

species of mammals. An example of a nature-landscape complex is also „Wielikąt” spreading over the area of 637 ha in the Lubomia parish (Rostański, 1997). It was established to protect a fishpond complex and local fishing business, preserving stations of rare species of birds at the same time.

### Conclusions

Being heavily degraded, the region of GOP is becoming an interesting object of research works. Flora and fauna have been catalogued in different points of the region since 1980s. It enabled to discover areas that are new from the natural point of view; they are often recultivated and submitted to the protection scheme. These are natural-landscape complexes like: pond complex Szopienice – Borki in Katowice, valley of the River Brynica with ponds, old riverbeds and park areas in Czeladź, water reservoir in Kozłowa Góra with a park in Świerklaniec, inter-forest meadows, river and ponds in Pniowiec and Strzybnica near Tarnowskie Góry. It should be emphasised that some of protected water reservoirs lose their qualities and are removed from the register of protected areas. For example, this is what happened to a sanctuary of water fauna in Paruszowiec near Rybnik, where, after the pond had been silted up and then purified, the protected species – *Trapa natans* – died out. This example demonstrates the great dynamism of changes within the reservoirs and their durability which is often quite short. Thus, it is very important to keep on monitoring the reservoirs in order to protect them from losing their unique features.

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## Forest Phytocoenosis of Upper Silesian Industrial Region in the Light of Antropoppression

Описується екологічний стан лісів горного регіону Сілезії в Польщі. Промисловий розвиток в цьому районі, пов'язаний з видобутком корисних копалин, значно вплинув на фауну лісів, на їх атмосферний і геологічний стан. Автор акцентує увагу на необхідності створення заповідників в цьому регіоні, оскільки саме лісові ресурси є захисними проти забруднення ґрунтів, формують сприятливі кліматичні умови, усувають можливість загибелі багатьох видів рослин і тварин.

Trees create a forest – this is an evident truth for each one of us. How many trees do we need to be able to call them forest but not a group of trees or the stand densities? And what except them create forest? The answer is simply. It must be a stand density significantly high to influence on soil and climate. In forest the mutual interacting between soils, vegetations and air can be observed. In our natural conditions the main feature of forest formation was strong natural expansion territorial and ability to renew its own system in normal succession. For the time being this ability is sometimes called in question (Szujewski, 1995). For ages, forests had been subject to strong exploitation, and their area grew reduced very quickly in Poland. The very first who gave attention to the necessity to keep in other words protect forests was Krzysztof Kluk. In XVII century Stanisław August Poniatowski, the



king published a Study treating about protection of forests and their farm implements.

At present woodiness in Poland amounts about 35%. The state of woodland preservation and the shape of forest stand are differentiated - from very well kept to factorial degraded. Most of the last mentioned appears on Silesian Upland, on the area of Upper Silesian Industrial Region (GOP). On this area the territorial deforestation took place already in Middle Ages (regions of Tarnowskie Gyry and Bytom). At those times wood was captured intensely to satisfy the ore mining, lead and silver metallurgy and forging. At the turn of XVIII and XIX centuries there occurred the development of metallurgy on Upper Silesia. In connection with metallurgy being in need of coal, logging was intensified (mostly beech, oak and alder). The XIX century brought up increase of population therefore enlarged the need of ground under cultivation and colonization. In spite of introductions of monoculture of pines and spruces, quickly growing species, the deforestation would surely be accomplished at that time without the appearance of alternative source of energy - coal. Nevertheless the 20<sup>th</sup> century is not free from cutting out of forests. At the cost of forests – transportation is developed i.e. railway and motor infrastructure, gas supply and water supply (Wika, 1999). Besides that USIR (GOP) became the centre of heavy industry in the country. It caused a new threat for forest complexes. Nowadays there shall be included to anthropogenic reasons of forest formation damage on the area – pollution of air and soil by industry and traffic, disturbance of hydrology, badly run forest economy (introduction of monocultures), contamination with waste material (illegal dumping areas). Nowadays the surface of forests of Upper Silesia carries out about 188,000 ha. Among which there are 161,104 ha in zones danger for emission of dust and gases. Greatest forests appear around Pszczyna, Rybnik, Lubliniec, Bukowno and Olkusz. The highly afforested cities are Kuźnia Raciborska, Bukowno, Ogrodzieniec and Tarnowskie Góry. The most devastated forests are found near Katowice, Brynek and Świerklaniec (I degree of damage).

Dangerous for plants are first of all dusts contained in air, which are among others magnesit, cement, carbonic, containing lead, zinc, cadmium compounds and gases. The most noxious is sulphur dioxide, then nitrogen oxides, fluorine, and chlorine compounds and hydrogen sulfide. Trees do not react in the same manner on given pollution. For instance the most resistant on sulphur dioxide are European larch, common pine, common spruce, common fir. Among deciduous trees the sycamore, black alder, European white birch, asp, leaf stalk and red oaks, **ruby acacia** characterize with

comparatively high resistance. One can also observe dependence between resistance of tree and its age – the younger the more resistant (Wika, 1999). Traffic, especially motor traffic, has very unfavourable impact upon health of forest phytocoenosis. USIR (GOP) has a very well developed net of motorways. Their average density equals 170 km / 100 km<sup>2</sup>, and is one of the highest in the country. The content of impurities and fumes increases decay of oxygen molecules by ultraviolet light radiation. Oxygen released then reacts with „common” oxygen forming ozone. This form of oxygen is poisonous for plants and animals (Reichholz, 1999). Damages of forest stand were divided into three kinds depending on emission intensity and time of its activity (Wika, 1999).

**Tab. 1. Kinds of forest stand damages**

Kind of	Symptoms	Reasons
Latent	Not visible with naked eye	Low dosage in short period of time
Chronic	Decolourization of leaves in consequence of loss of chlorophyll, local atrophy of leaf	Low dosage in long period of time
Peracute	Trees drying up, whole forest stands dying out	High dosage in short period of time

Man polluting air contributed also to forming of acid atmospheric falls. In result of acid rains wax layer covering leaves of trees is damaged, mineral substances are washed out, tissues (leaves drop prematurely), roots, seeds (their germination is disordered and also growth) are injured. There follow acidifying of soil, activation of heavy metals, disturbance of water balance, decay of plants. Pollution of environment contributes both to mechanical damages of plants and to decrease of their survival abilities. Increment of plants slowed down is a frequent symptom of excessive pollution of air with dust and gases. Such a situation can be observed in forests of USIR (GOP) in seventies. And its effects are visible in crowns of trees today. Places, in which there did not occur increment, are clearly visible. The high quantity of pollutions was also emitted at the beginning of eighties. For example the average annual concentration of sulphur dioxide in 1982 in amount from 32 to 64 microgramme fell on 83,3 % of the surface of the area of Katowice Voivodship (Province) when allowable annual concentration equaled 32 mickrogrammes (data gained from Province Epidemic and Sanitary Station {Wojewodzka Stacja Epidemiologiczno-Sanitarna}).

It is also worth to turn attention to characteristic in our area troubled rock mass as a result of exploitation of coal. As a consequence water relations are often disturbed. Many grounds become swamped there are being formed even new water reservoirs (e.g. „Żabie Doły” around Bytom and Chorzów region). In other places there follows lowering of ground waters level, what causes soil drying. As a resultant of mining activity there comes mining subsidence. Formed subsiding troughs are often filled with water (e.g. ponds in Czulów). All these changes influence negatively forest systems standing in the region.

There should be mentioned the irregular forest economy in past, which results have to be dealt up to now. By implementation of monocultures men made forest phytocoenosis more susceptible to unprofitable natural factors, such as secondary gradations of pests, droughts, low temperatures than healthy phytocoenosis. The higher grade of deformation the lower resistance. Decrease of resistance is also influenced by forest formed in monocultures (pines, spruces). Fires of monoculture fosters usually burn on big areas, as an example there can be taken Kuźnia Raciborska, where was burnt down 9,000 ha of forest. More over less biovariety causes the whole population to be less resistant, because it reacts in the same way on various threats.

In relation with such a large threat and in aim to protect of already existing forest formations there were founded a number of sanctuary forests on Silesian Upland. Those are among others **Las Murkowski** (*Luzulo pilosae - Fagetum*), **Ochojec** (*Circaeo - Alnetum*), **Segiet** (*Tilio - Carpinetum*), **Góra Chelm** (*Dentario enneaphyllidis - Fagetum*), **Smoleń** (*Ribo nigri - Alnetum*), **Hubert** (*Circaeo - Alnetum*), **Rotuz** (*Sphagno squarrosi - Alnetum*). Most of those forest sanctuaries are very unfavourably situated. There are 22 big industrial factories placed near them. The biggest are: Chemical Factory (Zakłady Chemiczne) „Hajduki” in Chorzów, Katowice Steelworks (Huta Katowice) in Dąbrowa Górnicza, Power Plant (Elektrownia) „Rybnik”, Power Plant (Elektrownia) „Siersza” in Trzebinia, Zinc Plant (Huta Cynku) in Miasteczko Śląskiw. According to investigations those 22 factories emitted 47,000 tons of dusts and 49,000. Tons of gases in 1994 (Public Inspection for Environment, 1995). In consequence there were investigated the content of heavy metals in soil of sanctuaries of former Katowice Voivodship. The highest content of cadmium was noticed in following sanctuaries: Segiet – about 24 microgrammes per one gramme of airy dry soil, Góra Chelm – about 18, Smoleń – 12, Ochojec – 8, the highest content of lead were found in Segiet – about 200 microgrammes per one gramme and Góra Chelm –

over 150. Summing up the following sanctuaries – Segiet, Smoleń, Góra Chelm and Ochojec are considered to face overflow of allowable annual concentration of heavy metals. The rest of sanctuaries were recognized to be in less menace.

However it is optimistic that the emission of detrimental dust and gases on the area of Upper Silesian Industrial Region considerably decreased last years.

**Tab. 2. Emission of industrial impurities (1992-1997)**

Impurity	Quantity 1992. (thousand tons a	Quantity 1997. (thousand tons a
Dust	127,1	70,4
Gas	738,1	607,5
<b>Including:</b>		
Sulphur dioxides	366	268,2
Carbon oxides	213,3	162,4
Nitrogen oxides	144,9	109,6
Hydrocarbons	11,9	4,6

Analyzing the table above there must be noticed that from 1992 to 1997 the quantity of gas and dust impurities decreased significantly. The decrease was reflected in reduction of the surface of forest stands under industrial emission.

**Tab. 3. The area of forest stands under influence of industrial emission**

Danger zone	1977 r. in thousand	1987 r. in thousand.	1997 r. in thousand
I	44,3	70,2	50,1
II	61,3	76,5	105,8
III	12,5	14,7	5

It can be noticed that the area of forest complexes in II Danger Zone increased. However their area in III Danger Zone, the strongest subject of pollution, decreased almost twice. It is connected with shutting down a lot of industrial plants, limitation of production and with concrete activities to protect environment.

Forest complexes form landscapes, protect soil against impoverishment of soil, influence climate, support many sorts of plants and animals. Trees, although long living, come into reaction with pollution quicker than any other living organisms. The reason is simple. Every day they have to filter huge quantities of air to hold carbon dioxide indispensable for photosynthesis. In time they gather many danger substances. A 150-year-old beech with a well-developed crown receives about 1 ton of dust molecules from air. After 150 years it has to overcome about 60 kg / m<sup>2</sup> of dust. If technical filters were to face

such a load there would be plugged for a long time. Trees thanks to leaves and stalks exchange have high ability for regeneration. More over they produce oxygen in photosynthesis. They are indispensable for human lives. Let us not demolish them with our own actions. They are to be indispensable for future generations not less than for ours.

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## Diversification of atmosphere dustiness and acidification of fall waters on the area of Silesian Upland

Аналізується рівень атмосферної забрудненості і окислення опадів регіону гірної Сілезії і деградаційний вплив цих факторів на антропогенну ситуацію в регіоні. Для аналізу використовується гідрометричний метод дослідження. Автори роблять висновки швидкого зростання рівня забрудненості і окислення водних опадів за останні 10 років і вважають терміною необхідністю розпочаток гідргеохімічних процесів для попередження розвитку цих явищ.

Measurements of fall of dust are of common practice in the whole world both in industrial and municipal centres. To determine dust fall is to collect dust falling in air to sedimentary vessels and then quantity of dust is determined with gravimetric methods. In selected points of investigated area, sedimentary vessels (there had been used Weck's jars up to Jan 15<sup>th</sup>, 1998, which then were replaced by plastic containers) are placed in special outriggers at the height of 3 – 3,5 m on the first day of

calendar month. Exposition time lasts one month. Currently there are 787 measuring points of dust fall within the borders of Silesian Voivodship (Province).

Phase composition of atmospheric dusts comes from the measurements. There were determined main components that prevails in dust (from several to dozen of percentage of volume in reference to each phase) and appliance components met rarely. Quartz, calcium sulphates (bassanite, gypsum), aluminosilicate phases with different content of K, Fe, Ca, Ti, Mg are included to main components. The following of main components are soot, fly-ash, graphite, iron oxides (hematite, magnetite, wüstyt) and calcite (Jabłońska, 1999).

Dust fall was a very serious problem especially of seventies when measurement values were over 500 g/m<sup>2</sup> annually. Here and there they even crossed the threshold of 2000 g / m<sup>2</sup> annually (Fig. 1). These concerned mostly the centre of Upper Silesian Industrial Region. In residual parts of USIR (GOP) the average fall was within the range from 250 g / m<sup>2</sup> annually to 500 g / m<sup>2</sup> annually. In the first half of eighties investigation provided in Katowice showed that results exceeded allowable limits in the prevailing area of the region. The map of dust fall in Katowice province showed improvement of aerosanitary in the second half of eighties. In spite of the situation having been continuously the worst in USIR (GOP), especially in its centre values did not exceed 850 g / m<sup>2</sup> annually. The basic improvement occurred in nineties (especially in their second half) when top level of values received equalled only 200 g / m<sup>2</sup> annually and was adequate to compulsory standards. The average maximal values of dust fall equalled:

- in period of 1970 – 1979 – 1779 g / m<sup>2</sup> annually
- in period of 1980 – 1989 – 945 g / m<sup>2</sup> annually
- in period of 1990 – 1998 – 372 g / m<sup>2</sup> annually

In analysis of dust concentration there were used the results of measurements performed in 31 measurement stations in general.

The beginning of eighties characterizes with high level of suspended dust in the whole voivodship

