. Although the industrialisation process affected the local landscape in a radical way, landscape changes did not occur in all parts of the coalfield with the same intensity. This fact was caused by a combination of natural (mainly geological), social and historical conditions. Based upon the analysis of the land cover development, we could identify a specific landscape development within each of the three so far actively used coalfields of the Ostrava-Karviná mining district, i.e. the Ostrava basin, the Petřvald basin and the Karviná basin.

At the beginning of the industrialisation process in the 1830s, the local landscape was used for agriculture in an intensive way and in all its parts which was possible thanks to the good soil quality. The agricultural use of the landscape corresponded to the needs of the traditional society where the priority was to secure plenty of food. Agricultural land occupied more than 75% of the area belonging to the Ostrava-Karviná mining district while the highest share of the agricultural land was registered in the Karviná part (77.5%) and the lowest in the Petřvald part (71.5%) of the coalfield. As far as the structure of agricultural land is concerned, arable land prevailed significantly in the subject area. Arable land was complemented with meadows and pastures whose size was not negligible. Compared to the data applicable on the whole of the Czech Republic, the landscape of the Ostrava-Karviná mining district had a higher share of arable land (65% of the total area) prior to the industrialisation process. On the other hand, the extent of pastures and meadows was slightly lower here (10.4%) compared to the remaining Czech Lands (17.6%). According to the information from the pricing operates, usual varieties of grain crops and potatoes were grown here. In the eastern part of the studied area also sugar beet, cabbage and from fodder crop clover were grown. Data about developed farm animal breeding, mainly sheep, confirm the statement about intensive agriculture use of the region.

With respect to afforestation, the area of the Ostrava-Karviná mining district was covered with forests in a very uneven way. Afforestation of the subject area was 16.4% at the beginning of the industrialisation process. This rate was below the average for the whole of the Czech Lands (29% of their total area). More extensive forests were present only in the central and south-eastern parts of the subject area. The afforestation within the area of later Ostrava agglomeration was very low. With respect to the age and the tree varieties, grown forests comprising mostly coniferous trees (primarily fir trees) and partly deciduous forests (primarily beech, oak and alder trees) prevailed even at the beginning of the industrialisation process. Due to favourable agricultural conditions the residential

network was rather dense in the subject area. However, individual municipalities were quite small. Urban fabric covered altogether 1.7% of the subject area in the 1830s which represented an above-average level compared to the whole of the state. Also remnants of the once extensive network of ponds, which was gradually dried out from the second half of the 18<sup>th</sup> century, were part of the local landscape at the beginning of the industrialisation process. Water bodies still occupied 3.6% of the subject area in the 1830s, which was more than the average (1.4%) in the whole of the Czech Lands.

The industrialisation process connected to the phenomenon of the Industrial Revolution brought a completely new situation since it placed very different demands on the landscape than in the traditional agrarian society. These demands had a new qualitative dimension and they changed and differentiated the landscape until then used only for agriculture. Regional differences in land use start to occur. Specific regions with an exceptionally high impact of human activity upon landscape (mining areas, urban agglomerations) appear. This was also the case of the Ostrava-Karviná mining district. In these regions landscape gets transformed in a much faster pace than in rural areas used for agriculture.

Fundamental changes in agricultural activity occurred in the first place. In the second half of the 19<sup>th</sup> century and in the first half of the 20<sup>th</sup> century agriculture in the Ostrava-Karviná mining district was affected by a range of facts: growing population and also high pace of urbanisation and industrialisation. With respect to agricultural use of the landscape we can distinguish between two main stages. At first agricultural activity strengthened its position in an extensive way during the second half of the 19<sup>th</sup> century, which brought along mainly an effort to gain the highest possible area of arable land. New arable land was gained on expense of other categories of the agricultural land fund, such as meadows, pastures, and mainly on the expense of non-productive soil. Therefore even at the beginning of the 20<sup>th</sup> century, agriculture played an important role within the Ostrava-Karviná mining district. However, the structure of agricultural land changed since, except for large estates, a fast fragmentation of the agricultural land fund took place. Prior to the First World War 60% of farmers owned an area of land smaller than 1 ha. Structure of farm animal breeding changed together with changes in land ownership. As early as at the beginning of the 20<sup>th</sup> century, individual breeding of pigs and goats, typical for a small-scale farming, prevailed.

Although the area of agricultural land was even higher in some municipalities at the turn of the 19<sup>th</sup> and 20<sup>th</sup> century than in the 1830s, there was an overall trend towards a fast suppression of the role of farming in the Ostrava-Karviná mining district. Eventually, at the end of the 19<sup>th</sup> century, the position of agriculture was no longer strengthened in an extensive way. A fast decrease of agricultural use of the landscape was affected by the processes of urbanisation and industrialisation. Amongst others, this also caused the situation where we can find a considerably lower level of agricultural use of the landscape in the first aerial photographs from the 1940s than in the previous decades.

Nevertheless, differentiation amongst individual parts of the Ostrava-Karviná mining district started to appear in the process of deagrarianisation. If we can find even less than 40% of agricultural land within the Ostrava part in the middle of the 20<sup>th</sup> century, then agriculture was maintained on more than 58% of the Petřvald part and more than 61% of the Karviná part. These figures were in all cases below the national average and in case of the Ostrava part they were even well below the average. The structure of agricultural land was rather fragmented in the middle of the 20<sup>th</sup> century. Coherent areas of arable land covered less than 11% of the Ostrava-Karviná mining district. Contrary to that, a mosaic of scattered arable land, meadows and permanent crops covered almost 40% of the subject area. Coherent pastures and meadows had only a marginal position (3.5%) and compared to the country-wide situation their presence was well below average. Also the representation of forests dropped considerably and as a result of that the Ostrava-Karviná mining district was one of the least afforested areas in the Czech lands in the middle of the 20<sup>th</sup> century.

On the other hand the share of landscape affected by industrialisation and urbanisation trends increased considerably despite the fact that these tendencies were demonstrated with a pronounced spatial differentiation. If industrial units including mine sites occupied already as much as 12.6% of the area in the Ostrava part in the middle of the 20<sup>th</sup> century, then their share was considerably lower in the Karviná and Petřvald parts (4% in the Karviná part and only 1.5% in the Petřvald part). The reason behind this was the absence of other than mining industry in the centre and the east of the Ostrava-Karviná mining district. Also the presence of urban fabric and transport infrastructure suggests a different development of the landscape in individual parts of the mining district. This was due to the fact that the Ostrava part of the coalfield demonstrated approximately twice as high concentration of urban fabric and four times higher concentration of transport infrastructure compared to the Petřvald and Karviná parts of the coalfield. Contrary to this, the presence of natural and semi natural areas in the landscape was similar in all parts of the Ostrava-Karviná mining district and differences can be found only in the proportionate representation of individual components within the category.

Political changes after 1948 through which Czechoslovakia entered a four decade long era of communist regime brought into the coalfield further strengthening of its unilateral economic focus and completed the transformation into the “steel heart of the republic”. The pace of the changes in the landscape was more dynamic than ever before thanks to the unprecedented intensity in using the economic potential of the area. It highlighted a varied character of the impact of industrialisation upon individual parts of the Ostrava-Karviná mining district.

Anthropogenic influence upon landscape changes was most intense than ever before in the history of the coalfield. The interest of the communist government in maximising the production of coal, coke, iron, steel and chemical industry products was obvious primarily in a fast increase of other industrial capacities in the

western part of the coalfield and in a coalfield-wide intense coal extraction. The influx of workforce into the industry required a mass housing construction. The over-stretched production and new residential development needed also a new transport infrastructure. The extensive mining activity subordinate to the ever increasing economic plans started to show its devastating impact upon the landscape which had to be rectified under reclamation projects. All this caused fast dynamics of land change.

The Ostrava part of the coalfield entered period of the 1970s as an area with a distinctly urbanised landscape; its strong share of industrial areas and an exceptionally dense transport infrastructure were significant. Construction of housing estates, industrial units, and also of transport infrastructure took place mainly at the expense of agricultural land which already played only a marginal role (13.1%) in the landscape of the Ostrava part of the coalfield. Contrary to that, we can observe that central government bodies attempted to maintain agriculture in the Petřvald and Karviná parts of the coalfield. This meant that there were considerably more agricultural areas preserved compared to the Ostrava part (nearly 40% of the Petřvald part and 37.5% of the Karviná part). According to the structure of individual types of agricultural areas, which were present, we can observe a pronounced drop in complex cultivation patterns and increase in arable land, which was a result of the collectivisation process in Czechoslovak agriculture. However, in general, the increase in arable land could not compensate for the decrease in complex cultivation patterns which lead to a fast deagrarisation of the Ostrava-Karviná mining district, even despite a temporary effort of the communist regime to support agriculture by all means and even in unfavourable conditions of the coalfield.

In connection with the processes of deagrarisation and abandonment, natural and semi natural areas started to increase significantly in the Ostrava-Karviná mining district. If at the end of the 1940s natural and semi natural areas covered 17.6% of the Ostrava-Karviná mining district, then at the beginning of the 70s their area increased by more than 10%. However, the share of parts representing this land cover altered. In the course of the 50s and 60s we can observe another decrease in the area of forests. At the same time the share of scattered trees, scrub and/or herbaceous vegetation associations increased considerably. These vegetation associations represent the land cover typical for abandoned agricultural areas, inactive waste heaps, re-developed areas after previously pulled down houses and their adjacent gardens. During this period the effects of mining activity started to be apparent mainly in the Karviná region where the volume of mining damage on the surface increased. This was noticeable in extensive changes of the settlements and in a fast expansion of anthropogenic landforms relief connected to mining activity.

With respect to further development of the landscape, we should mention substantial social changes that occurred at the end of the 1980s. Consequently, a fast economic transformation took place which ended the era of centrally planned

state economy and renewed market relationships. This situation immediately affected the Ostrava-Karviná mining district which was stagnating at that time and where the coal mining was maintained through measures of artificially controlled economy. Reduction of mining activities, restructuralisation of the mining district and curbing of the so far preferred heavy industry were the most significant changes affecting the intensity and structure of the land use in the coalfield. By the middle of the 1990s, all coal extraction in the Ostrava and Petřvald parts was ceased and it was rationalised in the Karviná part.

This instigated some perceptible changes in the land use. Primarily, the area of land immediately affected by mining activity decreased which is connected to the reduction of coal extraction and to the reclamation of the landscape. Regarding land use, the role of natural and semi natural areas increased significantly. These areas covered over 38% of the subject area at the beginning of the 21<sup>st</sup> century. This means that their extent increased by almost one third compared to the 1970s. Forests tend to return into the landscape more considerably. This results from the extensive reclamation activities and also from the transition of once worse quality natural and semi natural areas. The increase of natural and semi natural areas in the landscape was also connected to a fundamental change in agricultural policy of the state which withdrew the wide-scale support of agricultural production. This meant a significant reduction of agriculture in those areas where conditions for farming were not favourable. At the beginning of the 21<sup>st</sup> century, agricultural areas covered only one sixth of the subject area which was the historical minimum. Compared to the 1970s, complex cultivation patterns disappeared completely and agricultural land comprised solely arable land. In fact, a higher representation of these areas was maintained only in the Petřvald and Karviná parts of the Ostrava-Karviná mining district.

Suburbanisation belonged to new development trends which affected land use. It was manifested in two trends. The first was to built residential areas in original suburban locations, the other was construction of large storage, commercial and industrial units. Suburbanisation trends in the subject area were moderated by two factors: stagnation of the population in the region and using old industrial zones for new production and commercial activities. Although, compared to the beginning of the 1970s, the expansion of urban fabric halted, the Ostrava-Karviná mining district still represented a highly urbanised area. Urban fabric covered almost one fifth of the total area and discontinuous urban fabric prevailed here. Contrary to this, areas covered by industrial and commercial units and by transport infrastructure increased in all three observed parts of the Ostrava-Karviná mining district compared to the beginning of the 1970s. The most significant increase occurred mainly in the Ostrava part where industrial and commercial units covered over 18% of the area and transport infrastructure over 8% at the beginning of the 21<sup>st</sup> century.

During the performed analysis of the landscape development within the Ostrava-Karviná mining district, we identified seven fundamental processes

connected with landscape changes in the subject area. These are the processes of urbanisation, abandonment, intensification of agriculture, afforestation, deforestation, flooding and drainage. These processes hit individual parts of the coalfield with a different intensity and at different times.

By the middle of the 20<sup>th</sup> century, the studied landscape underwent a radical transformation from an agricultural area with undeveloped and unspecialised industry into a hub of industrialisation. The strongest process which we could observe in the whole of the Ostrava-Karviná mining district before the middle of the 20<sup>th</sup> century was the process of urbanisation. We use the term urbanisation to describe increase in both continuous and discontinuous urban fabric, increase in industrial areas and also in transport infrastructure. From the spatial point of view, the Ostrava part of the Ostrava-Karviná mining district was most strongly affected by this process. This part also became exceptionally industrialised and urbanised. This trend directly affected over 40 % of the Ostrava part by the middle of the 20<sup>th</sup> century. The process of urbanisation, in its wide definition, was most apparent in the Petřvald and Karviná parts by the middle of the 20<sup>th</sup> century; nevertheless, it did not reach the levels of the Ostrava part by all means. The process of urbanisation was dominant even during the second half of the 20<sup>th</sup> century; however, it was gradually becoming weaker and played only a relative role due to the process of abandonment. From our analyses we can also conclude that the process of urbanisation affected primarily arable land, pastures and meadows and partly also forests in the Ostrava-Karviná mining district. Only from the 1970s it was present more often also on unused natural and semi natural areas covered with solitaire trees, scrub and/or herbaceous vegetation associations.

The second most prominent process which characterised development in the local landscape was the process of abandonment. We use this term to describe a process in which residential areas, industrial units, agricultural areas, forests or water bodies change into natural and semi natural areas represented by solitaire trees, scrub and/or herbaceous vegetation associations. This process usually occurs on disused areas which get spontaneously covered with self-sowing vegetation. As far as the Ostrava-Karviná mining district is concerned, the process of abandonment affected agricultural areas, original urban fabric and until the first half of the 20<sup>th</sup> century also original water bodies. In the subject area, the process of abandonment did not take place due to lack of profit from agriculture but it was enforced by devastation of the land fund (ground subsidences, its contamination, etc.). Similar to the case of urban fabric also residential areas were abandoned due to ground subsidences. The process of abandonment was strongly manifested mainly in the Karviná part where it gradually increased its intensity during the 20<sup>th</sup> century. The process of abandonment was connected to the dynamics of coal extraction development. If more than 7% of the subject area was abandoned by the middle of the 20<sup>th</sup> century, then between 1947 and 1971 it was twice as much and between 1971 and 2009 even 19% of the Karviná part was abandoned. The process of abandonment hit primarily unfarmed agricultural

land and areas which remained here after cut-down forests. From the middle of the 1950s the process was more and more significantly affecting abandoned and pulled down urban fabric. This was connected to devastation of part of the original settlement. The process of abandonment was more intensive in the Ostrava part than in the Karviná part by the middle of the 20<sup>th</sup> century and it was demonstrated through abandonment of original farmed land and also of original ponds. The process reached its peak in the Ostrava part between 1949–1972 when it affected mostly plots which had been used in agriculture before and to a limited extent it affected urban fabric too. In the Petřvald part its development corresponded to the Ostrava part but its intensity was weaker and its character slightly different. The process has an ambivalent character with respect to the development of landscape. It can bring both positive trends (in the studied coalfield it is mainly a result of biological reclamation) and also negative trends (appearance of extensive unused areas, i.e. brown fields).

The process of intensification of agriculture was rather significant in the landscape of the Ostrava-Karviná mining district but our analysis recorded its more intensive course only between 1947–1971. However, in this case it concerns mainly the indication of changes in the structure of agricultural land influenced by collectivisation which affected the parts of Karviná and Petřvald. If we wish to include the overall representation of agricultural land into our analysis, then the process of intensification of agriculture will only appear as weak. Compared to the increase in arable land, the area of complex cultivation patterns (including also a considerable area of scattered arable land) dropped significantly which indicates a trend towards deagrarisation. On the other hand we can encounter the phenomenon of intensification of agriculture in a larger extent during the 19<sup>th</sup> century when we observe the process of intensification in agriculture through extensive methods.

Deforestation was not negligible for development of landscape in the Ostrava-Karviná mining district until the middle of the 20<sup>th</sup> century and this process affected primarily the Ostrava and Petřvald parts of the coalfield. A rapid decrease in forests occurred mainly in the Ostrava and Petřvald parts. If the share of forests dropped from 12.3% in the 1830s to 3.4% in the middle of the 20<sup>th</sup> century, then the share of forests in the Petřvald part dropped from 24.4% to 15.2% and in the Karviná part from 15.4% to 10.6%. There were many reasons behind the process of deforestation in the Ostrava-Karviná mining district. Firstly it was a result of cutting down of forests where the timber was used in industry. Further also a high level of damage caused by gas exhalants from industrial production took its toll; last but not least intensification of agriculture was to be blamed. Also the representation of individual varieties of trees altered. Already in the second half of the 19<sup>th</sup> century fir tree almost disappeared in forests and only more hardy deciduous vegetation gradually complemented with spruce remained. It is remarkable that forests were converted primarily into arable land in all studied areas. During the second half of the 20<sup>th</sup> century the process of deforestation got considerably

weaker compared to the pace of this process in previous years. The districts of Ostrava and Karviná showed the lowest afforestation from the whole of Czechoslovakia in the 1970s. A good quality forest cover cannot be really found in the subject area during this period. Only worse quality natural and semi natural areas spread.

In the last third of the 20<sup>th</sup> century this trend started to revert. The process of afforestation which, had been only marginal in the landscape development in the studied coalfield in previous decades, started to manifest itself rather strongly in the Karviná and Petřvald parts. Forests spread primarily in the areas previously affected by abandonment. These areas were covered by trees, scrub and/or herbaceous vegetation associations. Alternatively forests spread also on agricultural areas and on locations after pulled downs residential areas in the Karviná part. The Ostrava part was affected by afforestation only marginally compared to Petřvald and Karviná parts. Therefore, Ostrava region remained to be an area with a relatively low afforestation.

The topic of changes in water courses and water bodies in the Ostrava-Karviná mining district is connected to two last described processes: drainage and flooding. First, the process of drainage took place in the landscape of the Ostrava-Karviná mining district. This was connected to the drainage of sets of ponds which had been established in previous centuries. These ponds were converted into agricultural land. This phenomenon can be clearly observed both in the Ostrava and Karviná parts of the coalfield. From the middle of the 20<sup>th</sup> century the process of flooding became more pronounced. This was connected mainly to a more intensive coal extraction and to emergence of specific relief connected to mining: submerged ground subsidences and tailings ponds – mainly in the Karviná part. In the last third of the 20<sup>th</sup> century, mainly from the 1990s onwards, a large part of the submerged ground subsidences and tailings ponds were reclaimed which strengthened the process of drainage too.

A research which we had performed to solve this project task proved that the research into landscape development in the 19<sup>th</sup> and 20<sup>th</sup> century is a difficult task due to the complex nature of the examined areas. The archive research was used to play a complementary role in the analysis of land cover/land use. This was for two reasons. At first, analysis of multitemporal data is not able to shed light upon numerous substantial causal links which cannot be observed from stable cadastre maps and from aerial photographs. Therefore, it is useful to identify some phenomena, which can be consequently analysed in a detailed archive research. In the landscape affected by coal mining this concerns primarily a complex of questions connected to the evolution of environment in industrialisation centres of the 19<sup>th</sup> and 20<sup>th</sup> century including a subsequent effort to rectify the damage occurring in the landscape (i.e. the issue of reclamation). Also, it proved to be useful to observe landscape development using a small-scale probe on the level of one-cadastre municipality. Microanalyses performed this way allow a detailed and effective survey of printed and archive sources which enable full understanding of the observed phenomena. We published such microanalyses as a set of case studies. These

studies represent an important complement for understanding the development of the landscape in the Ostrava-Karviná mining district.

The work we are submitting here helps to describe the main development trends in the landscape of the Ostrava-Karviná mining district. Any following research should complement our findings with an analysis of qualitative changes since we could not fully take them into account. However, first of all it will be necessary to describe perceptions of the landscape changes, its nature and its use as these were expressed by contemporary observers. Historical research does not wish to understand only objective processes. It also aims to view their subjective understanding and the perception of a particular phenomenon in the society.