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POSTER

THE EXAMINATION OF THE AIR POLLUTION CAUSED BY VEHICLE EXHAUST EMISSIONS IN THE FOREST ECOSYSTEM OF ŚWIĘTOKRZYSKI NATIONAL PARK

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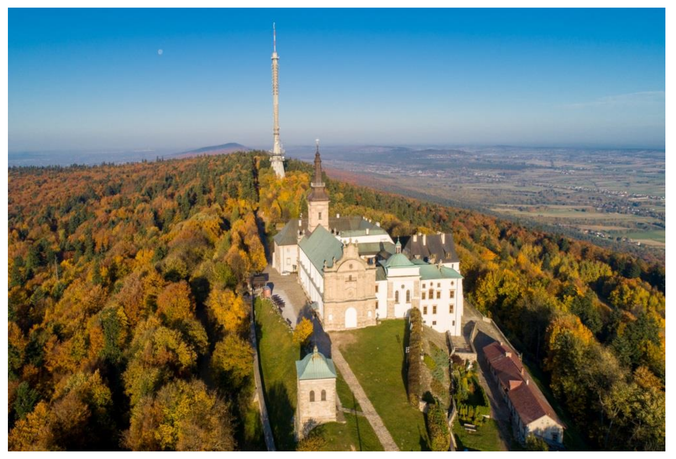
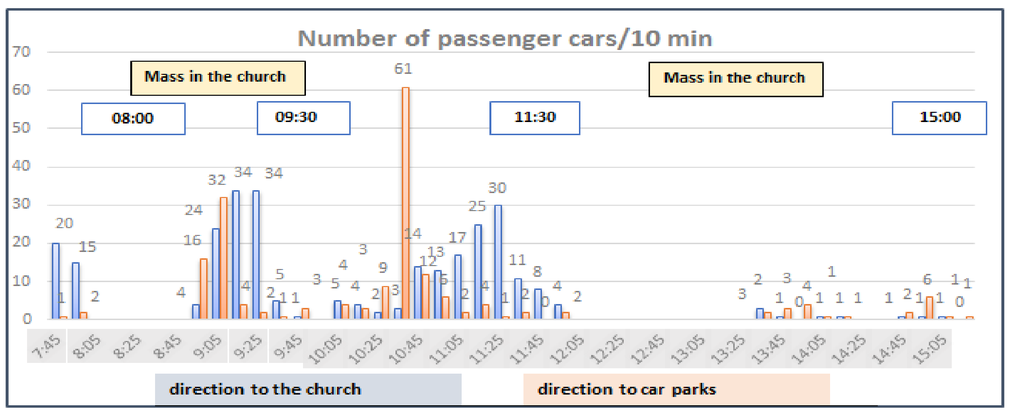


1. Introduction

The forest ecosystems of Świętokrzyski National Park (ŚNP) constitute 95% of the Park's unique natural potential. In the period of 2019-2020, the research studies regarding the impact of anthropopressure on functioning of the forest ecosystems within ŚNP were conducted. These research studies, to some extent, considered the proces of the analysis in the range of the impact **of traffic-related air pollution. It included the examination of the emitted pollutants within a distance of 2.3 km of the district road No. 0324T from the entrance gate to the Park up to the plateau of Holy Cross. The variation in the relative height of this section reaches 95.4 m and it is situated entirely on the western slope of Łysiec (Holy Cross - 594.3 m above sea level). It is primarily used by the vehicular traffic (cars, coaches, motorcycles, electric railway, bicycles) and pedestrian traffic**.

2. The specific objectives of the research studies – part A

- **the fixed monitoring of concentrations of the selected gaseous and particulate compounds and heavy metals at three measuring points located at the foot of the road and in its middle and final sections,**
- **periodic measurements in the range of the mobility of people, including their methods of moving,**
- **the calculation of emissions CO_2,**



Methodology for calculating CO2 emissions on a 2.5 km road section

Car fuel mass [kg/2,5 km, car]

↓

Mass and volume CO2 [kg/(2,5 km, car)]; [dm3/(2,5 km, car]

↓

The sum of the mass and volume of CO2 [kg/2,5 km]; [dm3/(2,5 km]

Fuel	Daily traffic volume [car/day]	Daily emission [kgCO2/day]	Annual emission [kgCO2/year]
Gasoline	221	115	7024
Diesel	196	70	4250
LPG	73	30	1837
Sum	490	215	13112

3. The specific objectives of the research studies – part B

- **the calculation of emissions (CO, NOx, PM) generated by motor vehicles, taking into consideration their age and type structures**,

Year of car production4.	EURO standard	Car share [%] depending on age
2019	6	6.0
2018	6	3.4
2017	6	3.1
….	….	….
2011	5	3.7
….	….	….
2000	3	6.5

Structure due to power supply and age of passenger cars

Car share [%] due to fuel		
Motor gasoline	Diesel	LPG
45	40	15

Methodology for calculating CO, NOx, PM emissions on a 2.5 km road section

Permissible unit emission value according to EURO standards [g/(km, car)]

↓

Value of the unit emission on the road length of 2.5 km [g/(2,5 km, car)]

↓

The sum of the emissions for the car stream [g/2,5 km]

Manufa-ctured after date	EURO Stan-dard	Diesel			Motor gasoline	
		CO	NOx	PM	CO	NOx
I 2000	3	1.6	1.25	0.125	5.75	0.375
I 2005	4	1.25	0.625	0.0625	2.5	0.2
IX 2009	5	1.25	0.45	0.0125	2.5	0.15
IX 2014	6	1.25	0.2	0.0125	2.5	0.15

Intensity of car traffic	CO	NOx	PM
64 [car/10min]	172	27	2
490 [car/day]	1.3 k	0.21 k	0.01 k
29890 [car/61days]	80.1 k	12.5 k	0.75 k

4. The specific objectives of the research studies – part C

- **estimations of CO concentration distribution in the cross-section of the road considering the intensity of the vehicle traffic, the distance from the centre of the road, the height above ground level and the prevailing weather conditions.**

Road and weather conditions

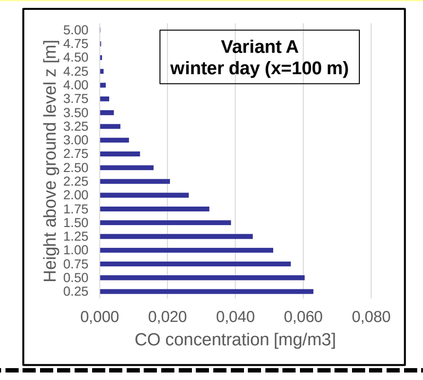
	Variant A winter day	Variant B summer day
Intensity of car traffic	384 [car/h]	
Efficiency of the equivalent linear emission source mL	0.12 [mgCO/(m, s)]	
Wind speed U	1.0 [m/s]	2.0 [m/s]
Dispersion coefficient σZ (distance x=100 [m])	1.5 [m]	7.9 [m]

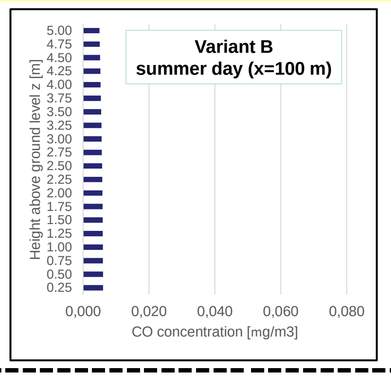
A simplified model of Pasquill - Gifford

$$C(x, z) = \frac{2 \cdot m_L}{U \cdot \sigma_z \cdot \sqrt{2 \cdot \pi}} \cdot \exp\left[-\frac{1}{2} \cdot \left(\frac{z}{\sigma_z}\right)\right]^2$$

where:

C (x, z) - concentration of a given gaseous pollutant [g / m3] as a function of distance from the road x [m] and height from the road surface z [m]





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