University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca,
Mănăştur 3-5, 400372 Cluj-Napoca, Romania

Climatic changes indicators, useful tools in emphasizing tree physiological disorders
Note 1. Testing the influence of total nitrogen from environmental air upon ornamental trees health status

Antonia ODAGIU, Ioan OROIAN*, Tania MIHAIESCU, Ilie COVRIG

6th CASEE conference "Latest Trends in Bioeconomy in Danube Region"
24th – 26th May, 2015
Slovak University of Agriculture in Nitra, Slovak Republic

Introduction

Report of the Intergovernmental Group on Climatic Changes

http://www.apmcluj.ro 9

In last five decades, the yearly temperature increased, in overall, by 0.90 ºC.

CO emissions increased by 80% during 1970 – 2004. 28% of this share is the result of increasing reported for the time interval 1990 – 2004.

Sea level - an average increase of 1.80 mm/year, 1993 – 2004 3.10 mm/year.

CH_4, CO_2, N_2O, HFCs, PFCs and SF_6

70% increase 1970 - 2004,

28% 1990 – 2004

Expectations - an average increase in annual mean temperatures compared to the period 1980-1990.

0.5 °C - 1.5 °C 2020 -2029

2.0° C - 5.0° C 2090-2099

1951 – 2011

Ascendant evolution of temperature - 0.5 °C

Ascendant evolution of precipitation regimen – 100 mm

University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca,
Mănăştur 3-5, 400372 Cluj-Napoca, Romania

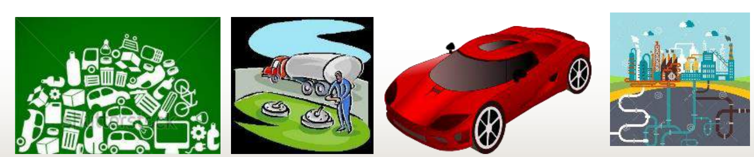
Introduction

Sources of greenhouse gases - CO_2, N_2O, and CH_4 (CO_2 equivalent) - in Cluj – Napoca

CO_2 — 67.45%

N_2O Nitrous oxide — 0.83%

CH_4 Methane — 31.72 %



Introduction

Ornamental trees

Well-known beneficial effect on air quality.

Physiological diseases of trees used as ornamental in populated towns increased.

The gravity of disorders depends at great extent on tree species, because they have different resistance against pollutants, and also on season.

Air pollutants

Tolerance of ornamental trees from urban agglomerations

Methodology of different pollutants identification in their leaves, needles and other vegetal tissues.

The importance and opportunity of using trees as environmental pollution bioindicators.

N_2O

Opportunity of simultaneously monitoring N_2O pollution, and physiological disorders it produces in urban ornamental trees.

Introduction

Testing the interrelations between a climatic change indicator N_2O and health status of three species of ornamental trees, *Aesculus hippocastanum*, *Pinus nigra*, and *Tilia cordata*, respectively

Aim

Material and Method

46º46’0’’N, 23º36’0’’E

Monitoring point ➡ N-W

CO_2

CH_4

N_2O

Tilia cordata

Pinus nigra

Aesculus hippocastanum

Kjeldahl method
(AOAC, 2001)

Center of Advanced Research for Supplying Life Quality and Environmental Protection
University of Agricultural Sciences and Veterinary Medicine Cluj – Napoca.

Results and Discussions

Table 1: Basic statistics for climatic parameters by monitored period, April – October 2014, in experimental area

Issue	Temperature (ºC)	Humidity (%)	Wind velocity (km/h)
N	214	214	214
Mean	16.06	70.59	19.85
Minimum	3.00	49.00	14.20
Maximum	28.00	94.00	25.80
Standard error of mean	4.66	0.69	0.21
Standard deviation	0.32	10.04	2.99
Variance	21.68	100.90	8.94
Coefficient of variability	28.99	14.23	15.06
Skewness	0.31	0.27	0.18
Kurtosis	0.20	0.34	0.98

Results and Discussions

Table 2: Basic statistics for main greenhouse gases with potential greenhouse effect – PGE (CO_2 equivalent), by monitored period, April – October 2014, in experimental area

Issue	PGE - CO_2	PGE - N_2O	PGE – CH_4
N	214	214	214
Mean	76.39	4.15	19.46
Minimum	57.22	0.06	0.04
Maximum	99.90	16.66	31.74
Standard error of mean	1.31	0.48	0.86
Standard deviation	16.55	7.04	12.66
Variance	273.90	49.56	160.02
Coefficient of variability	21.66	170.46	65.12
Skewness	0.54	2.18	1.05
Kurtosis	0.45	4.78	0.23

Results and Discussions

Table 3: The regression analysis for CO_2, N_2O and CH_4 emissions and wind velocity, by monitored period, April – October 2014, in experimental area

Issue	R	R^2	Regression line	p
CO_2 - wv	+0.897*	0.805	Y = - 35.519 + 0.897X	0.038
N_2O - wv	0.436^{ns}	0.519	Y = + 6.681 - 0.436X	0.298
CH_4 - wv	+0.933*	0.871	Y = + 35.519 - 0.933X	0.020

Note: ns – $p > 0.05$, * - $p < 0.05$.

Results and Discussions

Table 4: Basic statistics for NOx emissions by monitored period, April – October 2014, in experimental area

Issue	NO_X (µg/cm^3)
N	7
Mean	43.50
Minimum	30.90
Maximum	55.90
Standard error of mean	3.82
Standard deviation	10.13
Variance	102.66
Coefficient of variability	23.29
Confidence – 95%	32.87
Confidence + 95%	54.13
Skewness	0.20
Kurtosis	1.77

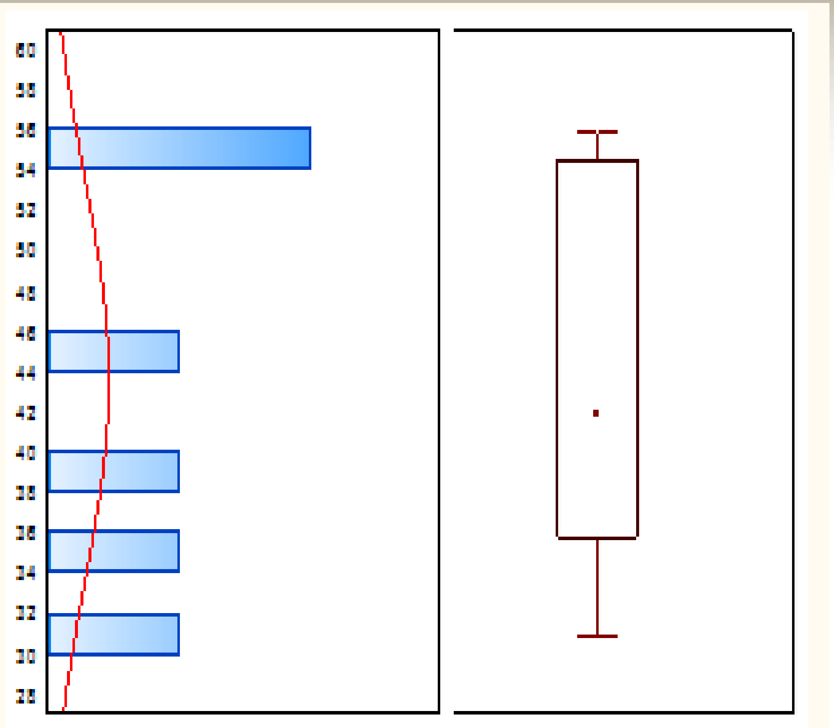
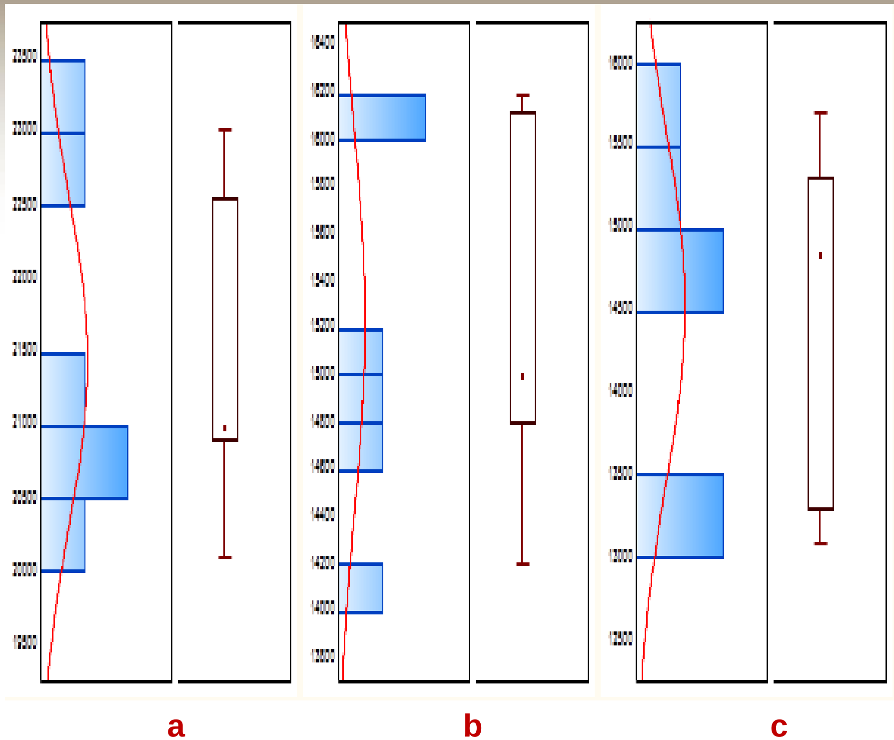


Figure 1: The histogram of NOx emissions by monitored period, April – October 2014, in experimental area

Results and Discussions

Table 5: Basic statistics for nitrogen content in tree leaves (ppm) by monitored period, April – October 2014, in experimental area

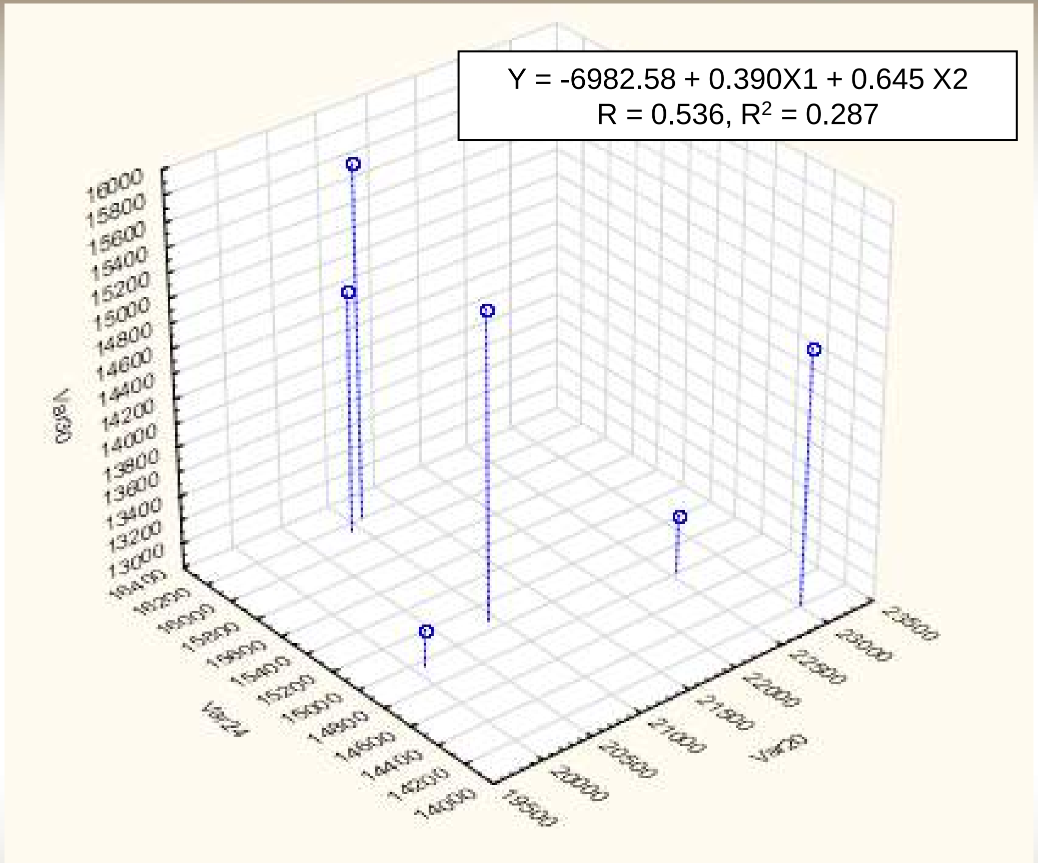
Issue	Tree specie		
	Tilia cordata	Pinus nigra	Aesculus hippocastanum
N	105	105	105
Mean	21429.83	15221.17	14518.50
Minimum	20100.00	14200.00	13100.00
Maximum	23018.00	16200.00	15700.00
Standard error of mean	108.56	76.58	104.62
Standard deviation	1112.76	784.95	1072.36
Variance	1238224.97	616149.77	1149965.50
Coefficient of variability	5.19	5.16	7.39
Confidence – 95%	20262.07	14397.41	13393.12
Confidence + 95%	22597.60	16044.92	15643.88
Skewness	0.59	0.31	0.59
Kurtosis	1.14	1.30	1.68



Note: a – *Tilia cordata* b – *Pinus nigra* c – *Aesculus hippocastanum*

Figure 2: The histograms of nitrogen content in leaves of the analyzed ornamental tree species s by monitored period, April – October 2014, in experimental area

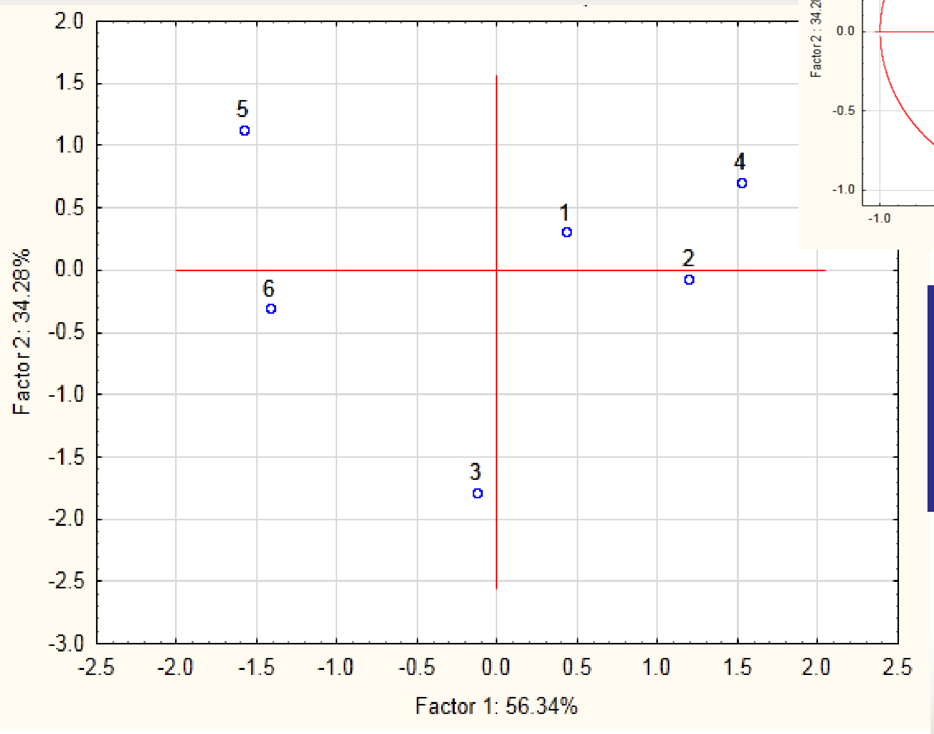
Results and Discussions

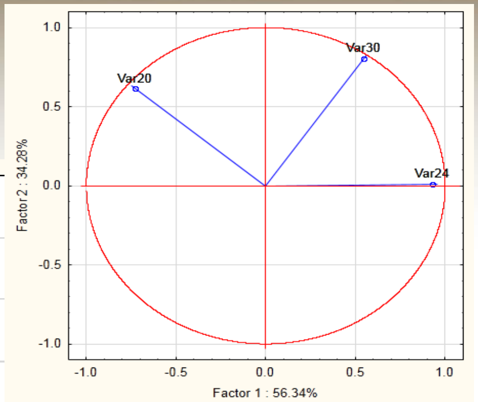


Note: Var 20 – *Tilia cordata*;
Var 24 – *Pinus nigra*;
Var 30 – *Aesculus hippocastanum*

Figure 3: The response area pattern of N content in leaves of the analyzed ornamental tree species, April – October 2014, in experimental area

Results and Discussions





Issue	Eigenvalues of correlation matrix			
	Eigenvalue	% Total variance	Cumulative Eigenvalue	Cumulative , %
30	1.690111	56.33705	1.690111	56.3370
24	1.028263	34.27544	2.718375	90.6125
20	0.281625	9.38751	3.000000	100.0000

Note: **Var 20 – *Tilia cordata*;**
Var 24 – *Pinus nigra*;
Var 30 – *Aesculus hippocastanum*

Figure 4: The Principal Components Analysis (PCA) applied to monitored ornamental tree species, April – October 2014, in experimental area

Results and Discussions

The tree species used in our study developed different behavior against nitrogen, exhibiting physiological disorders function of nitrogen concentration. The most sensitive is *Aesculus hippocastanum*, while *Tillia cordata* has the lowest sensitivity.

The most important contribution factor, expressed as as PGE, CO_2 equivalent, to climatic evolutions in Cluj - Napoca, is carbon dioxide (78.18%).

Strong correlations emphasized between carbon dioxide and methane expressed as PGE, CO_2 equivalent, and climatic conditions indicate necessity to contribute to their lowering, in a manner aligned to national policy and National Strategy Agenda of reducing GHG.

Further research is needed in order to emphasize the real retention rate of nitrogen from nitrogen protoxide in vegetal tissues of the analyzed tree species.