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Paweł Churski
Tomasz Kaczmarek *Editors*

Three Decades of Polish Socio-Economic Transformations

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Chapter 15
Environmental Change and Management

Andrzej Mizgajski and Małgorzata Stępniewska

Abstract The disastrous state of the environment in Poland has been one of the critical factors stimulating political, economic and social changes. How to turn away from real socialism in Poland was discussed at the 'Round Table', and one of the negotiating groups dealt exclusively with environmental protection issues. The transformation of the economy resulted in eliminating the most burdensome industrial plants and reducing industrial pressure on the environment. The national and regional environmental protection and water management funds enabled allocating a large portion of public funding to environmental protection. The association and the accession negotiations with the European Union (EU) involved harmonising environmental protection law with EU regulations. Accession to the EU further gave impetus to profound changes. On the one hand, it stimulated in-depth amendments in the law, and on the other hand, it brought a large influx of EU funds to support the reduction of environmental pressure. The transition period was generally a time for improving the quality of the environment, but new challenges are now emerging. Climate change is one of them. Poland has achieved a considerable reduction in greenhouse gas emissions, thanks to the in-depth restructuring of its economy; however, the decarbonisation of the economy has slowed down in recent years. There is also a growing social pressure on the government to implement effective measures in terms of air protection. The transition to a circular economy requires a reduction in the material consumption of the Polish economy, as well as an improvement in waste management, which is currently proceeding relatively slowly.

Keywords Environmental transition · Environmental policy · Pollution

A. Mizgajski (✉) · M. Stępniewska
Faculty of Human Geography and Planning, Adam Mickiewicz University, B. Krygowskiego 10, 61-608 Poznań, Poland
e-mail: andrzej.mizgajski@amu.edu.pl

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15.1 The State of the Environment at the Threshold of Transformation

The catastrophic state of the environment was one of the important factors that led to the political and economic transition. Real socialism treated the exploitation of the environment as a necessary cost for development. In the 1980s, social pressure on the authorities grew; however, the actions of the administration were apparent or superficial. The indicators of the condition of individual components of the environment systematically deteriorated (Statistics Poland 1990). In the 1980s, sulphur dioxide emissions stabilised at a level of 4.1–4.2 million tonnes, which accounted for about 10% of the emissions of Europe as a whole. In 80% of the cities, permitted dust concentrations, registered as a 24-h average over the year, were exceeded and in 15% of the cities; the exceedances were fivefold. Particularly high concentrations of air pollutants were found in Upper Silesia (Górny Śląsk), as well as in other large urban agglomerations, where emissions related to mining, heavy industry, energy production and municipal economy co-existed.

The water quality was extremely low. Only about 5% of the examined river sections had first-class water quality according to the classification in force at that time, while in Europe it was about 50% of river waters. In Poland, 37% of river waters did not meet any standards for usable waters. About 650,000 m^3 of water from coal mines with a load of 7000 tonnes of salt were discharged per day into the waters of the Vistula and Oder. Only 17% of industrial wastewater and 25% of municipal wastewater had an appropriate degree of treatment ensured. 109 Polish cities had no sanitation system and 366 cities had no sewage treatment plants. The cumulation of industrial and municipal pollution made it impossible to use river waters even for industrial purposes.

The situation in the area of waste management was similarly unfavourable. Annually, the industry generated 170–180 million tonnes of waste, half of which was landfilled and almost all the rest was directed to filling excavations and to form the land surface. In 1989, 11.5 million tonnes of municipal waste were collected, which was entirely disposed of in landfills. It should be noted that the collection was carried out in urban areas only, while the inhabitants of rural areas disposed of their waste in a disorderly manner. In Poland, there were over 1500 legal municipal waste dumps and many times more small, illegal dumps.

The state of the environment was spatially diverse. By 1983, the government had already designated 27 areas as ecological threat (Resolution of the Council of Ministers 1983). These areas covered 11% of the area of the country and were inhabited by 35% of the Polish population (Fig. 15.1). They were grouped together in the southern and central part of Poland. At the Baltic coast, the Gdańsk and Szczecin agglomerations were assigned to this group of areas. The areas of ecological threat (AET) accounted for 75% of total dust emissions and 81% of gas emissions. They discharged 55% of all untreated industrial and municipal wastewater in the country. Industrial waste posed a particular problem for AET, as 93% of the total weight of accumulated waste was deposited in these areas. The poor condition of

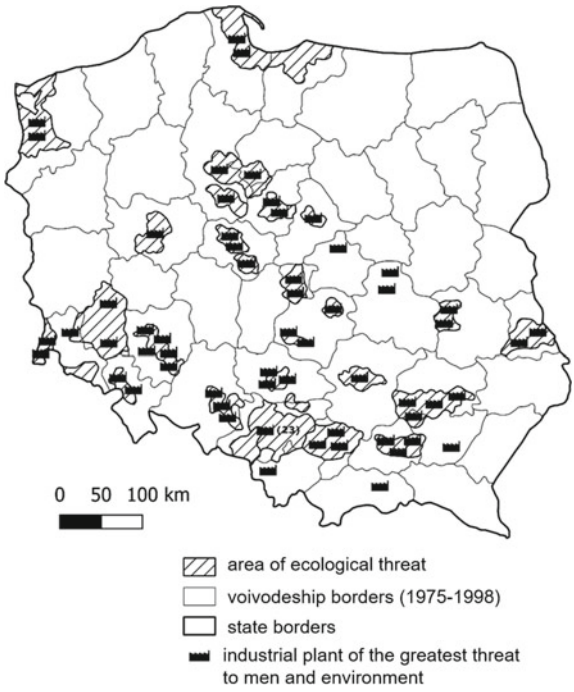

Fig. 15.1 Areas of ecological threat in Poland at the threshold of transformation. *Source* The authors' own study based on Statistics Poland (1984)

the environment has had a negative impact on the health of the society. The average life expectancy of people born in 1989 amounted to less than 67 years for men and 75 years for women. These figures were far below those for Western European countries (men 71 years, women 78—World Bank Open Data 2020).

The 'Solidarność' movement triggered social activity, including pressure on those in power, due to the disastrous state of the environment (Dulewicz 2017; Kassenberg 2014; Zakrzewski 2017). This raised the status of environmental management, which had previously been dispersed across various government agencies as an insignificant element. In 1983, the Office of Environmental Protection and Water Management was established, and in 1985 the Ministry of Environmental Protection and Natural Resources was created.

In the first few months of 1989, Round-Table discussions were held to determine the way in which Poland's political and socio-economic transition would proceed (Foundation for Democracy 2015; Institute for Sustainable Development 2004). The arrangements of the Ecological Group were of key importance for shaping the environmental management system in Poland. The group adopted 28 postulates, which constituted guidelines for the development of a strategic document of the State Environmental Policy. The later implemented contents of this document include:

- water management within the regional water management boards, based on an economic model of self-financing water management,

- the Ministry of Environmental Protection and Natural Resources taking over the management of forestry and national parks,
- introducing legal obligation to carry out an environmental impact assessment of investments,
- ensuring public availability of information on the state of the environment.

The arrangements also included interventions on the most pressing problems related to specific objects negatively affecting the environment. This set of arrangements includes the postulate to draw up a list of enterprises most burdensome to the environment and to take a decision on actions to reduce or eliminate their negative impact on the environment, up to and including the decision on liquidation of the plant. In 1990, a list was created, of 80 industrial plants posing the greatest threat for men and the environment due to the emission of pollutants into the air and water, accumulation of waste and threat to soil and groundwater.

15.2 The System of Environmental Protection Under Construction

Entering the period of transition of the political and socio-ecological system, Poland had disastrous indicators of environmental quality. At the same time; however, there was a far-reaching consensus among the outgoing and new political elites on the importance of environmental protection for the future of the country, as well as on the strategic directions of corrective actions (Protocol 1989). The existence of institutional frameworks at the national level, including, in particular, the Ministry of Environmental Protection, Natural Resources and Forestry and the National Fund for Environmental Protection and Water Management was important. Paradoxically, the deep economic collapse was a factor in favour of environmental improvement in the early 1990s. The shutdown of many plants, which were technologically backward and unprofitable, resulted in a reduction in the amount of pollutants emitted to the air, water and soil. For example, in the years 1985–1991, the total emission of sulphur dioxide fell from 4932 to 3552 thousand tonnes, the emission of dust from 1,788 to 923 thousand tonnes, and the amount of untreated wastewater discharged by industrial plants fell from 2000 to 1133 hm^3 (Statistics Poland 1992).

By 1990, following the Round-Table guidelines, the Ministry developed a strategic document called the National Environmental Policy. The political importance of the document is evidenced by the fact that it became the subject of a parliamentary resolution and was subsequently adopted by the Government in a modified form in September 1991 (National Environmental Policy 1991—NEP). The document declared the subordination of the needs and aspirations of society and the state to the opportunities offered by the environment.

The basic principle of the NEP was the need to restructure the system of environmental law and its implementation in such a way that each legal provision is strictly

adhered to, so that the rules cannot be circumvented using arguments of 'higher necessity', 'public interest' or 'impossibility'. The exposure of this principle documents how devastated the rule of law was during the period of real socialism. In view of the enormous pollution of the environment, counteraction was based on the principle of eliminating pollution at its source, which follows a hierarchical chain: avoiding the production of pollution—closing the circulation of materials and resources—neutralising pollution. In accordance with the principle of making environmental protection a social issue, the creation of institutional and legal conditions for the participation of citizens, social groups and non-governmental organisations was envisaged. The principle of economisation was understood as the use of the market mechanism, while maintaining the necessary scope of state interventionism. This was combined with the 'polluter pays' principle, which means that the perpetrator is responsible for the effects of pollution. Given the strong diversity of the ecological situation in the country, the principle of regionalisation was adopted, including the powers of the local government and the diversity of regional and local environmental policy mechanisms. The international context was also taken into account by introducing the principle of solving European and global environmental problems together. Finally, the NEP provided for the application of the principle of staging, which resulted from the enormous backlog and the huge investment outlay needed in environmental protection.

The review of NEP content shows that at the beginning of the transformation, Poland had a very modern concept of strategic environmental management. Although the Ministry of the Environment, Natural Resources and Forestry had extensive jurisdiction, the conditions for active policy were extremely difficult. The state's structures were in a poor state; there was a shortage of educated professionals. The level of ecological awareness among the society was very low, and there was a deep collapse of the economy causing impoverishment and lack of funds for investments. Despite these limitations, a great deal of effort was made to implement the most urgent investments in order to reduce the volume of pollution emissions. In the first phase of the transformation (1989–1992), the investment outlays on environmental protection increased from 0.6 to 1.3% of gross domestic product (GDP), while the share of environmental protection in the total investments increased from 3.7 to 6.5%. These figures illustrate the extreme effectiveness of the Polish system of mobilising funds for environmental protection at that time. It is also shown by a comparison of the sources of financing of the environmental protection in 1992: ecological funds 58%, own resources of enterprises 20%, municipal budgets 13%, central budget 5% and foreign aid 4% (Statistics Poland 1993).

From the very beginning of the transformation, the National Fund for Environmental Protection and Water Management, together with its regional and local counterparts, have played a decisive role in financing environmental protection. These funds have financial resources obtained from fees for the economic use of the environment. They are paid by economic entities relative to the amount of pollutants introduced into the air and water, the amount of waste stored and the volume of water intake for economic purposes. A smaller portion derives from penalties for non-compliance with environmental protection standards. This system, which was

developed in 1989, has proved to be very effective as it provides considerable funds that cannot be spent on purposes other than environmental protection. In 1991, the revenues of ecological funds exceeded 70% of the investment outlays on environmental protection in Poland (Statistics Poland 1992). The linking of fees to the amount of emissions was at the same time a factor mobilising economic entities to reduce pollution. In 1993, regional environmental protection funds in voivodeships became legal persons and manage about half of the funds collected in their territory. This made it possible to differentiate the outlays on environmental protection according to the priorities of each of the 49 voivodeships existing at that time.

The local government in communes established in free elections in 1990, triggered tremendous social activity, which from the beginning was aimed at improving municipal hygiene and the quality of the environment. An illustration of the organisational and investment efforts of municipalities in the first phase of the transformation may be the fact that expenditures on municipal sewage treatment plants in 1991 accounted for 24% of the total investment expenditures on environmental protection in Poland (Statistics Poland 1992). Progress was made mainly in the cities, while the economically weaker rural communes were less active in reducing emissions.

At the same time, the legal framework for the new social, political and economic system was being created. This was an extremely difficult task due to the dynamics of changes in all spheres of state operation. Moreover, it should be noted that the principle of legal continuity was very much in force in Poland, i.e. all new legal acts had to take into account the existing legal status. The Act on the Protection and Control of the Environment, dating back to 1980, had been amended 25 times since 1990 before the new act, (the Environmental Protection Law 2001) replaced it in 2001. Subsequent editions, among others, shaped the system of environmental protection funds, regulated the issues of environmental impact assessment of planned investments, updated administrative procedures in environmental protection and regulated administrative fines for exceeding the permitted emissions. In 1991, the Polish Parliament adopted a new Act on Nature Conservation (1991), which replaced the archaic act of 1949. This act provided a legal framework for establishing new forms of territorial nature conservation such as landscape parks, protected landscape areas and introduced various forms of site protection, apart from the already existing nature monuments.

The OECD report (OECD 1995) provides a review of the initial years of transformation (1990–1992) in terms of environmental protection. The report notes a significant improvement, mainly because of a decline in economic activity and restructuring of industry and energetics. The reduction of pressure on the environment was greater than the decrease in GDP, which indicated the effectiveness of the measures taken. The document stresses that in spite of significant investments, emissions of the municipal sector to water and air have not decreased, and waste management is limited to landfills, which, in two thirds of cases, do not meet safety requirements. Among the recommendations, attention was drawn to the necessity of ensuring economic effectiveness of public expenditure on environmental protection and its consistency with the ‘polluter pays’ principle. This postulate also concerned pricing the use of environment and shaping the structure of related fees.

After a deep, yet short, economic collapse, since 1992 there has been continuous GDP growth in Poland. This has been accompanied by a systematic, albeit differentiated, reduction of pressure on the environment and improvement its quality. This shows that the correlation between economic growth and increasing environmental impact is broken. The Report of the State Inspectorate for Environmental Protection (1998) indicated a clear reduction in the nuisance of industrial plants (mostly chemical plants and power plants), which were the largest emitters of pollutants. Against this background, the importance of the municipal sector as a source of pollution increased in the second half of the 1990s. Municipal wastewater became the main cause of water pollution, while emissions from local furnaces and vehicles became the most important factor of poor air quality in cities. In comparison with the pre-transformation period, the volume of municipal waste has increased twofold—the management of which consisted almost exclusively in landfilling.

For the environmental management structure, the administrative reform was very important, consisting in the creation of local governments for voivodeships and poviats (counties) in 1999, which, together with communes, took over from governmental agencies almost all administrative competences regarding environmental protection on the regional and local scale. The local government administration of regions and counties issues decisions concerning the conditions of using the environment, including the emission of pollutants. The regional and local parliaments elected through general elections, together with their executive bodies, can now shape and implement their priorities in environmental protection. This is all the more possible because local government regions have their own budget and have some influence on the directions of intervention of regional environmental protection and water management funds.

The 1990s were marked by a remarkable dynamic of investments to improve the quality of the environment. This was a great financial effort for a country undergoing profound reconstruction of all the sectors of its economy. Throughout that decade, there was a high rate of growth of expenditures, but the proportions were changing. By the year 2000, outlays on environmental protection already accounted for 2.1% of GDP, with current outlays slightly outweighing investments (OECD 2003). Nevertheless, it should be pointed out that the main expenditures on environmental protection were possible thanks to the mobilisation of domestic funds. The volume of foreign subsidies between 1991 and 2000 amounted to $590.3 million, which, on average, represented about 5% of all annual environmental protection expenditure (Statistics Poland 2001). The possibility of writing off Polish debts by half in 1991 as well as allocating up to 10% of the debts to environmental protection were important for the possibility of financing environmental protection. Within this framework, the EcoFund Foundation operated, which had at its disposal resources under the debt-for-environment swap scheme for a part of debts to the USA, France and Switzerland, as well as Italy, Sweden and Norway. In 1992–2010, the EcoFund allocated more than 2 billion PLN in the form of subsidies to about 1.4 thousand projects.

The first decade of transformation was a period of dynamic development of various forms of nature conservation, which was possible due to new legal regulations and

social acceptance for the legal protection of new areas. During this period, the number of national parks increased from 17 to 22, and their total area increased by more than 80%, reaching about 1% of the country's area (Statistics Poland 2001). The form of legal nature protection, which has experienced the greatest boom in that decade, is landscape parks as a protected area due to the value of the natural, historical and cultural and scenic landscape in order to preserve, promote these values in terms of sustainable development. Their number increased from 68 to 120, and the area exceeded 8% of the country's area.

The restructuring of the economy enabled significant progress to be made with industrial waste management, while the municipal waste management was the sector most neglected in the 1990s. The opening to the world, the systematic increase of the society's wealth, the uncritical duplication of Western European patterns, the faulty waste management system and the lack of legal regulations resulted in an avalanche of waste generation. In principle, the only form of waste handling was its landfilling, often in substandard or illegal landfills. The cubic capacity of the solid waste accumulated at municipal landfills increased from 42.7 to 49.8 million m^3 between 1990 and 2000 (Statistics Poland 2001). It was only in 1997 that the Act on maintaining cleanliness and order in communes and consequently in 1998 that the Act on waste came into force. The effectiveness of these regulations was very limited. The amount of collected municipal waste increased in the years 1990–2000 from 11 to 12.2 million tonnes per year (Statistics Poland 2017); only about 3% of this amount was selected for recovery in cities in 2000 (Statistics Poland 2001). Neither did the first years of European Union (EU) membership bring a breakthrough, even though supra-local waste management systems began to emerge.

A critical expertise of the Polish Academy of Sciences (Kozłowski 2002) stresses that in the 1990s the waste of energy, raw materials and materials inherent during the socialist system had reduced. This led to a reduction of loads of pollution introduced into the environment. However, the authors pointed out that the vigorous transformation process in Poland was not consistent with the objectives of the National Environmental Policy (1991). The following drawbacks were mentioned:

- The transition to a market economy did not prevent economic, social and environmental risks,
- The increase of the resources and energy use efficiency as well as the reduction of emissions from the most important branches of the economy was too slow,
- There was an inconsistency between the macroeconomic and environmental policies of the state, and as a consequence, systemic and legal as well as institutional changes in environmental protection were poorly harmonised with the dynamics of the social and economic transformation.

The OECD report (OECD 2003) summarises the first decade of transformation of environmental management in Poland. The report states that there are efficient and competent institutions of environmental protection in Poland, even though the enforcement of legal regulations needs improvement. Progress has been made in the area of reduction of air emissions, water abstraction, nutrient discharges and decline in the production of industrial wastes. However, further significant investments in

environmental protection infrastructure are necessary. The range of economic instruments used to rationalise the use of the environment has expanded, but the report highlighted the need to apply 'the polluter pays' principle. There is also a need to take greater account of environmental protection in spatial management plans.

In general, it can be said that Poland—given its first decade of political, economic and social transformation—has definitely caught up with Western Europe in terms of environmental protection. However, the enormity of previous backwardness and the systematic raising of environmental protection standards in European Union has meant that more effort is still expected, which is possible thanks to EU membership.

15.3 Polish Environmental Protection Within European Environmental Policy

Integration with the European Union formally started with the Resolution of the Parliament in 1992. This process has played a crucial role in the evolution of environmental management and financing of environmental protection in Poland. In 1994, the Association Agreement between Poland and the EU which was connected with the harmonisation of the Polish legal system with the *acquis communautaire*, came into force. As part of preparations for accession, nearly 200 acts of secondary EU legislation in the area of 'Environment' were analysed (Radziejowski et al. 2002) as to the necessity of their transposition into the Polish legal system and practical implementation. Waste management, water quality, air quality and reduction of industrial pollution were particularly difficult areas in the negotiations on EU membership (Progress of negotiations 2000). As a result of the negotiations, Poland obtained 10 transitional periods of several years allowing for the extension of the adjustment periods beyond 1 May 2004, as the date of its accession to the EU. The most important concerned municipal sewage treatment, waste management and integrated prevention and control of pollution in the largest industrial plants. Apart from the issues included in the transition periods, Poland completed the transposition of its legal system by the end of 2002. Meeting this requirement was a great challenge, as it involved not only the development of new regulations, but also required the provision of institutions and financial resources for their implementation, as well as the preparation of a control system and instruments for law enforcement (Radziejowski et al. 2002).

The accession to the EU was the time of intensive investments to make up for the delay in providing the technical infrastructure for environmental protection. This period involved, on the one hand, forcing Poland to apply EU standards in environmental protection, and on the other hand, the flow of EU funds allowing for a jump in investment outlays on objectives consistent with the priorities and measures described in the operational programmes. According to the information provided by the National Fund for Environmental Protection and Water Management, from 2004

to 2020, Poland has used over PLN 45.1 billion of EU funds under subsequent operational programmes for environmental protection. This amount should be completed by, probably only slightly smaller, funds allocated to environmental protection being included in regional programmes, in programmes devoted to rural areas and in funds for modernisation of the economy.

During the period of Poland's membership in the EU, foreign funds have accounted for somewhere between a dozen to more than 25% of total expenditure on environmental protection (Statistics Poland 2019a). Funds originating from the EU ensured the mobilisation of, at least, a similar amount of funds from domestic sources. The share of environmental protection expenditures in GDP in the first decade of the twenty-first century fluctuated between 3.1 and 4.5%, while the average share of environmental protection expenditures in GDP in the European Union countries was slightly above 2% (Eurostat 2020). In the next decade, this share decreased in Poland to 1.5% in 2017, but by 2018, it rose to 3.1%. The main reason for this was an increase in costs incurred by households for waste management, drinking water and sewage disposal.

Among the formal requirements for obtaining European Union funds for financing projects, the *sine qua non* condition is the conformity of projects with relevant EU and Polish strategic and operational documents. The long-term strategic framework for environmental management after the year 2000 was to be determined by the II National Environmental Policy (National Environmental Policy 2001—2nd NEP), which combined the experience of the transformation period and the EU approach. This document listed, among its main objectives, the impact on macroeconomic policy, the improvement of the quality of the environment and the reduction of pressures on it, the achievement of full regulatory compliance with the EU and the promotion of sustainable development. Meanwhile, only a year later the European Union adopted the 6th EU Environment Action Programme (2002), which coincided with the conclusion of negotiations on Poland's membership in the EU. As a result, Poland quickly updated the 2nd NEP and adopted the 'National Environmental Policy for 2003–2006 with the perspective for 2007–2010 (2003)' (3rd NEP). Successive editions of the NEP were created at irregular intervals (National Environmental Policy 2007, 2009, 2019). In spite of political changes, the priorities and objectives of subsequent documents were identical or similar and in line with the 6th EU Environment Action Programme (2002). They exposed systemic horizontal measures, including impacts on sectoral policies, development of economic mechanisms, institutional strengthening and increased public participation in environmental protection.

The lively tradition of silo mentality in the Polish government has resulted in ineffectiveness in introducing environmental perspective to sectoral policies. This is particularly true in the energy sector, where activity in favour of energy efficiency and the development of renewable energy sources has long been insufficient in view of the dominant position of coal-based energy. The postulate of institutional strengthening is also still valid, as subsequent structural and personnel changes are not conducive to the long-term formation of substantive strong institutions. However, it cannot be overlooked that integration with the EU has resulted in the need for extensive

changes in legal regulations. Their preparation and implementation rested, mainly, on the shoulders of the administration, which demonstrated its ability to prepare a large number of legal acts. Only in the first phase of the transposition of EU law were the most important acts creating legal order in environmental protection rewritten. These included Environmental Protection Law (2001), Water Law (2001), Act on waste (2001), Act on nature conservation (2004). In addition to these, dozens of other laws and hundreds of executive regulations were adopted.

Apart from horizontal issues, significant progress is being made in shaping economic instruments. Among the mechanisms implemented, one can mention the realistic pricing for water extraction, wastewater discharge and waste management and the introduction of market prices for energy carriers. The challenge remains to continuously expand the internalisation of environmental costs so that the perpetrator of the environmental damage has to include the costs of the damage reparation to the price of his products and services. The European Union requires Poland to apply extensive environmental impact assessment procedures for planned projects, which involves ensuring public participation and expanding access to environmental information. The threat of blocking subsidies for investments from the EU programmes turned out to be an effective instrument for making administrative procedures more public and for improving the quality of expert documents on the possible environmental impact of planned projects. Successive editions of the NEP have unsuccessfully raised the need to integrate the administration of environmental management and spatial planning. The lack of consideration of environmental terms is the reason for spatial conflicts and negative effects of erroneous space management on both the quality of life and the state of environment.

Since accession to the EU, the protection of natural heritage has taken on a new dimension resulting from the establishment of protected areas in Poland under the European NATURA 2000 Network. Communes opposed this new form of nature conservation for fear of hindering economic investments. Thanks to pressure from the European Union, as well as activities of non-governmental organisations, in 2018 NATURA 2000 sites occupied 9.5 million hectares of land in Poland, i.e. approximately 20% of the country's land area (General Directorate for Environmental Protection 2020). One million hectares of marine NATURA 2000 areas needs to be added to this. NATURA 2000 sites, including the Areas of Special Bird Protection and Areas of Special Habitat Protection mainly cover national legal forms of nature conservation, especially national parks, nature reserves and landscape parks. This results in a total of 1/3 of the country's land area being covered by various forms of nature conservation. After the year 2000, the pressure on natural resources, as a result of the decreasing emission of pollutants began to, systematically, decrease and at the same time, social resistance against legal protection of new areas was on the rise. Hence, only one new national park and two landscape parks were created. On the other hand, afforestation continued, which made it possible to increase the forest cover of the country to 29.6% in 2018, with the dominance of public forests (Statistics Poland 2019b). The forests grew healthier, which is assessed based on defoliation as an indicator of large-scale air pollution. Between 2004 and 2018, the share of damaged trees decreased from 34.6% to 18.7% (Statistics Poland 2005, 2019b), while the stands

of large, compact forest complexes remain healthier compared to the dispersed ones (State Forests, 2018). Concentration of activity in development centres, instead of peripheral areas, has resulted in the recovery of large mammalian populations. A spectacular example is the wolf, whose population increased from 719 to 2,868 individuals between 2004 and 2018 (Statistics Poland 2005, 2019b). The NATURA 2000 sites proved to be effective in protecting forest bird populations. In the years 2000–2018, the value of the Forest Bird Index, aggregating changes in the numbers of the most common forest birds in Poland, increased by 14%. Contrarily, the intensification of agriculture increased the pressure on birds of agricultural landscapes. Their worsening situation is reflected in the decrease in Farmland Bird Index during the period 2000–2018 by 25% (State Inspectorate for Environmental Protection 2018).

Within the EU, Poland maintains a high level of material intensity in terms of the economy. The main factors are the consumption of building materials and fuels (State Raw Material Policy 2019). There is a systematic progress in the efficiency of the use of resources, materials, water and energy in relation to GDP (Fig. 15.2). In the years 2004–2018, resource productivity, which determines the relationship between GDP and domestic material consumption, increased by 86%. The demand for water, which after 2000 stabilised at about 11,000 hm^3 per year, whereas in 1990 it was over 14,000 hm^3, is an example of the increase in natural resource efficiency (Statistics Poland 1992, 2019b). During the period 2004–2018, there was also a decrease in the energy intensity of GDPs by about 1/3. However, although the pace of breaking the link between economic development and material and energy use was faster in Poland than in the EU, the resource productivity and energy intensity of GDPs currently remain below the European average. Poland's share of energy from renewable sources is still

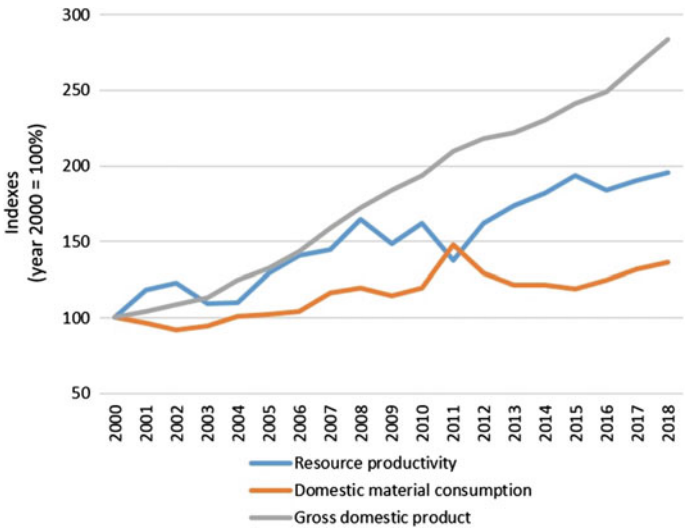

Fig. 15.2 Trends in resource productivity and material consumption in relation to gross domestic product in the years 2000–2018. *Source* The authors' own study based on Eurostat (2020)

low (11.3% in 2018, compared to 17.9% in the EU); however, its dynamic growth should be noted (Eurostat 2020). Energy obtained from renewable sources in the country comes mostly from biofuels and wind energy (Statistics Poland 2019c). The share of coal in the country's total primary energy supply is clearly declining, from about 95% in 1990 to 70% in 2018 (Institute of Environmental Protection—National Research Institute 2018).

Changes in waste management towards reducing the share of landfilling and increasing the recovery of raw materials began after 2012, when new regulations came into force, introducing common fees for municipal waste management and forcing segregation at source. As a result, the amount of municipal waste collected increased, from 9.6 mln tonnes in 2012 to 12.5 mln tonnes in 2018 (Fig. 15.3a). The share of selected waste collection also increased. In 2018, this waste accounted for 28.9% of the total amount of collected municipal waste, as compared to 10.5% in 2012 (Statistics Poland 2013, 2019b; Fig. 15.3b). Among the selectively collected waste, biodegradable waste, bulky waste, glass, plastics and paper represent the largest share.

The share of individual sources in air pollution has been changing. Focusing the attention of the inspection services from the beginning of the transformation on the industrial plants with the highest emission levels has proved to be a very effective tool (Fig. 15.3c), which made it possible in 2005 to, officially, close a list of plants posing the greatest threat for people and the environment, even though the supervision of such facilities continues. In turn, the role of diffuse sources of emissions,

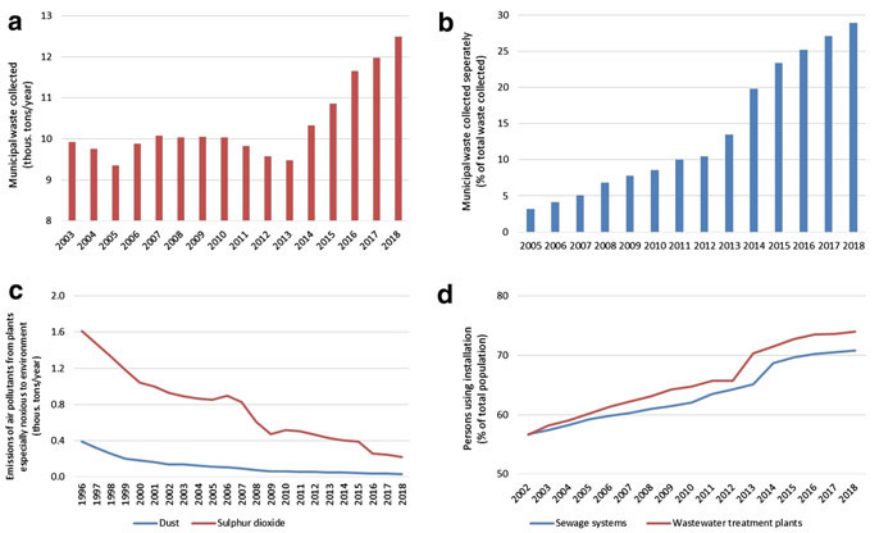

Fig. 15.3 Changes in selected environmental indicators after Poland's transition. The time period considered for each indicator results from the availability of comparable data. *Source* The authors' own study based on Statistics Poland—Local Data Bank (2020)

from the communal and living sectors and transport, has increased. In the years 2005–2018, exceedances of the air quality standards mainly concerned particulate matter PM10, PM2.5 and the benzo(a)pyrene (State Inspectorate for Environmental Protection 2010, 2014, 2019a). In 2018, out of 46 zones into which the national territory is divided for air quality monitoring purposes, 44 exceeded the permitted annual average level of benzo(a)pyrene concentration; 39 zones exceeded the permitted annual average level of PM10 and 14 zones exceeded the permitted annual average level of PM2.5 (State Inspectorate for Environmental Protection 2019b). The size of the average dust-exposure indicator, measured in the 30 largest Polish cities and agglomerations, decreased in the period 2010–2018 from 28 to 22 $\mu g/m^3$. However, in most cases, the indicator value still exceeds the standard for human health (20 $\mu g/m^3$) (Announcement of the Minister of Environment 2019). The main sources of particulate matter and benzo(a)pyrene in Poland are emissions from the communal sector, including the combustion of solid fuels for heating (National Centre for Emissions Management 2019a). Emissions associated with individual heating of houses are often located in densely populated areas, which directly affect the air quality in places where people live. Road transport, especially in the central parts of cities with dense networks of streets and intense car traffic, also has a frequent impact on exceeding the particulate matter and benzo(a)pyrene standards (State Inspectorate for Environmental Protection 2019b).

The implementation of the Water Framework Directive has led to a change in the approach to the protection of freshwaters, whose quality has so far been assessed solely on the basis of physicochemical characteristics. The new approach takes into account the ecological status of surface water bodies related to the quality of the structure and functioning of water ecosystems. Investments, following Poland's accession to the EU, increased the share of the population using sewage treatment plants from 58.2% in 2003 to 74.0% in 2018 (Statistics Poland 2004, 2019b; Fig. 15.3D). This resulted in an improvement in the condition of waters, even though their quality is still unsatisfactory (State Inspectorate for Environmental Protection 2009, 2019c). In 2018, good chemical status was found in 27% of freshwaters and good ecological status in 22% (Statistics Poland 2019b). For comparison, this was 38 and 40% in the EU on average (European Environment Agency 2018). However, the principle of 'the worst decides' should be taken into account, according to which for poor water status assessment, it is sufficient that one of the indicators does not meet the standard for good status. The reason for the poor chemical condition of most freshwaters in Poland is because they exceed the standards of several polycyclic aromatic hydrocarbons, brominated diphenylethers, heptachlor, mercury and related compounds (State Inspectorate for Environmental Protection 2019a, b, c). In turn, poor ecological conditions are often determined by factors not directly related to pollution. This is especially true for fish, whose living conditions do not always improve with the improvement of water quality, as they also need suitable habitats for reproduction and migration (Ciećko and Panek 2019).

Climate policy occupies a low position in Poland. It is significant that in the 7th EU Environment Action Programme (2002), climate change mitigation was at the top of the priorities, while in the 3rd National Environment Policy (2003) it is

listed as the last. Poland has been a signatory to the United Nations Framework Convention on Climate Change since 1994 and the Kyoto Protocol that has been operating it since 2002. In the first commitment period (Kyoto Protocol 1997), Poland committed itself to reducing greenhouse gas (GHG) emissions from 2008 to 2012 by 6% compared to base year emissions. Between 2013 and 2020, the EU member states and Iceland adopted a common reduction target, which included achieving average annual emissions of 80% of the total base year emissions of all member countries (Doha Amendment 2012). For Poland, the base year is 1988 for carbon dioxide, methane and nitrous oxide, 1995 for hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride, and 2000 for nitrogen trifluoride. In 2017, the total national GHG emissions were 413.78 million tonnes of CO_2 equivalent. Compared to the base year, the emissions for 2017 decreased by 28.3%. The biggest decrease in GHG emissions was recorded in agriculture and power generation. In agriculture, this was caused by structural and economic changes after 1989, including a reduction in animal and plant production. The reduction of emissions in the energy sector, in turn, was associated with the transformation of industry, a decrease in coal consumption and implemented measures for energy efficiency (National Centre for Emissions Management 2019b).

A comprehensive assessment and classification of communes in terms of changes in pressure on the environment and its quality in the years 2000–2009 is presented Kistowski (2012). The study shows a decreasing pressure of industrial emissions and a partial improvement in the state of the environment, even though it was still unsatisfactory for some air and water pollutants. In turn, the OECD Environmental Performance Review (OECD 2015) assesses the directions of changes in Poland since accession to the EU. The document indicates that environmental policies and institutions have strengthened since 2004. Increased investments have improved access to sanitation and solid waste services, helping to reduce environmental pollution. At the same time, the report notes that the Polish economy remains one of the most resource- and carbon intensive in the OECD, mainly due to its strong dependence on coal. The need for better pricing of environmental externalities and a clear specification of measures necessary for the transition to a low-carbon economy was stressed. Poland's efforts to establish a more effective system of municipal waste management were noted. However, municipal capacities should be strengthened in order to increase selective waste collection and develop a coherent investment approach to waste treatment.

15.4 Contemporary Challenges

In our opinion, Poland faces the following critical challenges: the adaptation to and mitigation of climate change, the reduction of environmental pressures caused by emissions, including, a decrease in particulate matter concentration, as well as the implementation of a circular economy. Of course, at the same time, actions must be

taken in the field of nature conservation, including both living and inorganic nature, as well as the landscape.

International reports point to the deepening effects of global climate change—in particular, rising temperatures and the intensification of extreme phenomena. The EU's response to these problems is the European Green Deal (2019), which expresses the aspiration to develop a modern and competitive, yet resource-efficient and low-carbon economy. The EU's objective is to achieve climate neutrality, i.e. zero net greenhouse gas emissions, by 2050. In the case of Poland, climate policy has played a marginal role and has only been undertaken in recent years. The framework for national action in this respect is formulated in the Strategic Adaptation Plan towards 2020 with a perspective to 2030 (2013)—SAP. The document presents climate change scenarios for Poland, considering extreme weather phenomena, such as heavy rainfall, floods, droughts, heat waves, hurricanes, as the greatest threat to society and the economy. These phenomena are likely to occur with increasing frequency and intensity, covering larger and larger areas of the country. Among the consequences of climate change, changes in hydrological conditions have also been identified, including the occurrence of longer rain-free periods, interrupted by violent and heavy rainfall. Groundwater levels will decrease, which will have a negative impact on biodiversity and ecosystems, particularly, freshwaters and wetlands. The SAP sets out the directions of adaptation measures to be taken for the most sensitive sectors and areas: water management, agriculture, forestry, energy, transport, construction, land use, health, biodiversity, as well as urbanised areas, mountain areas and coastal zones. As the implementation of SAP guidelines, in 2017–2019 local climate change adaptation plans were developed for 44 of Poland's largest cities, which comprise about 30% of the country's population. These plans included the assessment of sensitivity to climate change and identification of adaptation measures taking into account regional and local specificity.

Owing to Poland's much greater dependence on coal than other EU member states, the energy transformation remains crucial for reducing greenhouse gas emissions. The objectives and directions of measures in the energy sector are set out in the Energy Policy of Poland until 2040 (2019). The indicators of the energy transformation until 2030 include 60% of coal in electricity generation, 21% of renewable energy sources in gross final energy consumption and reduction of CO_2 emissions by 30% (compared to 1990). The necessary changes in the energy sector must be seen in the broad context of a fair transition, reflecting the compromise between the interests of all groups affected by this process. The rate of shutting down conventional energy sources must be correlated with the reduction of energy demand by:

- reducing the energy intensity of the economy and the municipal sector,
- thermomodernisation of buildings,
- development of dispersed renewable energy generation,
- making the energy management system more flexible by developing its storage and transmission system as well as supporting the transformation of regional economies towards independence from coal mining.

A major challenge will be to apply diverse tools in the regions so as to reduce environmental pressures. Differences in the ways and intensity of using the environment in Poland result in distinguishing areas with specific environmental problems in regional terms.

The first group includes mining and mineral processing areas, mainly Upper Silesia, Rybnik and Lublin coal basins. The effects of deep coal mining include land deformation caused by subsidence, changes in water conditions, changes in water quality (as a result of saline discharges from mine drainage), waste accumulation and air pollution (Pietrzyk-Sokulska et al. 2015). This is compounded by emissions from the developed metallurgy and power industry as well as communal and living emissions resulting from high population density. In turn, opencast lignite mining (Bełchatów, Pątnów-Adamów-Konin and Turów lignite basins) are related to large-scale transformations of the surface of the earth, changes in the structure and quality of soils, deep changes in the level of ground and surface waters and emissions of dust and gas pollutants (Kasztelewicz 2018). Increased mining pressure also occurs in the Legnica-Głogów Copper Belt, which is related to the deep mining of copper ore and the storage of post-flotation waste, as well as emissions from metallurgy.

Specific areas of large-scale industrial impact on the environment occur in the vicinity of large plants representing high-emission types of industry. This applies, in particular, to the petrochemical industry (e.g. Płock, Gdańsk), chemical industry (such as nitrogen plants in Puławy, Kędzierzyn-Koźle and Tarnów, chemical plants in Police, soda plants in Janikowo) and cement plants (12 plants located in 7 regions in 2018).

The agriculture production is linked with the emission of pollutants from dispersed sources to soil, water and air, which is associated with the use of pesticides and artificial fertilisers, as well as with animal husbandry (Gołębiewska 2016). The impact of intensive agriculture on the environment, additionally, includes erosion and degradation of soils as well as the simplification of a landscape structure, leading to the loss of habitats and biodiversity (OECD 2008, 2018). The above problems occur in particular in agricultural areas of the Szczecin Lowlands, Żuławy at the Vistula delta, Kujawy, the Wielkopolska Lowlands, Wrocław Plain, the Głubczyce Plateau, the Sandomierz Uplands and the Lublin Uplands.

Large cities constitute a different group of centres where pressure on the environment is concentrated. About 10.1 million Polish people live in urban areas with more than 100,000 inhabitants (Statistics Poland 2019d). The low quality of the urban environment is mainly due to the high, although systematically decreasing, use of coal to heat buildings. Additionally, emissions from vehicles account for a significant share of air pollution. Poland is characterised by a high rate of cars per 1,000 inhabitants (610 cars in 2018), with a large proportion being obsolete vehicles with high emissions (in 2018, the average age of cars was 14 years—European Automobile Manufacturers' Association 2019). Negative effects on the quality of the environment in cities are exerted by uncontrolled urban sprawl. This leads to unreasonable land development, makes it difficult to equip new suburbs with municipal infrastructure and, above all, generates additional car traffic related to commuting to central

cities, where services and jobs are concentrated. In urbanised areas, emissions from the communal and living sector overlap, in part, with industrial emissions.

In the outskirts, the source of pressure is the emissions to the air resulting from the use of low-quality coal and combustion of waste in household furnaces. The problem is the disorderly management of municipal sewage in many small settlement units and deficiencies in the enforcement of municipal waste management standards.

Tourist regions along the coastal strip, in mountains and lakeside areas feature dispersed seasonal emissions, which result mainly from the disordered sewage and municipal waste management.

In terms of pollution types, a particular challenge for Poland is the reduction of particulate matter. This requires, above all, the reduction of emissions from the households, municipal sector and cars. The National Programme of Air Pollution Reduction (2019), among the most important necessary measures, includes:

- transition to using low-emission fuels in heating devices,
- modernisation and expansion of local gas and heating networks,
- thermomodernisation of buildings,
- improvement in energy efficiency in the transport sector,
- management and optimisation of transport demand,
- promotion of new forms of mobility.

This should be accompanied by information and educational activities and the development of mechanisms to control local emission sources with emphasis on housing. It should be noted that the matter of air quality is easier to solve than climate-related issues, as corrective actions in this area have been socially accepted. For example, the growing awareness and social pressure on the authorities to counteract high concentrations of particulate matter meet with a response in the form of their resolutions to eliminate the usage of solid fuels in specific cities.

The high material requirements of the Polish economy make the implementation of a circular economy (CE) another form of challenge. This model is based on the assumption that the value of products and materials should be maintained in the economy as long as possible in order to minimise the consumption of resources and the generation of waste. Transition to a resource-efficient and low-carbon economy is the subject of the EU Action Plan for the Circular Economy (2015). The development of a CE will trigger structural changes in the economy and new trends, whose effects will be felt in economic, social and environmental dimensions (European Environmental Agency 2016). The Roadmap towards the transformation to a circular economy (2019) provides a framework for action in Poland. The priorities include strengthening the innovativeness of the economy, development of the market for secondary raw materials and the service sector ensuring the possibility of using products as an alternative to their purchase, e.g. car sharing. In turn, the State Raw Material Policy (2019) for boosting a CE formulates the principle of 'waste as a raw material', which should lead to the minimisation of waste and increased recovery of raw materials. It can therefore be concluded that in the policy sphere, a set of directions of strategic activities and legislative work aimed at stimulating the CE transformation has been proposed in Poland. On the other hand, there is a lack of

defined scope of monitoring (Rataj 2019), which would allow tracking the progress of the CE implementation, assessing its effects and introducing corrections so as to increase the effectiveness of actions.

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