

Forests in industrial regions and the reclamation process of environment

Małgorzata Faleńska-Jabłońska¹, Małgorzata Sulkowska² ✉

¹ Forest Research Institute, Department of Forest Ecology, Sękocin Stary, Braci Leśnej 3, 05-090 Raszyn, Poland

² Forest Research Institute, Department of Silviculture and Genetics, Sękocin Stary, Braci Leśnej 3, 05-090 Raszyn, Poland, phone: +48 22 7150461, fax: +48 22 7200397, e-mail: M.Sulkowska@ibles.waw.pl

Intensification of degradation processes of forests exposed to industrial emissions and the need of neutralisation of their negative effects has been already reflected in the 1899 resolution of the Austrian Forest Congress in Vienna. A fragment of this resolution was as follows: „...taking into account the scientific and economic importance of forests and the threat of industrial gases, it is necessary that all the factories that pose a threat to forests were equipped with the appropriate facilities of condensation and disposal of discharged gases. Congress calls on the government to issue the relevant legal regulations that would protect the forest and take the industry to responsibility for all damages...”.

The first scientific paper concerning forest damages caused as a result of industrial emissions in the Polish territories was published in Germany in the late XIX century (Reiss, 1893). Reiss – the head of Katowice-Mysłowice Forest Division (Upper Silesia Region – South Poland) with an area of 3500 ha then calculated the losses due to „damage smoke”, which were up to 200,000 German marks (Łuczkiwicz 1922a).

The author of the study also noted that if the tree species were better adapted to their habitat, then they were more resistant to the fumes. At the same time, he requested the extension of legal protection of forests and the establishment of „Air Act”, which could define the authorised concentration of toxic substances in the air and would indicate the measures that would limit their production (Łuczkiwicz 1922b, c).

As the time went and the dynamic of economic development as well as the negative impact of industry, in the evaluation of the degree of forest production disturbance by industrial emissions it became important to indicate the moment when the risk was crucial for the accumulation of immission in the environment of forest complexes. However, pollutant emissions are the anthropogenic factor, inherent and side effect of industrial development. „Industrial production is the keystone of today’s technological civilisation, while emissions could be regarded as somewhat excretory product of civilisation”, this statement was contained in the publication from 1969 by Janusz Wolak, Associate Professor and a longtime Head of the Department of Ecology and Environmental Protection (Forest Research Institute, Poland). Dynamics of changes in the forest environment in extremely unfavourable conditions was the basis for the genesis of term „industrial genesis desert” and the theory of industrial climax (Wolak 1968; Wolak 1969a, b).

In the Upper Silesian Industrial District within the years 1970–1975, there have been conducted joint studies by the Forest Research Institute and the US Environmental Protection Agency, which defined the nature of the forest environment degradation processes and the mechanisms that determine them (Wolak et al. 1975). This region is one of the most polluted areas in Poland, where over a century the accumulation of industrial pollution reached its maximum value in the years 1970–1980, exceeding several tens in extreme cases,

even a hundred times the permissible standards (Wolak et al. 1981).

The comprehensive and long-term studies conducted by researchers from the Department of Ecology and Environmental Protection of Forest Research Institute focused on the characteristics of the vegetation of three regions in the Upper Silesian Industrial District; namely: in the neighborhood of lead and zinc steel mills in Szopienice, Bolesław and chemical factory „Czarna Huta” in Tarnowskie Góry. The results showed the process and the dynamics of plant associations established in the deforested zone, which were formed in all types of forest habitats despite constant accumulation of air pollutants. The impact of fertility and moisture of soil determines the diversity of species composition and thus the formation of various types of plant communities of industrial genesis floristic formation. It was observed then that the shrub formations there were not only in the immediate vicinity of noxious industrial facilities but also at a significant distance from them (Wolak 1977).

For over 40 years, continuation of comprehensive studies by the Forest Research Institute relating to changes of the forest environment under the influence of emission in the Upper Silesian Industrial District and especially in Świerklaniec is an indication for the practice of foresters in preventing the negative effects of the degradation of forest ecosystems (Falencka-Jabłońska 2013).

Reclamation process with particular emphasis on the forest is an important practical action in regions exposed to industry pressure and long-term accumulation of pollution. Current status of forest reclamation in Katowice and Olkusz (Upper Silesia Region – South Poland) was the subject of field session – „Forests in industrial regions” in the II International Scientific Conference on Forestry – in the mountains and industrial areas (Forestry in the Mountains and Industrial Regions on the 65th anniversary of founding of the Faculty of Forestry in Kraków 22–23.09.2014).

Areas of long-term use of zinc–lead ores are extremely large in Europe compared with degree of soil contamination by lead and cadmium. During technological processes, flotation waste constituted up to 98% of the total processed materials. Storing them in waste tanks caused permanent degradation of soils as well as health and sanitary condition of adjacent forests in Olkusz (Upper Silesia Region – South Poland).

At the present, after-effects of unfavourable impact of industry and mining on forests can be observed in Pomorzany (Upper Silesia Region – South Poland) – landslides and deformations, flotation tanks. However, as a result of ongoing reclamation treatment for more than 15 years, there was a significant improvement in the health status of the forest, which was evidenced by significant reduction of the III and II zone of industrial damage.



Figure 1. A specialised greenhouse in tree nursery in Olkusz (Upper Silesia Region – South Poland)

Important role in reclamation process is the production of proper seedlings. In Olkusz (Upper Silesia Region – South Poland), the annual production of nursery material is 2,400,000 plants, of which approximately 400,000 is used as older seedling material. It is noteworthy that the demand of seedlings stock according to 10-year old plan for the most part is being allocated to the biological reclamation of post-industrial areas. According to the species the needs of seedlings of particular species are as it follows: Scots pine – 850,000, fir – 210,000, beech

– 150,000, oak – 45,000, birch – 15,000, larch – 5,000, the remaining species 70,000 and shrubs – 20,000 (all together 1,365,000 seedlings). Specialised nursery consists of seven greenhouses with of the area about 0.38 ha (fig. 1) and forest nursery (fig. 2). The average annual production of container seedlings in this nursery complex includes 40–50 tree and shrub species.



Figure 2. Tree nursery in Olkusz (Upper Silesia Region – South Poland)

While in Katowice, participants of the field session had the opportunity to look at the large-scale reclamation of forest damaged by mining. At first, there was waste tank complex „Krystyna” in Ochojec, where from 2005–2012, as part of reclamation work, was performed shape formation of the destination object (fig. 3). As a result of conducted works, there were created three hills using mining waste with height of 304–315 m. a.s.l. The target forestation was carried out by planting of seedlings of pine, birch, alder, linden, dogwood, viburnum and spindle into holes filled with fertile soil. Another target was the Mysłowice-Wesoła mine in Czułów (Upper



Figure 3. Reclamation on large-scale mining damages in Katowice (Upper Silesia Region – South Poland)

Silesia Region – South Poland) where was carried out the operation of damage reclamation on 10 ha area (fig. 4). After specialist preparation of the soil, restored was tree stand in the area of 7.5 ha. The container seedlings were used for reforestation, for example, annual Scots pine seedlings and biennial plants of deciduous trees species. Forest roads were reconstructed, and forest plantations were established and protected against grazing by animals using wire netting fence. There were left corridors to allow movement of animals.



Figure 4. Field session of conference participants and representatives of the Forest Service on the reclamation area after coal extraction

The effect of long-term effective management by foresters in Silesia is evidence that their work and land reclamation treatments are a practical example of the

famous statement of Professor Walery Goetl *what the industry has spoiled man should to fix...*

REFERENCES

- Falencka-Jabłońska M. 2013. Zmiany ekosystemów leśnych w zasięgu oddziaływania Elektrowni „Kozienice” – synteza 40-letnich badań interdyscyplinarnych. *Prace Instytutu Badawczego Leśnictwa. Rozprawy i Monografie*, 20, 1–304. ISBN 978-83-62830-19-0.
- Łuczkiwicz W. 1922a. Kilka słów o szkodach dymowych w okolicy Katowic. *Sylvan*, 40 (8/9), 195–198.
- Łuczkiwicz W. 1922b. Wpływ dymów fabrycznych na drzewostany. *Sylvan*, 40 (6), 131–137.
- Łuczkiwicz W. 1922c. Wpływ dymów fabrycznych na drzewostany. *Sylvan*, 40 (7), 160–164.
- Wolak J. 1968. Industrioklimaks a las. *Sylvan*, 112 (5), 67–70.
- Wolak J. 1969a. Wpływ emisji przemysłowych na las. Metodologiczna podstawa badań. *Sylvan*, 113 (4), 27–33.
- Wolak J. 1969b. Industrioklimaks, nowe pojęcie w teorii sukcesji. *Ekologia Polska, seria B*, 15(1), 41–44.
- Wolak J. 1977. Relationship between increase in air-pollution toxicity and elevation above ground. IBL, Warszawa.
- Wolak J., Harasymowicz M., Sienkiewicz J., Anders J. 1975. Opracowanie zasad zagospodarowania terenów leśnych na obszarach objętych oddziaływaniem przemysłu. IBL – scientific report.
- Wolak J., Harasymowicz M., Sienkiewicz J., Anders J. 1981. Opracowanie zasad zagospodarowania terenów leśnych na obszarach objętych oddziaływaniem przemysłu. IBL – scientific report.