



**MESAEP**

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of Environmental Protection

**20th International Symposium on  
Environmental Pollution and its Impact on Life  
in the Mediterranean Region**

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## **20<sup>th</sup> International Symposium on Environmental Pollution and its Impact on Life in the Mediterranean Region - October 26-27, 2020**

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## Foreword

The MESAEP biannual symposium on the state of the environment and its impact on the quality of life in the Mediterranean region has been established over the last forty plus years as a scientific institution in the Euro-Mediterranean basin. The 20<sup>th</sup> symposium was meant to celebrate the 40 years of MESAEP, a track record that makes MESAEP the oldest scientific society catering for the environment in the region. The main topic of the 20<sup>th</sup> MESAEP symposium was climate change, its impacts and how to adapt and/or mitigate it. Participation and interest were very large by the whole Mediterranean scientific community and beyond. And then, SARS-CoV-2 stroke.

Originally we rescheduled the Symposium from the Spring to the Fall of 2020 hoping that the pandemic would have been controlled by then; when we realized that this would not be the case we transformed the Symposium to a fully virtual event that took place on October 26-27, 2020. Participation was high this time around as well, with more than 200 papers presented in oral and poster form from across the Mediterranean. In fact, the virtual character of the 20<sup>th</sup> Symposium of MESAEP facilitated many of our colleagues to present their work and allowed us to appreciate the high level of innovative and environmentally and socially relevant work that is being done across the Mediterranean basin.

A large part of the scientific contributions of the MESAEP community to the 20<sup>th</sup> Symposium focused on environment and health questions, including environmental and health inequalities and the socio-economic determinants of exposure, as well as new and emerging technologies for environmental and health applications. A special part of the Symposium focused on climate change mitigation and air pollution abatement in the quest to explore win-win solutions to these problems. This special session was organized in collaboration with the ICARUS consortium, funded by the European Commission's Horizon 2020 framework programme for research and innovation. Other sessions of interest focused on traditional MESAEP themes, such as indoor and outdoor air pollution, water and soil pollution and control, environmental economics, policy and education and other various environmental themes. Of particular interest were sessions focusing on the circular economy and promoting the UN sustainable development goals in the region, tackling issues such as sustainable natural resource and waste management; energy, environment and sustainability; and natural and man-made environmental disasters.

The scientific contributions to the 20<sup>th</sup> MESAEP Symposium were overall of high calibre and explored very pertinent environmental and societal questions to which modern day science strives to produce a comprehensive evidence basis. Going through the abstract book you will have the chance to see for yourselves that the MESAEP community produces very relevant research results that address some of the most important questions regarding environment, sustainability and life quality in the region. Significant effort is also being made to render these findings usable by policy makers to promote evidence-based policy making in environmental and life quality protection. I hope that you will find this abstract book interesting to read and that you will appreciate the work done by scientists in the Mediterranean and the rest of Europe in this regard.



**Prof. Denis A. Sarigiannis, MESAEP President**

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# **ORAL PRESENTATIONS**

# **Environmental and health inequities – socio- economic determinants of exposure**

## **Health and climate change focus on Mediterranean region**

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The Mediterranean region is identified as the region most at risk from climate changes in Europe, due to the multiple factors that impact on it. Recent accelerated climate changes have exacerbated existing environmental problems in the Mediterranean Basin that are caused by the combination of changes in land use, increasing pollution and declining biodiversity and more in general with effect on ecosystems and on the health of the people. Rising temperatures, a significant decrease of rainfall in Southern Europe, an increase in thermal extremes, the periods of drought (medium confidence), and extremes storms are occurring frequently. Other factors include: Increased risks associated with floods, risk of loss of human life, coastal erosion and damage to infrastructure; Increased risk of water scarcity; Significant impacts on the distribution of terrestrial and marine species of animals and plants. Movement of species towards the North and at higher altitudes. High risk of local extinction in the presence of barriers to the spread of species, especially in the alpine environment. The character and severity of impacts from climate extremes depend not only on the extremes themselves but also on exposure and vulnerability.

For five broad and interconnected impact domains (water, ecosystems, food, health and security), current change and future scenarios consistently point to significant and increasing risks during the coming decades. Policies for the sustainable development of Mediterranean countries need to mitigate these risks and consider adaptation options, but currently there is a lack of adequate information — particularly for the most vulnerable southern Mediterranean societies, where fewer systematic observations schemes and impact models are based. A dedicated effort to summarize existing scientific knowledge across disciplines is underway and aims to provide a better understanding of the combined risks.

**Keywords:** human health, climate change, Mediterranean Region

## **Mercury accumulation in western Mediterranean fish. Concentration and environmental risk**

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The Mediterranean Sea is a water body in which the concentration of mercury is much higher than in equivalent marine environments. Most inputs of this metal originate from the general atmospheric fallout. However, in this semi-enclosed environment there are specific inputs of this metal that should be identified to understand. A significant proportion of Mediterranean fish devoted to human consumption is above the mercury threshold established by the European Community as suitable for human consumption. Mercury is primarily associated with muscle tissue rather than with fat which, besides oily fish, points to predatory but non-migratory fish species, e.g. lean fish, for the accumulation of this metal. The present study is devoted to determine the concentrations of total mercury and methylmercury in a great variety of lean fish species from the Western Mediterranean Sea and to determine how consumption of these specimens contribute to the total mercury intake in human populations.

1650 commercial seafood samples from the Western Mediterranean Sea were collected (Feb 2014-July 2019) in several sites such as Mallorca, Menorca, Eivissa, Alacant (Spain), Marseille (France), Genoa, Alguer, Civitavecchia (Italy). Samples from Egypt and the Atlantic Ocean (Senegal, Mauritania coasts) were also taken for comparison. Fish species were selected considering the most consumed by the population.

Comparison of the mercury concentrations in the specimens of the same fish species collected at different sites revealed where are the hot spots of introduction of the excess of this metal in comparison to the atmospheric fallout and allowed the identification of the source processes.

The fish species were grouped in three trophic levels, those feeding on plankton (first), on small fish and crustaceans (second) and on fish and cephalopods (third). A considerable number of the analyzed fish species exceeded the maximum levels proposed by the European legislation, such as dusky grouper (100% of the examined specimens), common dentex (65%), conger (45%), common sole (38%), hake (26%) and angler (15%), among others. Representation of the Hg concentrations vs. weight of each specimen from the third trophic level showed a significant positive correlation,  $r = 0.78$  ( $p < 0.01$ ).

The average THg intake due to fish consumption, 0.61  $\mu\text{g/g}$  ww, involved Hg estimated weekly intakes of 5.7  $\mu\text{g/kg}$  bw for children aged 7-12 years and 4.4  $\mu\text{g/kg}$  bw for adults. These values were higher than the provisional tolerable weekly intakes for total Hg intake recommended by FAO/WHO, 4  $\mu\text{g/kg}$  bw, 140% and 110%, respectively.

**Keywords:** Mercury, Commercial fish, Human Intake

# **Sustainable natural resource and waste management**



# **GIS-Based Approach for Determination of Sustainable Settlement Areas Suitable with Natural Environment**

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The main objective of the study is to determine the settlement areas of Seydikemer District that is not yet urbanized densely. Within this context, the database related to the natural environment of the region and existing land use was created by means of Unmanned Aerial Vehicle (UAV) and digitized in geographic information system (GIS). Land cover is classified by using Random Forest (RF) and Maximum Likelihood Classification (MLC) methods for Remote Sensing (RS). The natural environment properties of the area have been determined based on the obtained classification, the criteria for the suitability of the settlement areas have been defined by the Multi-Criteria Decision Analysis (MCDA) and Analytic Hierarchy Process (AHP). Natural suitable structure of the research area was carried out with weighted overlay technique. As a result of the analysis; It was determined that 16.02% of the survey area is suitable for use as a settlement area, 69.01% is moderate suitable for use as a settlement area, 14.97% is not suitable for use as a settlement area. As a result of the analysis of settlement areas compatible with the natural environment in existing rural and urban settlements, 13.51% of the existing rural settlements is found to be suitable, 61.84% is moderately suitable, and 24.65% is located in areas not suitable for settlement. 7.03% of the existing urban settlements is found to be suitable, 68.12% is moderately suitable and 24.85% is located in areas not suitable for settlement. Consequently, that the region is in a rapid urbanization process, it is foreseen the findings obtained from the study will make a significant contribution to the future settlement plans of the city in use of lands.

**Keywords:** Land use planning, Multi-Criteria Decision Analysis (MCDA), Sustainable settlement, Unmanned Aerial Vehicle (UAV), Geographical information systems (GIS)

# **GIS Based Ecological Sensitivity Analysis of Fethiye Göcek Sepa, Turkey**

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Fethiye-Göcek SEPA (Specially Environmental Protected Area), which is located on the Mediterranean coast, has been under the effect of intense tourism and urbanization in recent years. These pressures have led to changes in the natural fabric of the region. Especially due to the rapid progress of urbanization movements in the region, natural resource values have started to be destroyed. The aim of the study was to determine the ecological sensitivity of the region by spatial analysis of GIS. Firstly, data on natural resources including topography, soil, hydrology and land cover were evaluated. Land cover data were obtained from Landsat satellite image. The data obtained were transferred to GIS medium and digitized by geographical reference. Ecological sensitivity criteria were determined using MCDA and AHP techniques. The determined criteria were integrated into the digital maps and the areas with ecological sensitivity were determined on the spatial scale using weighted overlay analysis in GIS environment. As a result of the analysis, it was found that 7275 ha (15.45%) of the region have low degree, 22315 ha (47.38%) have moderate level, 17510 ha (37.18%) have high level of ecological sensitivity. Although the area is a protected, tourism and urbanization movements are still continuing in the region. For this reason, regions with high ecological sensitivity should be protected with absolute protection zone. The information and results obtained from the study are likely to be sources of spatial planning at various levels, particularly in tourism and urban planning. This study has been produced from the dissertation on Evaluation of Land Use Changes in Fethiye-Göcek Special Environmental Protection Area within the Scope of Ecological Planning.

**Keywords:** Ecological Sensitivity, MCDA, AHP, CBS, Fethiye-Göcek SEPA/Turkey

# **A GIS-based, sustainable, smart waste management system for urban areas: Municipality of Beykoz Case**

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This study proposes a new generation, GIS-based, sustainable smart waste management system for improving the quality of life in urban areas. The rapid increase of waste and surplus material for citizens in urban areas turns into complex problems with the rapidly increasing population. Also, when urban cleaning needs are added to those problems, it becomes very difficult for municipalities to manage these requirements. Records of environmental operations carried out with traditional waste management systems in urban areas are progressing through printed documents, but problems arise in their follow-up, control and traceability. For example, the accuracy of the waste and cleaning data collected with printed forms depends entirely on the initiative of the staff filling the form, but it is difficult to detect in any mistake. Similarly, waste notifications that remain only across the field team can escape the supervision of administrative supervisors. Those services are tried to be based on concrete data enough, reaching realistic data in the current situation requires a long process and performance. Field notifications, demands and complaints that are not dependent on the location and that do not involve any visual return pose an obstacle to preventing environmental pollution. Therefore, if these problems cannot be removed with effective solutions, environmental pollution in urban areas increases significantly, recycling efficiency is weakened, thereby decreasing the quality of life in cities. In this proposed system, an integrated online Geographic Information System has been created fed from instant data on urban waste management and urban cleaning services. This system contains a GIS web portal accessible to citizens instantly, a spatial management panel and spatial visual reporting tools for decision-makers. With this system, waste management and cleaning services were developed by informing the public and other stakeholders and encouraging their active participation in demand management. With the help of GIS, that enable presenting of an urban service electronically, collection of solid wastes with high efficiency was ensured as a result of optimization of vehicle routes, container needs and distribution, travel times. In this study, In order to determine the attribute information about the components that are important in waste management and cleaning services, “field data collection” was purchased as a service from an external company and field studies were carried out first. Next, a questionnaire with 948 citizens from 45 neighborhoods, including approximately 20 citizens from each neighborhood, was conducted by a survey team of engineers. With this survey, statistical data such as waste types generated by citizens, waste discharge frequencies, average waste amounts per household were collected. Thereafter, GIS infrastructure has been put up by providing the necessary hardware and software for storing the obtained data in relational database, processing it in GIS and accessing it from the web. The Information on waste management and cleaning services and all components that matter are then transferred to the established GIS infrastructure. The proposed system is implemented in “Municipality of Beykoz” – Istanbul, Turkey.

Experimental results indicated that integration of GIS-based software into urban services and the use of up-to-date and accurate data in waste management outperformed other traditional waste management

and cleaning systems, providing an effective solution in determining the needs of the region, in addition, a significant increase has been achieved in service speed and efficiency. As a result of optimizations using GIS, site-related field operations have been made sustainable, measurable, analyzable, auditable and improvable.

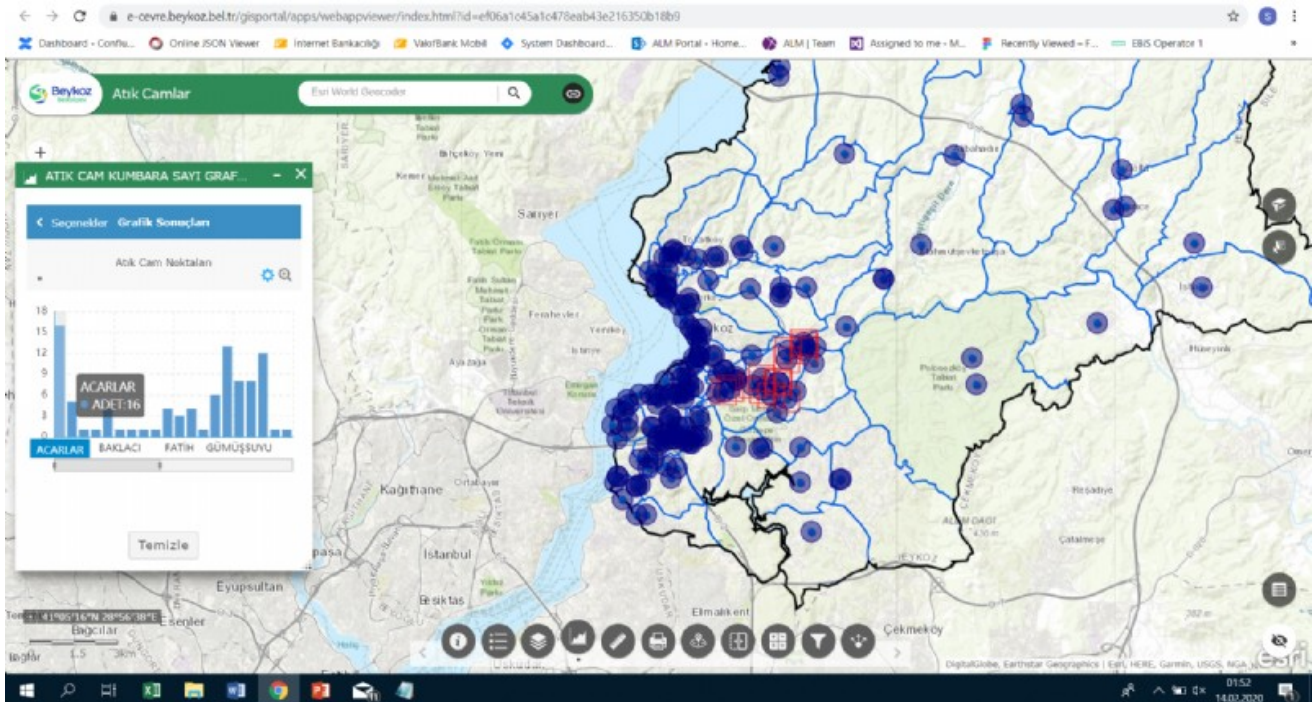
**Keywords:** Environmental pollution, GIS in municipalities, sustainable waste management, recycling, buffer analysis

### **Buffer\_analysis**



*Buffer analysis of containers*

### **Waste glass container in selected region**



*waste glass container region by region*

# **Evaluation of recycling in the municipality of West Macedonia in Greece**

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The exponential population growth in urban areas makes existing solid waste management policies and strategies challenging. Practices like waste recycling, prevention, reuse, and recovery are fundamental elements needed for the reduction of solid waste disposed in landfills, especially in cities where more sustainable management practices need to be adopted. Recycle, reuse, and recovery deal with the conversion of used materials into new ones reducing the need to consume natural resources. If materials are not recycled or reused then new products are made by extracting fresh, raw material from our Earth as mining and forestry is taking place. This paper presents the findings of a study, where 246 citizens from the area of the municipality of West Macedonia took part. This study is concentrating on the determinants of recycling behavior amongst the residents in the Municipality of West Macedonia. This study took place at the International Hellenic University, Thessaloniki. The overall objective of this study was to understand: a) the drivers of waste and recycling behaviors and this included the understanding of the factors that impact waste and recycling behavior, b) which terms are most readily understood in relation to recycling materials and behaviors and this included the understanding the range of different terms used for various materials and behaviors and the measuring which are most commonly understood and used by resident and c) which messages and media are most likely to change waste and recycling behavior and this pointed the need for a message testing in order to determine the most effective methods of communicating behavioral interventions of the West Macedonia community and it is also aimed to understand which media and channels are the most effective in reaching specific target audiences. According to the results there is a lack of understanding of recycling for citizens aged over 61 years old. For the citizens over 61 years old there is a lack of awareness and consideration of recycling issues on a regular basis. Recycling is mentioned by many of them as an important way for consumers to minimize their impact on the environment. Indeed only 36.2% of the participants have been involved in recycle programs and this percentage is very low in comparison with other areas of Greece.

**Keywords:** waste management, waste recycle, waste management in the Municipality of West Macedonia

# **Bioenergy generation from spent tea and potato wastes through anaerobic codigestion within bioeconomy approach**

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## **INTRODUCTION**

Anaerobic digestion is a well-established process in which renewable energy carrier-biogas is simultaneously generated through upcycling of organic waste streams. Biogas is a green energy vector having a crucial role in the future sustainable bioeconomy development. Flexibility of these systems such as digestion of multiple feedstock enables not only energy production but also waste management and has an economic potential for the locals. The combination of the local wastes has a great concern within this perspective. Potato production is one of the major agricultural activities in worldwide including Turkey and nearly 100 ktons/year of peels are produced from potato industry globally. Turkey is one of the important tea producers worldwide, the production is over 225 thousand tons/year. Since tea is a popular beverage, spent tea waste amount is considerable potential in the country. The aim of this study was to optimize the inoculum amount in the anaerobic digesters treating spent tea and potato waste.

## **MATERIALS&METHODS**

Within this scope, biomethane potential tests were set up for five different inoculum/substrate ratios (I/S: AD1:1.0, AD2:1.5, AD3:2.0, AD4:2.5, AD5:3.0) on the basis of volatile solids (VS). Anaerobic batch tests were conducted by Automatic Methane Potential Test System (AMPTS) II (Bioprocess Control, Sweden), active reactor volume was 400 mL. The reactors were operated in triplicates under mesophilic conditions for 20 days. The blank reactors including only standard inoculum without feedstock were also conducted and the background biomethane production was subtracted from the experimental setups. The results were reported based on the VS content of the feedstock in the reactors.

## **RESULTS**

The results showed a clear effect of I/S ratio in biomethane production (Figure 1). Whereas increasing I/S ratio resulted faster biogas production in the system, the highest methane yield was recorded as 244 mLN CH<sub>4</sub> gVS<sup>-1</sup> in AD4 operated with I/S of 2.5. The methane yields were gradually increased with increasing I/S ratio and ranged between 225-244 mLN CH<sub>4</sub> gVS<sup>-1</sup> except AD5 in which the methane yield was 233 mLN CH<sub>4</sub> gVS<sup>-1</sup>. There was not a significant difference on VS values between the reactors at the end of the operation period ( $1.9 \pm 0.01$ ). Soluble COD values were in the range of 2180 mg/L - 410mg/L. Alkalinity was measured as  $4250 \pm 45$  mg/L showing there was not a limitation in the reactors regarding buffering acidity. I/S ratio is a key parameter affecting VFA production and methane generation rates. Since increasing amount of inoculum enables higher biomethane yield, while shortening the incubation period, it should be noted that, the optimum value for I/S ratio is highly dependent on substrate characterization and inoculum source.

## **CONCLUSION**

In the sustainable circular economy approach, bioenergy has a major role in green energy production and optimization of optimization of the operating conditions for local feedstock has a crucial role. Results revealed that, the spent tea waste and potato waste are potential feedstock in anaerobic digesters

whereas the optimum I/S ratio is 2.5. These findings offer practical information to future applications of biomethane production with spent tea and potato waste as feedstock.

**Keywords:** anaerobic co-digestion, bioeconomy, biomethane potential, tea waste, potato waste

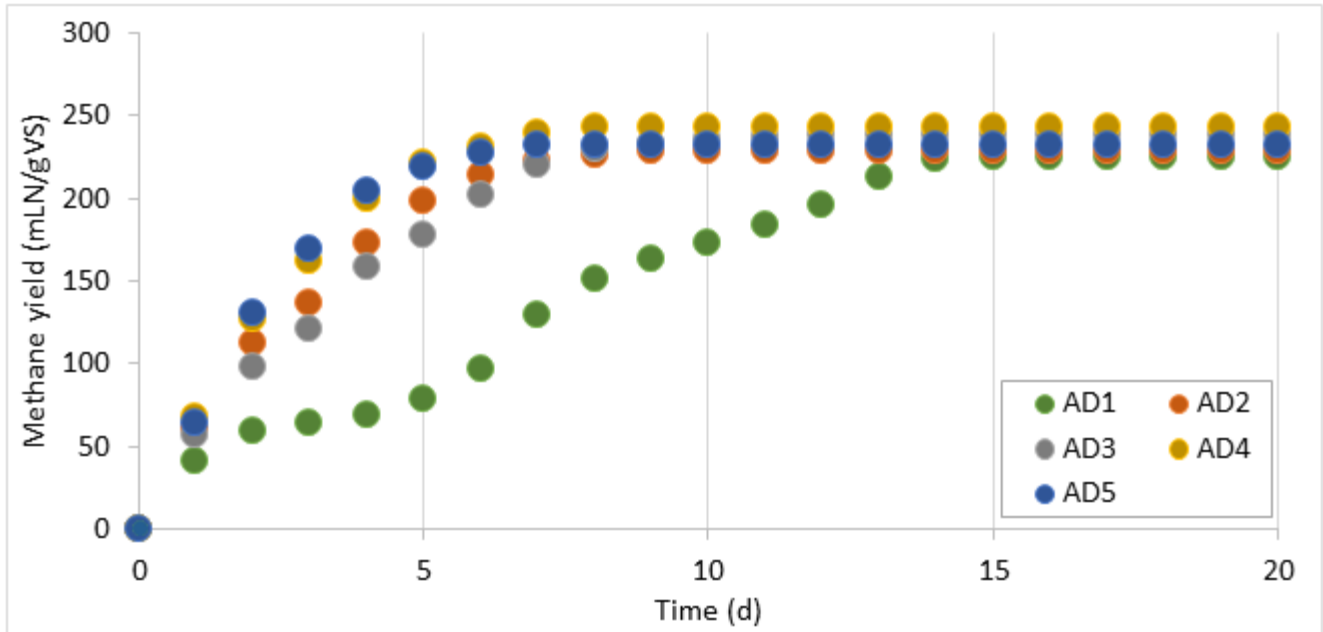


Figure: Methane yields of the digesters



# **Environmental health and well-being**

## **Nature is well-being: investing in prevention and health of children**

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Over the last few years, the scientific community has invested increasing efforts and resources in studying how particular lifestyles can positively influence children's health. Children's health represents one of the most important priorities of the Sustainable Development Goals (SDGs). As reported in the XIII Conference of the Parties in Cancun, the biodiversity gives rise to benefits for human health, by underpinning ecosystem functioning and resilience. The provision of essential ecosystem services and the options for adapting to climate changes represent a mandatory needs. Nature is Wellbeing, in Italian "Natura è Benessere", represents the 2018 project of the Italian Ministry of Health dedicated to children in order to enhance actions on their health. The main objective of this project is to promote awareness on child health prevention by addressing environmental risk factors in urban areas and the potential benefits of access to green spaces. When surrounded by green spaces, children are able to think creatively and develop autonomy and cooperative spirit. Furthermore, playing outdoors facilitates the development of children's intellectual, emotional, social and physical abilities. The project has developed information and training tools to help pediatricians and other health professionals, families, schools and environmental educators promote children's health and well-being by preventing environmental risks and promoting natural green and blue spaces. The relationship between biodiversity and children's health is one of the challenges of preventive medicine and modern urban planning. Among other things, the project recalls the commitments made in the Parma Declaration on Environment and Health of 2010, reiterated in the most recent Ostrava declaration of 2017, including the health risks of children and other vulnerable groups associated with compromised conditions environmental accepting the priorities and objectives set in the "European Environment and Health Youth Coalition". Innovative multi-sectorial cooperation and actions are requested in order to insure healthy lives and promote wellbeing for children. Parks, playgrounds and vegetation in public spaces are a central component of these approaches and provide opportunities for active lifestyles. Public green spaces can reduce the environmental hazards such as air pollution and noise and mitigate the impacts of extreme events (heat waves, extreme rainfall or flooding) and must be easily accessible for all population groups, with particular attention to children. Healthy and sustainable living environments provide health benefits that include improved levels of cognitive development and mental health, physical fitness and well-being. To spend time in nature, allow the reduction of social disadvantage and the short-sighted use of digital technologies. The relationship between biodiversity and children's health is one of the challenges of preventive medicine and modern urban planning.

**Keywords:** Nature, children, health, well-being

## **Mercury concentrations in lean fish species from western Mediterranean Sea**

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Mercury (Hg) is ubiquitous in the biosphere, occurring in the air, water, land, and soil, as well as in living organisms. Excessive exposure to Hg is associated with a wide range of adverse health effects including damage to the central nervous system, kidneys, cardiovascular system and lungs, when inhaled. Hg easily passes from an organism to another through biomagnification. Among foods, Hg is present almost everywhere, but the major source of mercury intake in humans is fish. The Mediterranean Sea is a semi-enclosed sea with a long history of Hg inputs from both anthropogenic and natural sources and it supplies fish to over 480 million people in Europe and in the world. Although there are limitations imposed by European Union on the maximum Hg levels that must be present in edible fish, many of them exceed these limits. The aim of this study is to report mercury concentrations in edible fish species from the Mediterranean Sea, with a special focus on eight different sites scattered in the western part of Europe, Balearic Islands (Mallorca, Menorca and Eivissa), Alacant, Alguer, Marseille, Genoa and Civitavecchia, in order to assess the potential toxicity risk of Hg in the population that usually consume fish in their daily/weekly diet.

**Keywords:** fish, mercury, Mediterranean Sea.

# **Air quality and health risk assessment (HRA) around the Valdemingómez Environmental Complex located in Madrid**

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## **INTRODUCTION**

The VEC is a Technological Park with capacity to treat 200,000 tons of solid waste per year that belongs to Madrid Council. Although incineration process is a sustainable way to reduce waste, the Incinerator Plant cause a major concern among Madrid's citizens regarding the potential toxicity of the gases emissions. In order to assess the Air Quality in the Incinerator surroundings, we have carried out an in situ campaign to measure the levels of the main pollutants such as Particulate matter (PM 2.5), Total Carbon (TC) as the sum of organic and elemental carbon, Heavy Metals (HM), PAHs and POPs as dioxins (PCDD) and furans (PCDF). In addition, a Health Risk Assessment (HRA) have been performed to identify the risk burden and the health effects in the nearby population to the complex.

## **METHODOLOGY**

The in situ campaigns were conducted from 26th October 2017 to 26th November 2017 at two different locations. The first one is at 5,5 km of the VEC and is the closest populated area to the Incinerator Plant, onwards named as Ensanche de Vallecas (EV). The second one is located at 18 km far from VEC and is an urban background site at Madrid city center, onwards named as Madrid Salud (MS). All pollutants were analyzed following Reference methods (Directives 2008/50/CE and 2015/1486/CE) and for HRA, the US-EPA recommendations were followed.

## **RESULTS**

The analytical results showed no significant differences between the levels of PM 2.5 and TC at both locations. The HM levels were also similar among the locations. However the Arsenic concentration was higher at the MS location 1.328 ng/m<sup>3</sup>  $p < 0.05$  than at the EV location 0.26 ng/m<sup>3</sup>. The overall analysis of 17 different PHAs showed no differences when compare the results at both locations. The concentration of B(a)P, the only regulated PAHs, was significant higher at the MS location (0.407 ng/m<sup>3</sup>  $p < 0,05$ ) than at the EV location (0.3 ng/m<sup>3</sup>), however do not exceed the annual recommended value of 1 ng/m<sup>3</sup>. As expected for the incineration process, the levels of POPs were higher at the closest location (EV) with an average concentration of 0.071 pg/m<sup>3</sup> if compare with the 0.021 pg/m<sup>3</sup> obtained at the farthest location (MS). The recommended value by the WHO is 0.3 pg/m<sup>3</sup>. Finally, in order to identify the potential risk for nearby population, an HRA was performed. Although the estimated risk at this location was slightly higher than expected,  $2.34 \times 10^{-6}$ , it stands within the acceptable levels ( $10^{-4}$  to  $10^{-6}$ ) for carcinogenic effects due to respiratory exposure to POPs.

## **CONCLUSIONS**

The campaigns carried out to assess the AQ in the VEC surroundings did not show significant differences in the overall levels of the pollutants analyzed therefore the Incinerator plant do not contribute to increase the gases emissions at Madrid area. Although the POPs levels were higher at the nearby location (EV),

the HRA performed remain in the acceptable level. However, additional epidemiological studies might be required to assess the actual burden of disease (BoD) and to reduce the potential exposure to POPs in the nearby area to the plant. Moreover, the present regulations do not include the POPs compounds and the values obtained also not exceed the WHO recommendations to foster special actions. In these cases the HRA seen to be a powerful tool to identify the risk and the potential health effects on population.

## **REFERENCES**

UE Directive 2008/50/CE and 2015/1486/CE for Analytical Reference methods WHO recommendations for POPs and US-EPA recommendations for HRA [https:// www.epa.gov/risk](https://www.epa.gov/risk)

**Keywords:** Air Quality, Health Risk Assessment, Health effects, Burden of Disease

# **Green awareness in action – how energy conservation action forces on environmental knowledge, values and behavior in adolescence school life**

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Affordable, reliable, sustainable and modern energy consumption is a crucial goal of the Agenda 2030. To raise each citizen's awareness for more effective energy consumptions, proper education is inevitable. The classroom project GAIA (Green Awareness in Action) was designed to change energy decreased consumption patterns to pursue green behavior. The class-wise aim was to improve schools' CO<sub>2</sub>-balance and to promote environmentally sustainable behavior without impacting school life quality. Our target group were sixth graders (N = 132, M = 11.03, SD ± 0.23, 53.4% = females) of one Greek school. To monitor the project's effect, a pre- and post-test design was applied to measure environmental literacy regarding environmental knowledge, attitudes/values and behavior. The theoretically founded scales were calibrated with the Rasch model. Dependent on students' logit score, a regression analysis revealed that low achievers reached higher learning effects compared to high achievers. Related to the environmental knowledge types, an ANCOVA analysis revealed a knowledge gain in action-related- and effectiveness knowledge. The overall learning effect correlates positively with pro-environmental preference (high scores in preservation, low scores in utilisation) and negatively with weak pro-environmental preferences. Anthropocentric (utilitarian) preferences primarily focusing on nature exploitation have considerably.

**Keywords:** environmental education (EE), education for sustainable development (ESD), environmental knowledge types, environmental attitudes and values, moderated regression, sustainability

# **Children's care for dogs, environmental values and ecological behavior**

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Does the care of dogs substantially interfere with the environmental values and general environmental behavior of children? There is little empirical research on pet ownership and environmental protection in the literature. To investigate this relationship, the 2-MEV scale and GEB scale were applied to measure environmental attitudes/values and behavior, aligned with the 'Children's Treatment of Animals' scale to measure individual care for dogs. The study involved 480 students from four nine-year public compulsory public schools in south-eastern Slovenia. There were more girls (51%) than boys (49%) in the sample. Students aged 10 to 15 years ( $M = 12.16$ ,  $SD = 1.48$ ) participated in the research. The results show that the more Slovenian primary school children report practicing general environmental behavior, the better they care for a dog. Female students took more trouble with their dogs and practiced general environmental behavior more often. Younger students had a more pronounced attitude towards nature preservation and more often practiced general environmental behavior. Overall, this research offers some evidence-based background to promote education for sustainable development among school students.

**Keywords:** care for a dog, environmental attitude sets, general environmental behavior (GEB), school students, environmental values (2-MEV scale)

# **Determination of Environmental Attitudes of Recreational Activities Participants with New Ecological Paradigm Scale**

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The aim of the study is to determine the attitudes and environmental sensitivities of people involved in environmental recreation activities. For this purpose, a quantitative analysis was conducted on residents in Istanbul. Dunlap and Liere (1978) developed the “new ecological paradigm” scale to elucidate the new world view of environmental attitudes. Demographic and general variables were analyzed by t-test and one-way Anova. Factor analysis was performed for the new ecological paradigm variables in order to reveal the main factors determining the environmental attitude of the participants. The results of factor analysis were evaluated and the environmental attitude of the participants in recreation activities was revealed and discussed in conclusion.

**Keywords:** Recreation, Environment, New Ecological Paradigm



## **Assessing the Ecosystem Services of Nestos Delta lagoons – Greece: coupling with sustainability indicators**

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The concept that ecosystem services are essential for human well-being is increasingly accepted and embedded in policy at local, national and global scales. Anthropogenic climate change, the loss and degradation of biodiversity and ecosystem services are acknowledged as being among the most substantial challenges facing humanity in the 21st century. Sustainability's ultimate goal is to improve and maintain society's welfare by preserving the services that derive from ecosystems. Ecosystem services are typically divided into a) provisioning, b) regulating and c) cultural services. Selection and quantification of the proper indicators of ES is required to develop policies related to water systems management. The Nestos Delta (ND) lagoons were chosen as study area for ES investigation, due to the recorded high biodiversity, the significant economic value and the lack of ES oriented research. The protected area of ND lagoons is located at the western bank of Nestos River delta (N. Aegean Sea, Macedonia, Greece) and functions as nutrient transfer basin between an area of extensive cultivation and the coastal zone of Kavala Gulf. ND lagoons are exploited by a Fishing Cooperative. The present study is the first report of values of indicators of ES provided by ND lagoons coupled with environmental sustainability indicators (ESI) the selection of which was based on: a) economic and social outputs, b) the WFD implementation, c) the Habitat Directive (92/43/EU), d) their relation to the eutrophication process and e) the availability of data. To this aid a list proposed by CICES was consulted for ES indicators, while the OECD Core indicators framework has been used for the ESI (Table1). For the assessment of indicators, samplings took place enriched with available datasets/timeseries from stakeholders. Our results show that "regulating" ES are in threat since the chemical status is characterized as "less than good" -based on the WFD classification-, while regarding the trophic status the lagoons could be classified as eutrophic. As for biodiversity, in total 249 protected species (Directive 2009/147/EC, IUCN Red List, Habitat Directive) had been recorded to inhabit or migrate to and around the lagoons. Regarding the "provisioning" services a decrease of 40% occurred the period 2011-2013, followed by 6 years of stability. This decrease though did not affect the fishermen income, which remained stable.

Since this is the first study on ES and ESI of ND lagoons several key findings can be summarized. First of all, we could argue that the ESI quantified in the area agree with the ES indicators, both responding to structural and functional changes. Our next step is to link ES indicators, creating instead of the traditional DPSIR (Driving forces-Pressures-States-Impacts-Responses) model, a DPSEI (ES replacing Impacts) model, which could provide a useful management/governance tool and also be an asset for other case studies on transitional water bodies.

**Keywords:** Ecosystem Services, Coastal lagoons, Sustainability indicators, Nestos Delta, WFD

**Table 1: Ecosystem Services and Environmental Sustainability Indicators**

Ecosystem Services	ES Indicator	Environmental Sustainability Indicator	ESI Quantification
Food production (Provisioning)	Fish Catches/Species (tn/ha)	Fish resources	Fish catches (tn/ha, €/year)
Nutrients regulation (Regulating)	Nutrients concentration (μmol/l) Chl-a (μg/l) TSS (mg/l)	Eutrophication / Water quality	Nutrients concentration (μmol/l) Algal biomass (μg/l) Physico-chemical elements (mg/l)
Education/Research (Cultural)	Visitors (No/year)	Cultural	Sites protected for historical, cultural, aesthetic reasons (No)
Natural diversity (Cultural)	Species (total) (No)	Biodiversity	Threatened or extinct species (No), Protected area % of national territory

## **One health and ecohealth in global public health strategy**

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The One Health and EcoHealth approach were conceptualized as a global public health strategy that encourages interdisciplinary collaboration and communication on health at the human-animal-environmental interface. Over the past decade, a significant increase in the circulation of infectious agents was observed. With the spread and emergence of epizootics, zoonoses, and epidemics, the risks of pandemics became more and more critical. Human and animal health has also been threatened by antimicrobial resistance, environmental pollution, and the development of multifactorial and chronic diseases. This highlighted the increasing globalization of health risks and the importance of the human-animal-ecosystem interface in the evolution and emergence of pathogens and chemicals substances. A better knowledge of causes and consequences of certain human activities, lifestyles, and behaviors in ecosystems is crucial for a rigorous interpretation of disease dynamics and to drive public policies. As a global good, health security must be understood on a global scale and from a global and crosscutting perspective, integrating human health, animal health, plant health, ecosystems health, and biodiversity. They are recognized to be wicked problems and need to be tackled using integrated approaches to health. Environmental changes and human activities can affect the ecosystems state and therefore constitute a potential risk to well-being and human and animal health in One Health and Ecohealth approach. The socio-economic evolution causes the release and emissions in the ecosystems of multiple contaminants (chemical and microbiological), often emerging, whose diffusion, interaction and effects on human and animal health are often ignored or poorly known; furthermore the effects of the enhancement of extreme weather events must be identified and known. Ecosystem approaches to health is a transdisciplinary research that brings together public health, environmental health people, veterinarians, ecologists, social scientists, policy makers, local authorities and experts from other fields and community members to explore how ecosystem changes can have adverse impacts on human health and implement practical solutions to address these health challenges. Six principles of this approach include transdisciplinary, participation, gender and social equity, system-thinking, sustainability and research-to-action. The development of efficient and rapid tools and methods for emerging contaminants (microbiological and chemical) detection is very useful in implementing preventive measures for risk evaluation for human health also when weather extreme events occur and it is recommended by EU strategic research (e.g. Horizon 2020) and policy programmes (EU Directives) also according to OneHealth perspective and EcoHealth approach. Furthermore these tools and methods allow also to study the environmental spread of antibiotic resistance bacteria and promoting their responsible and prudent use. One health and Ecohealth approach enhance and Promote the collaboration level on the impact of climate changes on animal health and human health and improve the knowledge of the connections among ecosystems health, biodiversity loss and spread of diseases that have an impact on health and well-being for the definition on integrated approach in global public health strategy.

**Keywords:** EcoHealth, One Health, ecosystem

# **Future trends on green and healthy cities. The Madrid (spain) case**

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## **Summary**

This study aimed at providing a methodological framework to incorporate views on green, smart and healthy cities into a single long-term vision by 2050. The Madrid City has served as a case study within the EU ICARUS project. The main outcomes can be summarized in a single vision called "slow city".

## **Introduction**

According to WHO (2016), poor air quality is one of the main environmental risks because of its impact on human health and the authorities are aware of it. Nowadays the main reaction to cope with this problem is to set up air quality plans, policies and actions to reduce the levels of atmospheric pollutants and improve the air quality especially in urban areas. However, the lack of a future vision constrains the implementation of long-term policies towards healthier, smarter and more sustainable cities. Therefore, future visions developed by professionals in collaboration with key stakeholders (public health, urbanism mobility, etc.) can be an excellent tool that should be considered to the aforementioned air quality plans, thus making a success on the medium and long-term future of cities.

## **Methodology and Results**

To elaborate a future vision, a dynamic collaborative process has been followed. This was a bottom-up process, in which experts from different sectors and policy-makers determined future green and healthy visions based on a dynamic implementation of the collaborative process. The methodological process was structured into four sequential phases, which evolved from preliminary literature reviews to identify potential future trends, semi-structure interviews with experts to gather their views and participatory workshops to elaborate longer term narratives visions where refinement of collective views could take place. At the final stage, a multi-criteria analysis (MCA) was carried out to select the final future narrative.

In the Madrid city case, the participatory workshop brought to the elaboration of four partial narratives: (i), "The car paradise", based on a scenario where private car will predominate and the multifunctional level of the city will be very high; (ii) "The long distance city", for those scenarios in which the multifunctional level of the city will be very low and private vehicles will predominate; (iii) "The public

transport paradise” for the scenario in which public transport will predominate, but larger distances should be covered due to the low multifunctional level of the city; (iv) “the slow city” for that scenario in which public transport will predominate and the multifunctional level of the city will be very high. To select a final future narrative, an MCA was carried out. The MCA was based on a questionnaire design to analyse the narratives based on which one generate more positive impacts for environment, economics and society, and where local policy makers were asked to participate. In particular, the Analytic Hierarchy Process (AHP) developed by Saaty (2013) was used to derive ratio scales from both discrete and continuous paired comparisons of sustainability impact categories. These comparisons were taken from a nine-point scale, which reflected the relative strength of preferences and feelings of policy-makers on the likelihood that specific impacts from each category can be generated by the four narratives visions. During the process, four pair-wise matrices (environmental, social, economic, and global matrix) were obtained for each future vision and transformed into priority vectors. The combination of priority vectors provided weights to rank the impacts expected to be generated by each vision. Finally, the visions with the highest weight were selected. As summary, the long-distance city generated the worst impact among all the analysed categories and resulting in last rank position. The Public transport paradise and the car paradise showed a better impact, 0.10 and 0.28 respectively, and were ranked into the third and second position. The Slow city vision obtained the best impact record among all categories (0.66-0.54). This future vision was the preferred one by the stakeholders for Madrid 2050.

### **Conclusions**

This study selected the so-called "slow city" scenario for Madrid 2050. This model stands for a multifunctional city where the activities and employments are in nearby areas so, all the daily needs (shopping, leisure, exercise, mobility, etc.) can be satisfied due to the household/office proximity.

### **Bibliography:**

- WHO 2016. Ambient air pollution: a global assessment of exposure and burden of disease. ISBN: 978-92-4-151135-3
- Saaty, T. L. 2013. Analytic hierarchy process. In Encyclopaedia of operations research and management science (pp. 52-64). Springer, Boston, MA.

### **Acknowledgement**

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**Keywords:** smart green and healthy cities, future trends, Madrid, narratives, slow city

# **Age-related dose deposition of particulate matter in human respiratory tract: findings from a birth cross-sectional study in Portugal**

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Indoor air pollution remains a great global concern. Particulate matter (PM), namely ultrafine particles (aerodynamic diameter smaller than 0.1  $\mu\text{m}$ ; UFP), is considered as one of the most health-relevant air pollutant for various subpopulations, one of which is children. Knowledge on the specific dose deposition of PM may provide a critical link for better understanding of the relationship between individual exposure and the respective health effects. Mathematical models have proven to be important tools for analysing PM dose deposition in the respiratory tract providing relevant data for health risk assessment, source apportionment of human lung burdens and control strategies purposes. This work aimed to estimate the deposition dose of different PM sizes at different age categories. Inhalation dosimetry estimations were carried out using the multiple-path particle dosimetry model (MPPD, v3.04). Age specific 5-lobe model with uniform expansion was adopted in the present study. Total, regional and lobar deposition was estimated for 3-months' old children (corresponding the infants), 21–30 years, 31–40 years and 41–55 years old female adults. Real-time sampling of PM<sub>10</sub>, PM<sub>2.5</sub> and UFP was conducted in 65 homes located in Porto Metropolitan Area between May 2018 and February 2019. 48-h PM<sub>10</sub> and PM<sub>2.5</sub> were measured by DustTrak™ DRX Aerosol Monitors (Model 8533, TSI Inc. MN, USA), while Portable Condensation Particle Counters (P-Trak™ Model 8525, TSI Inc. MN, USA) were used for 8 h sampling of UFP (particles size: 20-1000 nm). Multi-path particle dosimetry model was performed based on participant' specific data to estimate deposition fractions of PM with different sizes. The highest deposited fraction for PM<sub>10</sub> and PM<sub>2.5</sub> was obtained in the age group of 41 to 51 years' respiratory tract, whereas their lowest deposition fraction was observed in 3 months old infants. Inversely, the highest and lowest deposited fractions of UFP were recorded in 3 months old infants and in 31-40 years old age airways, respectively. Through nasal breathing PM<sub>10</sub> was highly deposited in the head (87% of total deposition fraction in all age groups) when compared to other PM fractions. Also for all age groups, pulmonary region was highly deposited by both UFP (43%) and PM<sub>2.5</sub> (39%). PM<sub>10</sub> and PM<sub>2.5</sub> depositions were greater in adults than in newborns (0.96 and 0.75 vs. 0.86 and 0.60). This difference may be due to many factors, such as physical mechanisms, particle size, as well as due to airflow and anatomical and physiological factors. Across all age categories, lower lobes received maximum deposition than the upper and middle lobes. Deposition fraction in a lobe was proportional to the volume of air passing through that lobe, as lower lobes (i.e. with higher volumes) experienced higher PM deposition; middle lobes with smaller volumes thus shown a lower deposition. PM<sub>2.5</sub> dominated the deposition in all five lobes of infant, children and adults. This fine fraction deposition in lobar regions can lead to decreased lung function, increased development of chronic obstructive pulmonary disease

and respiratory morbidity. This study represents an important step towards a better understanding of human exposure to PM for a consequent reduction of health risks. The application of the multi-path particle dosimetry model has demonstrated that smaller particles (PM<sub>2.5</sub> and UFP) tend to deposit in pulmonary area while PM<sub>10</sub>, are mainly found in head region, namely in infants. Considering the lung lobe specifically, higher PM deposition was observed in the right lobes than in the left one.

### **Acknowledgement**

This work was supported by FCT-FAPESP (FAPESP/19914/2014) and by Base Funding – UIDB/00511/2020 of the Laboratory for Process Engineering, Environment, Biotechnology and Energy – LEPABE – funded by national funds through the FCT/MCTES (PIDDAC). Joana Madureira, Carla Costa and Ana Inês Silva are supported by FCT (SFRH/BPD/115112/2016; SFRH/BPD/96196/2013 and SFRH/BD/145101/2019 grants, respectively).

**Keywords:** particulate matter, ultrafine particles, children, respiratory deposition

# **Organophosphate and pyrethroid pesticides in farmers and general population**

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Organophosphate (OP) and pyrethroid (PYR) pesticides are commonly used in agriculture as well as for domestic and gardening use. They eliminate insects because of their strong potential to disrupt the brain and nervous system of these organisms. Unfortunately, this neurotoxic effect is not selective enough as to avoid damage to other non-target species, including humans. There is growing public concern on pesticide use not only for the negative impacts on wildlife and the environment but also for the potential adverse health effects on humans. OP and PYR pesticide exposure has been related to several health effects, including respiratory, digestive, reproductive and neurological problems, among others. A method for the analysis of OP and PYR pesticides based on the organic moiety of these compounds has been developed. Urine analyses of these metabolites in urban non-occupationally exposed individuals and farm workers shows that ingestion of these pesticides occurred in both populations.

Comparison of the population of farmworkers with the population of non-farmworkers living in rural and urban areas shows that the former had higher concentrations of 2-diethylamino-6-methylpyrimidin-4-ol (DEAMPY, metabolite of pirimiphos; medians 1.7 vs. 0.81 ng/ml, respectively), 4-nitrophenol (PNP, metabolite of parathion; 2.3 vs. 1.3 ng/ml), 3,5,6-trichloro-2-pyridinol (TCPY, the metabolite of chlorpyrifos; 4.2 vs. 2.2 ng/ml) and 3-phenoxybenzoic acid (3-PBA; 2.4 vs. 1.1 ng/ml). These differences were consistent with occupational activity as farmworkers are directly exposed to these pesticides through inhalation, dermal contact and indirect ingestion (e.g. skin, eyes), through the manipulation of these substances when either mixing, loading and handling treated crops, or spraying and applying them into the fields. However, the aforementioned median values showed differences of two times, indicating that people not occupationally exposed to the use of these pesticides was also incorporating these compounds, probably as consequence of food consumption, e.g. fruits and vegetables. Thus, chlorpyrifos (metabolised into TCPY in humans) is one of the most frequently found pesticides in plant products, and the one with higher number of quantifications exceeding the maximum residue levels allowed by the EU legislation (EFSA, 2017). OP and PYR pesticides are also employed as biocidals for domestic purposes, for household pets and gardening, among other uses (e.g. ornamental plants). In addition, residents living in areas close to the application of pesticides may be at increased risk of exposure, in a similar way than occupationally-exposed individuals (EFSA, 2014).

## **References**

EFSA Journal 2014; 12(10): 3874, 55 pp. EFSA Journal 2017; 15(4): 4791, 134 pp.

**Keywords:** organophosphate pesticides, pyrethroid pesticides, urine markers of exposure



## **Study of the protective effect of melatonin on hepatotoxicity induced by a local Linuron herbicide in wistar rats**

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The purpose of this work is to evaluate the toxic effects of a pesticide widely used in agriculture as a herbicide, at a dose of 100 mg/kg/day, for 30 days in an experimental model in Wistar rats, while assessing the preventive effects of melatonin, at a dose of 500 µg/ml/day. Indeed, the administration of linuron caused an inflammatory state which is revealed on the one hand, by significant changes in the parameters related to liver function and on the other hand by the reduction of reduced glutathione (GSH) and a considerable increase in glutathione S-transferase (GST) levels, which are biomarkers of oxidative stress. The preventive treatment of the rats with melatonin in the presence of linuron improved the activity of the antioxidant defense status GSH, GST. Of this, it should be stated that people exposed to pesticides, and mainly farmers as well as consumers of pesticide-treated products, face a real danger of their health being affected. This suggests that melatonin can act as an effective preventive agent to reduce the intensity of oxidative stress generated in an experimental model and will represent a potential treatment for the deleterious effects of linuron.

**Keywords:** Linuron, melatonin, GSH, GST, oxidative stress.

## **Study of the protective effect of melatonin on nephrotoxicity induced by a Linuron herbicide in wistar rats**

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<sup>2</sup>Bashkir State Medical University, Cardiology Medical Residency Department, 450000-Oufa, Russia.

The purpose of this work is to evaluate the toxic effects of a pesticide widely used in agriculture as a herbicide, at a dose of 100 mg/kg/day, for 30 days in an experimental model in Wistar rats, while assessing the preventive effects of melatonin, at a dose of 500 µg/ml/day. Indeed, the administration of linuron caused an inflammatory state, which is revealed on the one hand, by significant changes in the parameters related to kidney function, and on the other hand by the reduction of reduced glutathione (GSH) and a considerable increase in glutathione S-transferase (GST) level, which are biomarkers of oxidative stress.

The preventive treatment of the rats with melatonin in the presence of linuron improved the activity of the antioxidant defense status GSH, GST.

Of this, it should be stated that people exposed to pesticides, and mainly farmers as well as consumers of pesticide-treated products, face a real danger of their health being affected.

This suggests that melatonin can act as an effective preventive agent to reduce the intensity of oxidative stress generated in an experimental model and will represent a potential treatment for the deleterious effects of linuron.

**Keywords:** Linuron ; melatonin; GSH; GST; oxidative stress.

## **Involvement of free radical activity in the development of breast cancer in the wistar rat: protective effect of luteolin**

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This study was conducted to evaluate the effectiveness of supplementation of an antioxidant the luteoline on oxidative status (the antioxidant defense system) in an animal model with breast cancer chemically induced by 7,12- Dimethylbenz(a)anthracene(DMBA). Indeed, the administration of DMBA has caused breast cancer, which is revealed on the one hand, by the formation of mammary carcinomas and on the other hand by the reduction of glutathione -S - transferase (GST), and a significant decrease in reduced glutathione levels (GSH), which are biomarkers of oxidative stress. Preventive treatment of rats with luteolin in the presence of DMBA has decreased significantly increased tumor incidence, with an improvement in the activity status of antioxidant GSH, GST. This suggests that lutein may act as an effective chemo-preventive agent against the breast cancer via the reduction of radical attacks on the glands mammary.

**Keywords:** breast cancer, luteolin, 7,12-Dimethylbenz(a)anthracene, oxidative stress.

## **Integrated exposure modelling for cadmium**

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The purpose of this study was to describe and evaluate forward integrated exposure model for Cadmium (Cd). This included the construction and analysis of exposure scenarios in order to calculate expected relevant biomarker levels (e.g cadmium concentration in urine and blood), which were directly compared with real life human biomonitoring (HBM) data. Towards this goal, exposure estimates for cadmium were calculated using the integrated exposure modelling platform INTEGRA and were later validated with HBM data. The assessment of Cd intake included major exposure pathways such as diet water, inhalation, dust and soil ingestion. Diet mostly corresponded to meat and edible offal food category, fish and seafood, vegetables and vegetables products, grains and drinking water. The HBM data, collected in the framework of several studies and facilitated by the HBM4EU consortium in an effort to cover a large part of EU Member states, were aggregated and age differentiated. HBM data were accompanied by detailed exposure related to environmental emissions data, food items residues concentration in dust and in soil, concentration in ambient and indoor air, were used as ancillary data for exposure reconstruction, describing multi-pathway and multi-route exposure. The results of the study can be considered representative for the general population in the EU from newborns to the elderly. They showed that diet is the main source of Cd exposure and it is mostly related to items highly consumed by adults. The daily intake for all age groups ranges between 0.2 and 1  $\mu\text{g}/\text{kg}_{\text{bw}}/\text{d}$ . Adults are also susceptible to Cd exposure through smoking which has been proved to be the second most prevalent exposure pathway. The daily intake contribution of smoking found to be 0.02  $\mu\text{g}/\text{kg}_{\text{bw}}/\text{d}$ . Regarding to HBM data, the levels of Cd in blood and urine are in the range of 0.1 to 1 mg/L. Moreover, the expected biomonitored levels are not directly related to the daily intake patterns, but to the accumulation through aging. These observations are highly corroborated with the indicative measure levels, confirming the robustness of the estimates and provide increased confidence when using it to compare with regulatory thresholds based on the toxicological properties of Cd in humans. Lastly, the analysis indicated that individuals that are highly exposed to cadmium are close to the EFSA tolerable week intake of 2.5  $\mu\text{g}/\text{kg}_{\text{bw}}$ . Internal dose was calculated based on reconstructed intakes calculated by HBM data of cadmium in urine. In most of the studies it found to be 0.1 and 1  $\mu\text{g}/\text{g}$ . This is the result of cadmium's high accumulation in the kidneys, due to its very slow elimination. The level of confidence regarding the intake estimates or the exposure levels of a specific pathway and route (e.g. identification of contribution of smoking over diet regarding Cd exposure) requires more detailed information regarding the daily activity pattern and microenvironments encountered, dietary habits and consumer products use. This in turn requires the use of individual HBM data, accompanied by ancillary information that would shed light on the mechanistic link between exposure dynamics and observed HBM data.

**Keywords:** human biomonitoring, exposure modelling, exposure pathways

# Exposure modelling and risk assessment of endocrine disrupting chemicals

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The purpose of this study was to describe and evaluate forward integrated exposure model for endocrine disrupting chemicals such as Cadmium (Cd), Flame retardants, phthalates and DiNCH. This included the construction and analysis of exposure scenarios in order to calculate expected relevant biomarker levels (e.g cadmium concentration in urine and blood), which were directly compared with real life human biomonitoring (HBM) data. Towards this goal, exposure estimates of the substances for all exposure routes (oral, inhalation, dermal) were calculated using the integrated exposure modelling platform INTEGRA and were later validated with HBM data. The HBM data, collected in the framework of several studies and facilitated by the HBM4EU consortium in an effort to cover a large part of EU Member states, were aggregated and age differentiated. HBM data were accompanied by detailed exposure related to environmental emissions data, food items residues concentration in dust and in soil, concentration in ambient and indoor air, were used as ancillary data for exposure reconstruction, describing multi-pathway and multi-route exposure.

The results of the study can be considered representative for the general population in the EU from newborns to the elderly. They showed that diet is the main source of Cd exposure and it is mostly related to items highly consumed by adults. The daily intake for all age groups ranges between 0.2 and 1  $\mu\text{g}/\text{kg}_{\text{bw}}/\text{d}$ . The analysis indicated that individuals that are highly exposed to cadmium are close to the EFSA tolerable week intake of 2.5  $\mu\text{g}/\text{kg}_{\text{bw}}$ . Internal dose was calculated based on reconstructed intakes calculated by HBM data of cadmium in urine. In most of the studies it found to be 0.1 and 1  $\mu\text{g}/\text{g}$ . This is the result of cadmium's high accumulation in the kidneys, due to its very slow elimination. Regarding phthalates and DiNCH the daily intake of DEHP, DiNP and DnBP was close or above 1  $\mu\text{g}/\text{kg}_{\text{bw}}/\text{d}$ , while for DiNCH and especially for BBzP daily intake seemed to be one order of magnitude lower. The daily intake estimates for phthalates are usually one or two orders of magnitude below the respective TDI, with the exception of BBzP, for which intake estimates of the upper part of the exposure distribution is close to the threshold of 10  $\mu\text{g}/\text{kg}_{\text{bw}}/\text{d}$ . With respect to flame retardants, skin contact and object to mouth exposure are the main source exposure and they are mostly related to consumer products, highly used by infants, presenting a daily intake of 3 and 1  $\mu\text{g}/\text{kg}_{\text{bw}}/\text{d}$  respectively. The daily intake for the rest of the age groups ranges between 0.01 and 0.1  $\mu\text{g}/\text{kg}_{\text{bw}}/\text{d}$ , which is far below the calculated 'provisional' TDI of 13  $\mu\text{g}/\text{kg}_{\text{bw}}/\text{d}$ .

Exposure reconstruction and internal dose assessment offer unique opportunities regarding the interpretation of HBM data, quantitatively associating them with exposure pathways contribution in the overall intake. In order to carry out exposure reconstruction, a minimum of information regarding the toxicokinetic behavior of the compound of interest is required. This allows the translation of the biomarker levels measured at a given point in time, to long-term daily intake patterns. Thus, the level of confidence regarding the intake estimates or the exposure levels of a specific pathway and route requires

more detailed information regarding the daily activity pattern and microenvironments encountered, dietary habits and consumer products use. This in turn requires the use of individual HBM data, accompanied by ancillary information that would shed light on the mechanistic link between exposure dynamics and observed HBM data.

**Keywords:** exposure reconstruction, risk assessment, exposure modelling, endocrine disrupting chemicals

## **Exposure modelling assessment for flame retardants**

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The purpose of this study was to describe and evaluate forward integrated exposure model for flame retardants (TCEP). This includes the construction and analysis of exposure scenarios in order to calculate expected relevant biomarker levels (e.g concentration in urine and blood), which were directly compared with real life human biomonitoring (HBM) data. The integrated exposure modelling platform INTEGRA has been used for estimating multi-pathway exposure. As exposure to flame retardants are more prevalent through skin contact transfer, the pathways involved in the analysis were related to consumer exposure (transfer from skin contact with furnishing or baby chairs, mouthing of objects and toys by the children). Therefore, exposure estimates to flame retardants were calculated and were later validated with HBM data that was collected in the framework HBME4EU project, in an effort to cover a large part of EY Member states. Besides HBM data, environmental emissions data, food items residues concentration in dust and in soil, concentration in ambient and indoor air, were also used as ancillary data for exposure reconstruction, describing multi-pathway and multi-route exposure. From these categories, concentration in dust is suspected to arise from materials to the surface and subsequent partitioning into dust, while also consumer products, ranging from children and baby products, to furniture and electronic appliances are substantial exposure sources.

The results of the study can be considered indicative for the general population in the EU from newborns to the elderly. They showed that skin contact and object to mouth exposure are the main source of flame retardants and they are mostly related to consumer products, highly used by infants, presenting a daily intake of 3 and 1  $\mu\text{g}/\text{kg}_{\text{bw}}/\text{d}$  respectively. The daily intake for the rest of the age groups ranges between 0.01 and 0.1  $\mu\text{g}/\text{kg}_{\text{bw}}/\text{d}$ , which is far below the calculated 'provisional' TDI of 13  $\mu\text{g}/\text{kg}_{\text{bw}}/\text{d}$ . The highest exposure percentages are observed also due to skin exposure. Regarding the expected urinary concentrations of DCEP (a major TCEP metabolite), the results, after evaluated against the measured HBM data, indicated that although the levels of exposure for all age groups are within the range of measured DCEP levels, the daily intake of children is highly overestimated.

**Keywords:** exposure modelling, flame retardants, exposure reconstruction

## **Risk assessment of phthalates and DINCH starting from human biomonitoring data**

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Phthalate esters are widely used industrial chemicals. Their major portion, found in the environment, is the result of the slow release of phthalates from plastics and other phthalate containing articles due to weathering. A set of realistic exposure scenarios were evaluated for the phthalates, including assessments that start from environmental emissions to environmental and micro-environmental concentrations, food items residues, concentration in dust and in soil, concentration in ambient and indoor air, as well as exposure to consumer products. Phthalates exposure is associated to various pathways and routes, which are defined by their intended uses and physicochemical properties. To better validate the integrated exposure models, human biomonitoring data (HBM) were used.

For modelling phthalate compounds, the INTEGRA modelling platform was used. The overall modeling framework for assessing the source to dose continuum with regard to DEHP, was built upon a unified simulation environment (asclxtreme), comprised of four interconnected modules, namely: multimedia indoor air quality module, exposure assessment modeling, internal dose, uncertainty and variability across all stages of the assessment. The generic PBTK model developed in INTEGRA is designed to describe the ADME processes occurring in the human body at different life stages in as much as possible detail, so as to be easily applicable to a broad variety of chemicals after proper parameterization. The model in its generic form includes the parent compound and up to three generations of potential metabolites. Advanced QSAR models are used to estimate physicochemical and biochemical parameters of the model in order to expand its applicability domain to a large chemical space. Environmental and exposure data from several studies, collected in the framework of HBM4EU consortium, were fed into INTEGRA assuming multi-pathway exposure including inhalation (both gaseous phase and particles), dietary ingestion through several food items and eventually emissions from building materials and use of consumer products.

In most of the studies, the daily intake of DEHP, DiNP and DnBP was close or above 1  $\mu\text{g}/\text{kg}_{\text{bw}}/\text{d}$ , while for DiNCH and especially for BBzP daily intake seemed to be one order of magnitude lower. For DEHP case study, the estimated concentrations for the several media were 1.5  $\mu\text{g}/\text{m}^3$  for the gaseous phase, 5.5  $\mu\text{g}/\text{m}^3$  for the particles and 3600  $\mu\text{g}/\text{gr}$  for settled dust. These levels of predicted urinary levels of DEHP metabolites that fluctuate around 11  $\mu\text{g}/\text{L}$  for the sum of the three major metabolites (MEHP, 5-OH-MEHP and 5-oxo-MEHP), are within the same magnitude of order of the measured levels that are within 10 to 100  $\mu\text{g}/\text{L}$ . Based on the above, exposure to DEHP from all pathways and routes exceeds 10  $\mu\text{g}/\text{kg}_{\text{bw}}/\text{d}$ , especially for neonates, where dust ingestion seems to be a significant contributor to the overall intake. For phthalates, daily intake estimates are usually one or two orders of magnitude below the respective TDI, with the exception of BBzP, for which intake estimates of the upper part of the exposure distribution is close to the threshold of 10  $\mu\text{g}/\text{kg}_{\text{bw}}/\text{d}$ . Daily intake estimates for phthalates were derived based on the exposure reconstruction results of the available aggregate HBM data.



Overall, the use of expected biomonitored levels is a very useful approach for assessing the validity of the overall exposure assessment, because biomonitoring includes the contribution from all sources, pathways and routes.

**Keywords:** exposure modelling, human biomonitoring, generic PBTK model, exposure reconstruction, risk assessment

# **European exposure and health examination survey (EXHES) study reveals the impact of prenatal exposure to metals, PFOS, PFOA, organophosphates, and organochlorines on early child development**

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Unraveling the exposome (the totality of exposures through an individual's life course) may be a cornerstone towards precision prevention in public health. The presented approach was applied to a cohort of 50 mother-child pairs in the framework of HEALS project. The links between in utero exposure to metals, PFOS, PFOA, organophosphates, and organochlorines, metabolic pathway deregulation, and clinically observed phenotypes were drawn through a urinary and serum untargeted metabolomics analysis using UPLC-Q-TOF/MS and NMR, followed by integrative bioinformatics and exposome-wide association algorithms. Spectral pre-processing was performed using the Bioconductor R packages XCMS and CAMERA. The databases HMDB, Metlin, and Lipid Maps, were used for metabolites identification. Enrichment and pathway analyses were performed using GeneSpring GX, which mapped significant biomarkers to known biochemical pathways based on the information contained in public databases (MetaCyc, Wikipathways, and KEGG). The Exposome-Wide Association Study (EWAS) approach was adopted to comprehensively and systematically associate multiple exposure factors discovering robust correlations with metabolites levels and dysregulated pathways. Metabolite identification revealed that the total number of unique annotated metabolites in urine and serum samples analysis using LC-HRMS was 751, and 7830, respectively. The detected metabolites on serum samples were mapped on 246 pathways, while urinary metabolites on 163. According to EWAS analysis, birth weight is positively affected by S-Adenosylhomocysteine levels during the first trimester of pregnancy, and negatively associated with the levels of Citrulline, and DEAMPY, at delivery. In addition, higher exposure levels to Hexachlorocyclohexane (HCH), 2,2',4,5,5'-Pentachlorobiphenyl (PCB101) and 2,4'-DDT, can lead to height increase. The same outcome is associated to citric acid levels. Head circumference is positively associated with exposure to 4,4'-DDT at the first trimester. Overall, functionally coupling advanced bioinformatics algorithms applied on omics data with exposome-derived information on exposures and health indicators can support the high-dimension-biology-based association of environmental exposures and adverse health outcomes in early life.

**Keywords:** EXHES, exposome, metabolomics, bioinformatics

# **Method development and optimization for the quantitative analysis BPA, BPS and BPF in human urine samples using an HRMS instrument**

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Substances within the bisphenol group are used in the manufacture of plastic articles such as polyvinylchloride (PVC) and polycarbonate. Currently, bisphenol A (BPA) is the substance in the bisphenol group that produced and used in the highest volumes. The use of other bisphenols is small in comparison with BPA (KEMI, 2017). There is wide use of polycarbonate, with it being used in the manufacture of modern optical media, such as DVDs and CDs, sports equipment, medical and dental devices, building and construction materials, automotive parts and domestic appliances, as well as food containers, such as reusable beverage bottles and some manufacturing equipment. BPA is also used in epoxy resins, such as those used to line food and beverage cans. Small amounts of the BPA contained in these food contact materials migrate into food and beverages stored in materials containing the substance, resulting in human exposure. BPA is also used in the manufacture of thermal papers, leading to concerns regarding the exposure of cashiers in frequent contact with thermal paper in receipts. BPA was identified as having endocrine disrupting properties for human health by the Member State Committee of the European Chemicals Agency (ECHA) (ECHA, 2017). Because of its toxic for reproduction properties, BPA was already listed as a substance of very high concern (SVHC) on the Candidate List under Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH). The identification of BPA as a SVHC generates pressure for BPA to be substituted by other bisphenols in the European Union (EU). A number of other bisphenols have been registered under REACH. The Swedish Chemicals Agency has identified over 200 other bisphenols with a chemical structure similar to BPA that can occur on the European market (KEMI, 2017). Herein this work, an innovative rapid LC–ESI(–)MS method was developed incorporating minimum sample preparation time with minimum solvent consumption for the simultaneous determination of BPA, BPS and BPF in human urine. The backbone of the project consisted of three novel elements: The first element was the use of an HRMS instrument, LC-QTOF/MS, Agilent 6540; the second one was the optimization of the electrospray ionization parameters of BPA, BPS and BPF by a multivariate approach in order to achieve optimal instrumental sensitivity; and the third element was the development of an optimized extraction protocol based on the Liquid-Liquid method. Guidelines and best practices to avoid contamination from sample collection to data acquisition have been also established, including the use of specific reagents and materials, and cleaning strategy. To sum up, the presented human biomonitoring method of BPA, BPS and BPF, is characterized by the use of an HRMS instrument in comparison to the existing ones in the literature, (Casas et al., 2013, Chen et al., 2016) and by high sensitivity.

## **References**

CASAS, M., CHEVRIER, C., HOND, E. D., FERNANDEZ, M. F., PIERIK, F., PHILIPPAT, C., SLAMA, R., TOFT, G., VANDENTORREN, S., WILHELM, M. & VRIJHEID, M. 2013. Exposure to brominated flame retardants, perfluorinated compounds, phthalates and phenols in European birth cohorts: ENRIECO evaluation, first human biomonitoring results, and recommendations. *International Journal of Hygiene and Environmental Health*, 216, 230-242.

CHEN, D., KANNAN, K., TAN, H., ZHENG, Z., FENG, Y.-L., WU, Y. & WIDELKA, M. 2016. Bisphenol Analogues Other Than BPA: Environmental Occurrence, Human Exposure, and Toxicity—A Review. *Environmental Science & Technology*, 50, 5438-5453.

ECHA 2017. MSC unanimously agrees that Bisphenol A is an endocrine disruptor. In: ECHA/PR/17/12 (ed.).

KEMI 2017. Bisfenoler – en kartläggning och analys. KEMI, Sweden.

**Keywords:** human biomonitoring, Bisphenols, BPA, BPS, BPF

# Method development and optimization for the quantitative analysis of phthalates and Hexamoll® DINCH metabolites in human urine samples

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Phthalates and their substitute Hexamoll® DINCH®, are a group of plasticizers with a production volume of millions of tons per year. They are widely used in the manufacture of plastics, to make them soft and flexible, and in personal care products. They can be found in common products such as soaps, sun tan lotion, soft plastic toys, plastic bottles, raincoats, shoes and food packaging. Due to their endocrine disrupting properties, some phthalates have been assigned use restrictions since the late 1990s. There is societal concern due to their toxicity to reproduction and presence in biological matrices of humans with Greenpeace having conducted several studies addressing phthalates in consumer products and the potential health effects emerging from its endocrine disrupting effects in the early 2000s. We have developed, optimised and validated a new analytical method in the framework of the HBM4EU project, which overcomes the major analytical challenges in the human biomonitoring of phthalates and Hexamoll® DINCH®. Our method can lead to the quantification of 14 phthalates metabolites (MEP, MBzP, MiBP, MnBP, MCHP, MnPeP, MEHP, 5OH-MEHP, 5oxo-MEHP, 5cx-MEHP, MnOP, OH-MiNP, cx-MiNP, and OH-MiDP) and 2 Hexamoll® DINCH® metabolites (OH-MINCH and cx-MINCH). Separation of the isomers can be achieved following the developed online SPE LC-MS/MS method. Guidelines and best practices to avoid contamination from sample collection to data acquisition have been also established, including the use of specific reagents and materials, and cleaning strategy. To sum up, the presented human biomonitoring method of phthalates and Hexamoll® DINCH®, is characterized by higher sensitive in comparison to the existing ones in the literature (Berman et al., 2013; Huang et al., 2016; Koch et al., 2017; Ye et al., 2008), thus results in reliable results of 16 urinary biomarkers of exposure to plasticizers faster than before (in only one analytical run).

## References

Berman, T., Goldsmith, R., Goen, T., Spungen, J., Novack, L., Levine, H., Amitai, Y., Shohat, T., Grotto, I., 2013. Urinary concentrations of environmental contaminants and phytoestrogens in adults in Israel. *Environ Int.* 59, 478-84.

Huang, P. C., Tsai, C. H., Liang, W. Y., Li, S. S., Huang, H. B., Kuo, P. L., 2016. Early Phthalates Exposure in Pregnant Women Is Associated with Alteration of Thyroid Hormones. *PLoS One.* 11, e0159398.

Koch, H. M., Ruther, M., Schutze, A., Conrad, A., Palmke, C., Apel, P., Bruning, T., Kolossa-Gehring, M., 2017. Phthalate metabolites in 24-h urine samples of the German Environmental Specimen Bank (ESB) from 1988 to 2015 and a comparison with US NHANES data from 1999 to 2012. *Int J Hyg Environ Health.* 220, 130-141.

Ye, X., Pierik, F. H., Hauser, R., Duty, S., Angerer, J., Park, M. M., Burdorf, A., Hofman, A., Jaddoe, V. W., Mackenbach, J. P., Steegers, E. A., Tiemeier, H., Longnecker, M. P., 2008. Urinary metabolite concentrations of organophosphorous pesticides, bisphenol A, and phthalates among pregnant women in Rotterdam, the Netherlands: the Generation R study. *Environ Res.* 108, 260-7.

**Keywords:** human biomonitoring, phthalates, Hexamoll® DINCH

## **Multi-omics Analysis Reveals that Co-exposure to Phthalates and Metals Disturbs Urea Cycle and Choline Metabolism**

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The aim of this study was to obtain mechanistic insight into how co-exposure to phthalates and metals causes neurodevelopmental perturbations based on in vitro assays. HepaRG cells were exposed to two mixtures of DEHP, DiNP, and BBzP phthalates, methylmercury and total mercury. The concentrations of the pollutants were multiplied by ten for the second mixture. The effective concentrations of the chemicals in vitro were estimated through extrapolation from human biomonitoring data through internal dosimetry modeling using the INTEGRA computational platform. Multi-omics analysis was performed on the treated cell models including transcriptomics, proteomics, and metabolomics. Integrated pathway-level analysis of transcriptomics and proteomics data revealed that co-exposure to phthalates and heavy metals leads to the perturbation of the urea cycle due to alterations in the expression levels of arginase-1 and -2, argininosuccinate synthase, carbamoyl-phosphate synthase, ornithine carbamoyltransferase, and argininosuccinate lyase. Co-mapping of proteomics and metabolomics data revealed that their common drivers are responsible for the homeostasis of metabolic pathways related to choline, phosphatidylcholine, phospholipases and triacylglycerol metabolism. The identification of the urea, phosphatidylcholine biosynthesis I and phospholipases metabolic pathways is of interest since these pathways have been also identified in human samples from the REPRO PL and PHIME cohorts using untargeted metabolomics analysis and have been associated with impaired psychomotor development in children at the age of three to six. Our work reveals that co-exposure to plasticizers and metals disturb biochemical processes related to mitochondrial respiration during critical developmental stages that are clinically linked to neurodevelopmental perturbations.

**Keywords:** exposome, cross-omics, in vitro models

## **Effects of heavy metals to neurodevelopment in a mother-infant cohort study**

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The neurodevelopmental exposome paradigm was applied on a 178 mother-infant pairs cohort. Heavy metals prenatal exposure was determined to measure mercury in hair samples selected at birth, while cord blood and breast milk samples were analysed for mercury, cadmium, lead, and arsenic, as well as for essential elements (selenium, zinc, copper). Cognitive function, language, and motor development were assessed in children at the age of 18 months by the Bayley Scale for Infant Development (Bayley-III) development tool. The individual-level biological profiles were characterized using both nuclear magnetic resonance (NMR) spectroscopy and mass spectrometry (MS) for the untargeted urinary and plasma metabolomics analysis. Integrated pathway analysis and exposome-wide association algorithms were used for the evaluation of the associations between in utero exposure to metals and metabolic pathway dysregulation, as well as between metabolic pathway perturbations and neurodevelopment. NMR and LC-MS/MS analysis of plasma samples, as well as the analysis of urine samples pointed out the presence of oxoglutaric acid, oxalosuccinic acid, succinate, 2-oxoglutarate, formate, isocitrate, oxoglutaric acid, glycerol, L-carnitine, glutathione, methionine, cysteine, pyruvate, N-acetylglutamic acid,  $\beta$ -alanine, serine, and arginine. Therefore, pathway analysis revealed that the most perturbed metabolic pathways from exposure to heavy metals were related to TCA cycle, purine, pyrimidine, phospholipids and carnitine metabolism, and glycolysis. The aforementioned results suggested major disturbances to cells biochemistry, which resulted in the impairment of antioxidant defense mechanisms leading to the clinically observed results in linguistic, motor development and cognitive capacity.

**Keywords:** metals, neurodevelopment, metabolomics, EWAS



# **Source apportionment of polycyclic aromatic hydrocarbons (PAHS) in aerosols and study of their effect in human health: A comparison between the warm and the cold season of the year**

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PAHs are produced during the incomplete combustion of organic material. This fact is an indication for their emission sources which may include forest fires, volcanic activity, combustion of domestic heating fuels, coal and coal tar production, oil refinement, vehicle and means of transportation emissions (Tarantini et al., 2011). In Greece, the financial crisis that has been going on for over a decade now has forced citizens to search for cheaper and less eco-friendly fuels for domestic heating and their vehicles. The aim of this study examines the variation of emission sources and PAHs induced lung cancer risk throughout the seasons of the year 2017 and compare the cancer risk induced by PAHs, measured during the winter of 2013. PM<sub>2.5</sub> were measured in three different stations in the city (rural, urban background, traffic) during February-March (cold season) and June-August (warm season) of 2017 followed by chemical analysis of 19 PAHs. It was concluded that PAH levels were increased during the cold period of the year. Using the Positive Matrix Factorization model it was found that the main emission sources for the rural station were biomass combustion (28%) and vehicle emissions combined with industrial activity (72%); for the urban background station industrial activity (18%), vehicle emissions (38%) and biomass combustion (44%); and for the traffic station biomass combustion (36%), vehicle emissions (54%) and industrial activity (10%). Using PMF results, the conditional probability function indicates as the most possible sources of PAHs the oil refinery situated in the western part of Thessaloniki, the cement production factory in the district of Efkarpiia and main roads of the city (Ring Road, Lagada Street etc.). Based on the toxicity of benzo[a]pyrene, the Toxic Equivalent Quotients (TEQ) for the warm period of the year were calculated as follows: 0.29 ng/m<sup>3</sup> for the rural station, 1.05 ng/m<sup>3</sup> for the urban background station and 0.62 ng/m<sup>3</sup> for the traffic station. For the cold time of the year the values were 1.01 ng/m<sup>3</sup> for the rural station, 2.16 ng/m<sup>3</sup> for the urban background station and 2.56 ng/m<sup>3</sup> for the traffic station. Using the Multiple Path Particle Deposition model, the particle deposition along the human respiratory tract per age group was modelled in order to calculate the PAH-induced lung cancer risk. The maximum value of cancer risk was estimated for children (0-3 months old) in the urban traffic station, during the cold time of the year ( $1.741 \times 10^{-6}$ ) and the minimum risk was calculated for the female adults' group, in the rural station, during the warm period of the year ( $0.043 \times 10^{-6}$ ). Cancer risk assessment has also been carried out by Sarigiannis et al. (2015) who studied PAH-induced lung cancer risk in Thessaloniki during the winter of 2012-2013. The measurements were performed the same period as in the present study. The results showed an increase in cancer risk in the traffic station, from 2013 to 2017 indicating an increase of PAHs emissions during that time and a relative stability of cancer risk for the urban background station. Furthermore, the population living in proximity to the traffic station is at higher risk, as the result of the extensive use of diesel vehicles. Ambient air PAH levels in the urban environment are greatly affected by seasonal effects of emissions patterns. The use of a refined methodology assessing the levels of exposure and the health risk from exposure to PAHs, allows us to significantly differentiate

the actual health risk between different urban sites as well as between different age groups. On the urban scale the most significant PAH sources in ambient air are industrial activities and road transport.

### **References**

Sarigiannis, D. A., Karakitsios, S. P. & Kermenidou, M. V. 2015. Health impact and monetary cost of exposure to particulate matter emitted from biomass burning in large cities. *Science of The Total Environment*, 524-525, 319-330.

Tarantini, A., Maître, A., Lefèbvre, E., Marques, M., Rajhi, A. & Douki, T. 2011. Polycyclic aromatic hydrocarbons in binary mixtures modulate the efficiency of benzo[a]pyrene to form DNA adducts in human cells. *Toxicology*, 279, 36-44.

**Keywords:** particulate matter, polycyclic hydrocarbons, positive matrix factorization, lung cancer risk

## **Particle related air exposure during physical exercise: levels, dose and deposition in respiratory system**

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The life of 21st century has become more sedentary, which promotes higher prevalence of non-communicable diseases; about one third of worldwide adult population is insufficiently active which translates to 6% of global deaths. Furthermore, physical inactivity combined with unsuitable diet may lead to increased obesity. In order to improve the overall health and well-being, various national and international organizations recommend to practice physical exercise on regular basis. In cities, outdoor exercising is the most common and accessible form of exercising. However, the respective benefits can be reduced or even outweighed by the adverse effects of air pollution. Thus, this work aimed to evaluate the influence of air pollution on human inhalation dose and deposition in respiratory tract while conducting different types of physical exercise.

Information on levels of PM<sub>2.5</sub> and PM<sub>10</sub> was obtained from the national system of monitoring stations for cities Oporto and Lisbon along 2015-2018. A total of 5358 subjects was used to assess the anthropometric data of Portuguese population and its exercise habits. Inhalation dose were estimated for specific age categories of children and adult, considering different exposure and physical exercise scenarios and using age-specific parameters. The deposition of particles in the respiratory system was estimated by Multiple-Path Particle Dosimetry Model (version3.04, ARA).

Traffic-originated PM<sub>2.5</sub> and PM<sub>10</sub> were the relevant pollutants for the exposure assessment while exercising in the selected areas; PM<sub>10</sub> daily limit of 50 µg/m<sup>3</sup> was exceeded up to 40% of stations. The anthropometric data were rather similar between the populations of both studied areas. Furthermore, the results indicated that vast part of the adult population is overweight (body mass index of 25 to 29.9 kg/m<sup>2</sup>), with approximately 25% of subjects being obese in an age-range of 41-60 years old. The dose exposure to PM pollutants were in general higher in autumn when compared to spring. The highest inhalation dose was observed for the youngest children (<6 years) mostly due to longer time exposure (60 min per day vs. 150 or 300 min per week for adults) and due to their higher minute ventilation rate relative to body mass. In adults, the prolonged exercise duration influenced greatly the particle dose, being up to 1.1 times higher for moderate activities than for intense ones. Concerning the particle deposition within human respiratory system, the total of deposited fraction was higher for PM<sub>10</sub>, being deposited in the head (65-95% for all age group total deposition fraction) and tracheobronchial (1-23%) regions. Fine PM deposition in respiratory system was as follows: 16-76% in the head, and 13-33% in pulmonary region, being the lowest in tracheobronchial region (3%). Across all the physical exercise scenarios and across all adult age categories, higher deposition was observed for lower pulmonary lobes – for PM<sub>10</sub> it was 33% in left lower and 32% in right lower lobe, whereas the lowest abundance was observed the right middle lobe (8%). For PM<sub>2.5</sub> the respective percentages were: 19% in left lower and 26% in right lower lobe; in right middle lobe the abundance was 7%.

The presented results also showed that in terms of 5 lobes, similar trends were observed in both adults and children. While physical exercise should be recognized as a relevant component of national and international public health programs, integrated and intersectoral approaches, with emphasis on outdoor environment, are needed in order to promote health benefits and disease prevention among sport practitioners' of all ages.

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**Keywords:** environmental pollution, ambient air, physical exercise, traffic, particulate matter (PM), public health

# **Climate change mitigation and air pollution abatement – towards win-win solutions**

# **Modeling of Bioclimatic Comfort Change Depend on Global Climate Change: Case of West Mediterranean Basin of Turkey**

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In recent years, increasing greenhouse gas concentration in the atmosphere caused global warming and climate change. Climate change is affecting meteorological events on a global and regional scale, causing bioclimatic comfort conditions to change. In the study, western Mediterranean Basin of Turkey due to global climate change aimed to model the changes in bioclimatic comfort conditions. Since the period in which the bioclimatic conditions deteriorated the most in coastal Mediterranean climate zone between May and October, this interval was considered as temporal change in the research. To determine the current bioclimatic comfort, climate data (temperature, humidity, wind speed and cloudiness) for the 1986-2016 period at the meteorological observation stations in the basin were used. RCP4.5 and RCP8.5 scenarios of IPCC were used for reasonal projection and as climatic model RegCM4.3.4 with dynamic downscaling method with resolution of 20 km applied to meteorological data set for climatic change. In this study, bioclimatic comfort was calculated using PET (Physiological Equivalent Temperature) by means of RayMan software, which is one of the most widely used bioclimatic comfort indices, which includes human energy balance calculations as well as meteorological parameters. PET data obtained from the calculation were transferred to GIS medium and spatial distribution of bioclimatic comfort at basin scale was obtained by using IDW analysis. As a result of the change in climate system, with bioclimatic comfort conditions were observed. The information and conclusions of the study are very likely to assist decision-making at various levels, including health, tourism and regional planning.

**Keywords:** Climate change, Bioclimatic Comfort, PET, RayMan, West Mediterranean Basin

## **Determination of bioclimatic comfort areas according to different age groups: Case of Fethiye Göcek SEPA / Turkey**

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Human with changing age, their metabolic activities are differing and so their bioclimatic comfort values are changing. In the study, determination of bioclimatic comfort with human age in Fethiye-Göcek SEPA (Specially Protected Area), Mugla was aimed. Since the period in which the bioclimatic conditions deteriorated most in the coastal Mediterranean climate zone is between May and October, this interval was considered as temporal change in the study. In order to determine bioclimatic comfort, climate data (temperature, humidity, wind speed and cloudiness) of 1987-2017 period were used obtained from meteorological observation stations in the region. The age variable was evaluated at 10 year intervals. In the study, bioclimatic comfort was calculated by using PET (Physiological Equivalent Temperature) and RayMan model, which is one of the most widely used bioclimatic comfort indices, that includes human energy balance and personal characteristics as well as meteorological parameters. In the RayMan model, the age parameter was considered as variable while the other parameters were stated constant. As the age changed, it was observed that there were changing bioclimatic comfort spatially in the region. The information and results obtained from the study are very likely to be the source of health-oriented urban planning and tourism studies.

**Keywords:** Bioclimatic Comfort, PET, RayMan, Fethiye-Göcek SEPA

# **Transition to Climate Friendly and Unpolluted Cities until 2050**

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Many cities in Europe and beyond have very ambitious climate protection goals, e.g. becoming carbon-free by 2050. At the same time cities are striving for meeting ambitious air pollution control aims, especially for PM<sub>2.5</sub> and NO<sub>2</sub>; it is very likely, that the European Commission will decrease the PM<sub>2.5</sub> limits further, so that the aims for air pollution control will get more ambitious. Currently, separate plans for climate protection and air pollution control are prepared. However, as measure for air pollution control also influence greenhouse gas emissions and vice versa, it is obvious that a common plan for climate protection and air pollution control would result in more efficient bundles of measures. Thus we strive here for developing visions for cities, where greenhouse gas emissions are reduced by 95-100% (not allowing for carbon leakage) and simultaneously the WHO target values for air quality, e.g. 10 µg/m<sup>3</sup> PM<sub>2.5</sub> annual mean, are not exceeded. These aims should be fulfilled in such a way that the costs and utility losses should be minimised and thus wellbeing and quality of life of the population is maximized. First, the technical options that might be used to meet the above mentioned aims are described. The main secondary energy carrier will be electricity produced with CO<sub>2</sub>-free power plants.

As the production from solar and wind energy is fluctuating and storage of electricity is expansive, some electricity will be used to produce hydrogen, which will be the second important energy carrier. Hydrogen might be stored and distributed in the retrofitted natural gas network. Biomass (wood, biogas,) is used to less extent. The potential is limited and in small combustion systems the emissions of pollutants are too high, so biomass may only be used in larger units with very good filters. The modes for transport used include autonomously driving interconnected vehicles (cars, small busses and trucks), rail-bound transport systems, walking and cycling.

Cities are divided into mixed zones and into fast lanes, where transport modes are separated. Options for private transport include private 'taxis' for only one party and small busses (6-8 places), that simultaneously pick up people from and transport people to different places along the route. However, simulations show, that to avoid traffic jams during rush hours, rail-bound traffic is necessary in addition to taxis and small buses. With regard to the building stock, it is essential that all buildings are highly heat insulated.

Our simulation here shows, that especially replacing windows makes the buildings tighter and so indoor pollution is increasing. Thus all buildings should be equipped with a mechanical ventilation system with heat recovery. A larger number of techniques for heat production is available: electric heat pumps - where possible combined with photovoltaik cells on the roof, combined heat and power units, fuel cells and condensing boilers using hydrogen, district or block heating and cooling a.s.o.

The concept described above is analysed quantitatively for the city of Stuttgart and indicator values for the realisation of the concept in 2050 are given. E. g. the number of vehicles will be drastically reduced. If the concept with private 'taxis' is realised, the necessary number of vehicles will be halved. With small buses, only 20% of the vehicles driving now through the city are needed. Thus a combined system with ride sharing during rush hours and car sharing outside the rush hours might be an optimal system.



Variable pricing may be used to steer the behaviour of the transport users. Less cars also mean less occupied parking space on the streets leaving free spaces for other purposes.

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**Keywords:** CO<sub>2</sub>-free city, clean air in cities, green cities

# **Uncertainty associated with assessing personal exposure to particulate matter with high temporal resolution using low-cost portable sensors**

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## **Summary**

Combining particulate matter (PM) concentration and heart rate (HR) data from low-cost sensors can provide personal exposure information with high temporal resolution. Uncertainty associated with low-cost sensors was determined by collocating them with reference instruments, and using this data to model personal exposure to PM. Four models were used with different levels of complexity (in reference to the variables implemented in the model). The results showed that the more complex models, using HR, sex, ethnicity and other variables as proxies to determine minute ventilation, responded better to changes in activity and provided data with less uncertainty. Low-cost sensors could be used for modelling personal exposure to particulate matter.

## **Introduction**

Exposure to PM has been linked to several health issues and a key step in understanding, and subsequently reducing its impact on health, is to accurately measure exposure on a personal level. Low-cost sensors facilitate extensive studies which can provide data with high-temporal and spatial resolution, but come with certain shortcomings stemming from simplified sensing technologies. Personal exposure calculations from this data have uncertainties which differ according to the type of model used. Several models were used to calculate personal exposure from heart rate and PM concentration data. Uncertainties associated with these models were compared to determine which variables have the highest impact on the uncertainty in each approach.

## **Methodology and Results**

A portable low-cost PM sensor was used to measure concentrations with high temporal resolution (1 min) for one week in the spring of 2019. Prior to using this sensor in field conditions, it was validated and the results showed that the PM<sub>1</sub> data had relatively low uncertainty. HR was used as a proxy for calculating minute ventilation, and was measured by a low-cost activity tracker. Four models were used to determine personal exposure to PM (from most to least complex): 1. using HR, sex, ethnicity and age (Greenwald et al., 2019); 2. using HR and sex (Zuurbier et al., 2009); 3. using sex, age, body weight, microenvironment characteristics (Madureira et al., 2018); 4. using age and sex, and determining minute ventilation by using average values for specific age groups. Two models did not use HR as input data. The results showed that models 1 and 2 had similar patterns and were mostly in agreement, except at elevated concentration levels. Model 3 mostly followed the pattern from models 1 and 2, but also had some high deviations, which were even more evident at higher concentrations of PM.

Model 4 did provide some correction to the raw PM data, but proved to be relatively unresponsive to changes in activity, compared to other models.

### **Conclusions**

The models used for calculating personal exposure proved to differ, mostly based on the number of considered variables. Models 1 and 2, which used HR as a proxy for minute ventilation, provided data that mostly corresponded with changes in activity and PM concentrations, and the models that did not use HR, showed less response to changes. This research showed that models which use data for multiple variables, which can also be obtained from non-intrusive low-cost sensors, have less uncertainty. Further research is also needed to validate modelled exposure with directly measured personal exposure.

### **Acknowledgement**

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### **References**

- Greenwald, R., Hayat, M.J., Dons, E., Giles, L., Villar, R., Jakovljevic, D.G., Good, N., 2019. Estimating minute ventilation and air pollution inhaled dose using heart rate, breath frequency, age, sex and forced vital capacity: A pooled-data analysis. *PLOS ONE* 14, e0218673.
- Madureira, J., Aguiar, L., Pereira, C., Mendes, A., Querido, M.M., Neves, P., Teixeira, J.P., 2018. Indoor exposure to bioaerosol particles: levels and implications for inhalation dose rates in schoolchildren. *Air Qual Atmos Health* 11, 955–964.
- Zuurbier, M., Hoek, G., Hazel, P. van den, Brunekreef, B., 2009. Minute ventilation of cyclists, car and bus passengers: an experimental study. *Environmental Health* 8, 48.

**Keywords:** particulate matter, minute ventilation, dose assessment, low-cost sensors, uncertainty assessment

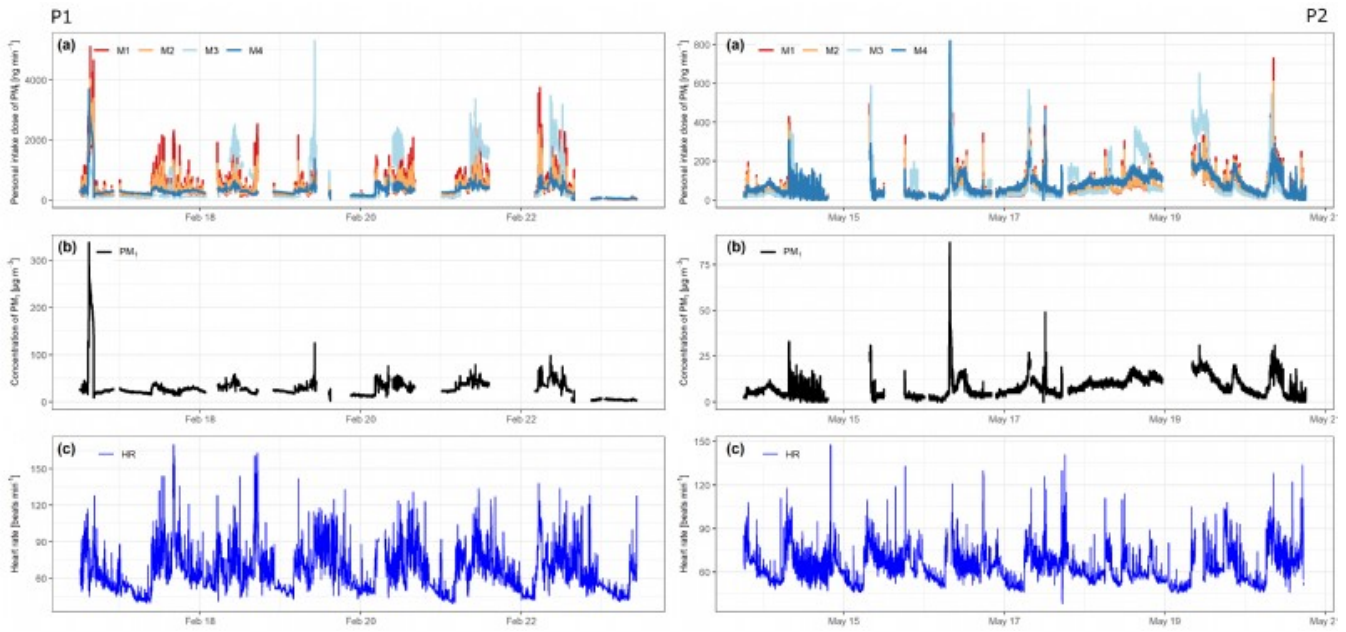


Figure 1. (a) Calculated intake dose of PM<sub>1</sub> for all four models, (b) measured concentrations of PM<sub>1</sub>, (c) heart rate in beats per minute. Left side for participant 1 (P1) and right side

## **Cost-benefit analysis of carbon mitigation measures in European cities: the importance of co-benefits**

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This study has been developed within the European Union funded Horizon 2020 project Integrated Climate forcing and Air pollution Reduction in Urban Systems (ICARUS). In this study we apply cost-benefit analysis (CBA) and cost-effectiveness analysis to evaluate some carbon mitigation strategies which have been proposed by the cities within the ICARUS project. The selected measures relate to three broad areas: energy efficiency measures, in the form of heating system replacement and building insulation investments (Basel, Brno and Stuttgart); active transportation measures, i.e. promotion of walking, cycling and public transportation (Athens, Brno and Stuttgart); and alternative fuel vehicles, particularly private cars and public buses (Brno, Milan and Stuttgart). The quantification of health benefits builds upon a health impact assessment (HIA) of the selected measures. The HIA models the complex process that goes from individual exposure to different pollutants to short-term and long-term health effects. The following health impacts from exposure to PM and NO<sub>2</sub> are included in the analysis: adult mortality, infant mortality, Chronic bronchitis, Chronic bronchitis in children aged 6 to 12, Cardiac hospital admissions, Respiratory hospital admissions, and Bronchitis symptoms in asthmatic children aged 5 to 14. In order to input a monetary value to non-tangible impacts, the following assumptions have been made:

- Health Endpoint valuation. The valuation of health endpoints builds on previous studies, and in particular on Hunt et al. (2011) that presents values for a range of health endpoints.  
- Carbon savings. The Social Cost of Carbon (SCC) is set at \$31 (€201829.03) as suggested by a study by Nordhaus (2017).

- Health benefits from increased walking and cycling. Health benefits linked to the increased cycling and walking are measured using the WHO-Europe (2014) Health Economic Assessment Tool - HEAT for

walking and cycling. The benefit of increased physical activity is measured in terms of number of deaths avoided, using the value of a statistical life in the selected country.

- Noise, Accidents and Travel Time Losses. A number of impacts are included in the valuation of some of the measures. First, noise reduction benefits, which can emerge in the case of traffic reductions or in the case of switching from conventional cars to electric vehicles. Second, accidents costs and benefits which can emerge in the case of traffic reductions or in the case of switching to different transport methods. Accident costs include material damages, medical costs, cost of lives lost, cost of loss of productivity and cost of suffering (Gössling et al. 2019). Third, travel time costs, as shifting from personal car use to public transport, walking or cycling is associated to extra travel time. Several parameters have been suggested in the literature to value these co-impacts. An example is the study by Litman and Doherty (2011), which we follow in this study.

Our analysis shows the importance of the inclusion of health co-benefits in economic analysis of carbon mitigation strategies. Options that may appear costly in terms of the financial cost per tonne of carbon reduced become viable in many cases when co-benefits are considered. Different strategies in different cities may be appropriate. It is therefore important to define a policy at an appropriate scale (the urban level) to address carbon mitigation.

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**Keywords:** cost-benefit analysis, carbon mitigation, health co-benefits, energy efficiency, active transport, electric vehicles

## **Development of an integral modeling system to study air quality climatic trends in European urban areas**

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Trying to model future climatic change impact on local scale air quality, one should be aware of the inherent difficulties in trying to mathematically describe the associated phenomena and quantify the relevant input due mainly to lack of knowledge and missing accurate enough input data. For answers that require high temporal and spatial refinements the issue of computational capacity must also be considered. Moreover, consideration should be given to the additional difficulty due to high temporal variability of the defining parameters not only on the level of hour and day but also on the level of the year and even beyond. Within the frame of the European Project ICARUS, the present work aimed at building a comprehensive integral modeling system to study air quality climatic trends in European urban areas coping with the above-mentioned difficulties as successfully as possible. For air quality modeling on the urban scale both WRF-Chem and CAMx models have been utilized offering capability of results intercomparison and inherent model uncertainty. Concerning emissions input, the University of Stuttgart (USTUTT) High Resolution (1 km x 1 km) Emission Inventory Scenarios Data produced within ICARUS Project, have been postprocessed. To study air quality climatic trends (a) the climatic period (e.g. 2001-2050) together with the specific climatic scenario coming from Representative Concentration Pathway (RCP) are selected. (b) All days of the above climatic period are grouped using weather cluster methodology (c) for a given climatic period interval (e.g. 5 years) cluster based representative days are selected on one hand for performing detailed air quality modelling simulations and on the other hand for selecting appropriate boundary conditions for those simulations and (d) Pollutant Representative concentration (CR) indicators per climatic time interval indicators are estimated based on the above mentioned detailed simulations. The present methodology has been applied for the city of Thessaloniki selecting the moderate RCP4.5 climatic scenario for the period 2001-2050. The weather clustering has been performed using modelling data from the Coordinated Regional Climate Downscaling Experiment (CORDEX) provided from the Earth System Grid Federation (ESGF) index nodes with 10km space resolution. In addition, comparisons of the obtained modelling concentration data with available experimental data where feasible, are presented and discussed.

**Acknowledgement:** This work has received funding from the European Union's Horizon 2020 under grant agreement No 690105 (Integrated Climate forcing and Air pollution Reduction in Urban Systems (ICARUS))

**Keywords:** air quality, modeling, urban areas, weather clustering, climatic trend.

## **Multi-sensor data collection for personal exposure monitoring: ICARUS experience**

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As part of the ICARUS (Integrated Climate forcing and Air pollution Reduction in Urban Systems) H2020 EU project, sampling campaigns took place in seven European cities (Athens, Basel, Brno, Ljubljana, Madrid, Milan, Thessaloniki), aiming to characterize urban population exposure to air pollutants.

The main objectives of these campaigns were to: (i) collect data on external environmental exposure and exposure determinants by combining location, activity and air pollution data in different microenvironments, (ii) demonstrate feasibility of using new sensor and mobile technologies in collecting exposure data, and (iii) analyse and compare exposure data in several different European cities. To this end, over 600 participants from over 250 households were recruited altogether in these cities, comprising individuals of all ages and all socioeconomic groups. The process included both at home and personal monitoring for 7 days, including a weekend, in both summer and winter periods. Information was collected using a combination of exposure monitoring devices, questionnaires and time activity diaries. In addition to static sensors placed at volunteers' households, wearable sensors enabled dynamic measurement of personal exposure, location and intensity of activity. Participants were also asked to provide information on their household characteristics, time-use patterns and socioeconomics background. Through the internet of things and taking advantage of WiFi and LoRaWAN communication protocols, data from multiple devices were wirelessly synchronized and uploaded to an



online data collection platform. Combining spatiotemporal information on air pollution and activity data of individuals, we were able to directly calculate individual exposure profiles and to aggregate information according to specific microenvironments and activity, respectively. Personal exposure reports were then prepared and distributed to all participants. In the next step, these data will be used to parameterize and validate various simulation models (e.g. Agent Based Models) (Figure 1).

In addition to exposure assessment results (example given in Figure 2), in this presentation the overall experience gained through conduction of sampling campaigns in all seven cities will be summarised, focusing on the following aspects: sensors selection and evaluation, development of the overall study design, data harmonisation and building of supporting ICT infrastructure, as well as overall feasibility evaluation including user experience as reported by both participants and field workers.

**Acknowledgement:**

This work has received funding from the European Union’s Horizon 2020 Programme for research, technological development and demonstration under grant agreement No 690105 (Integrated Climate forcing and Air pollution Reduction in Urban Systems (ICARUS)). This work reflects only the authors’ views and the European Commission is not responsible for any use that may be made of the information it contains.

**Keywords:** multi-sensors, air quality, personal exposure, IT infrastructure, user experience

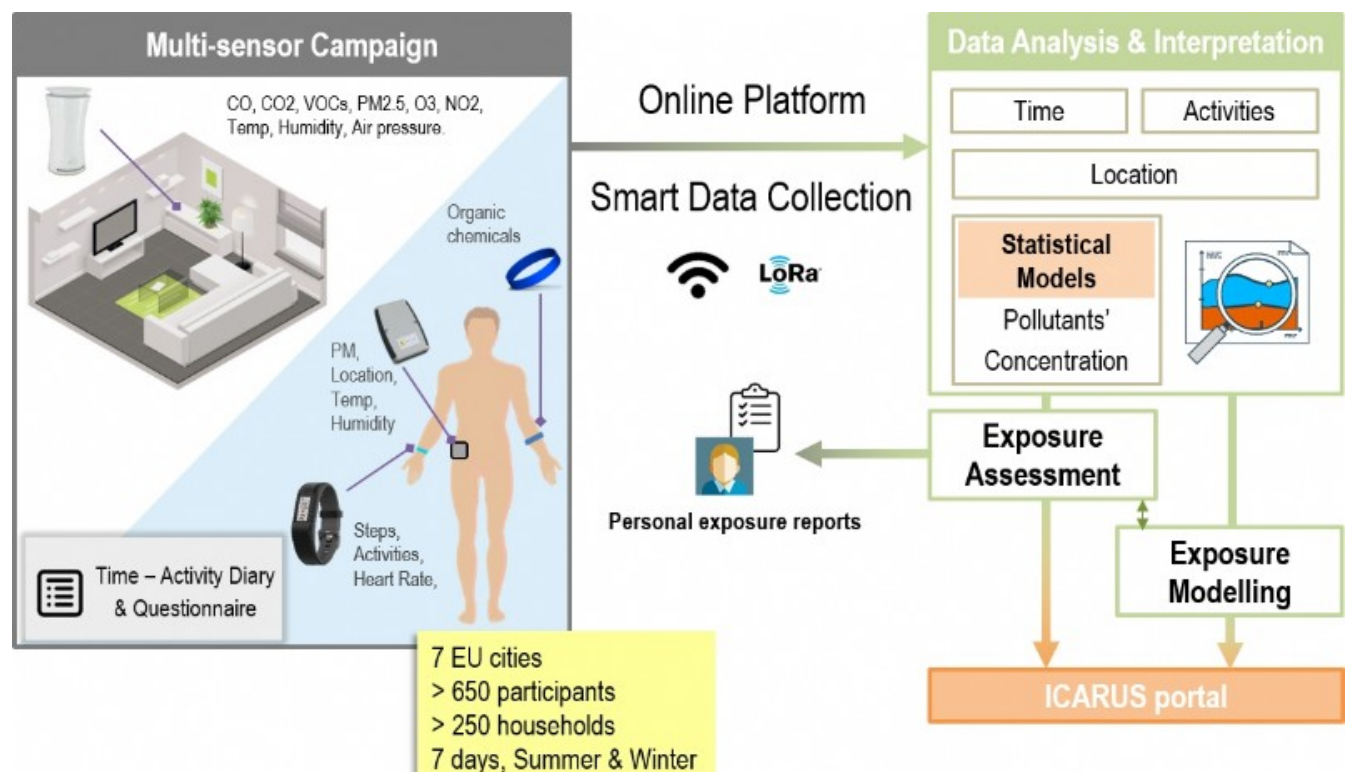
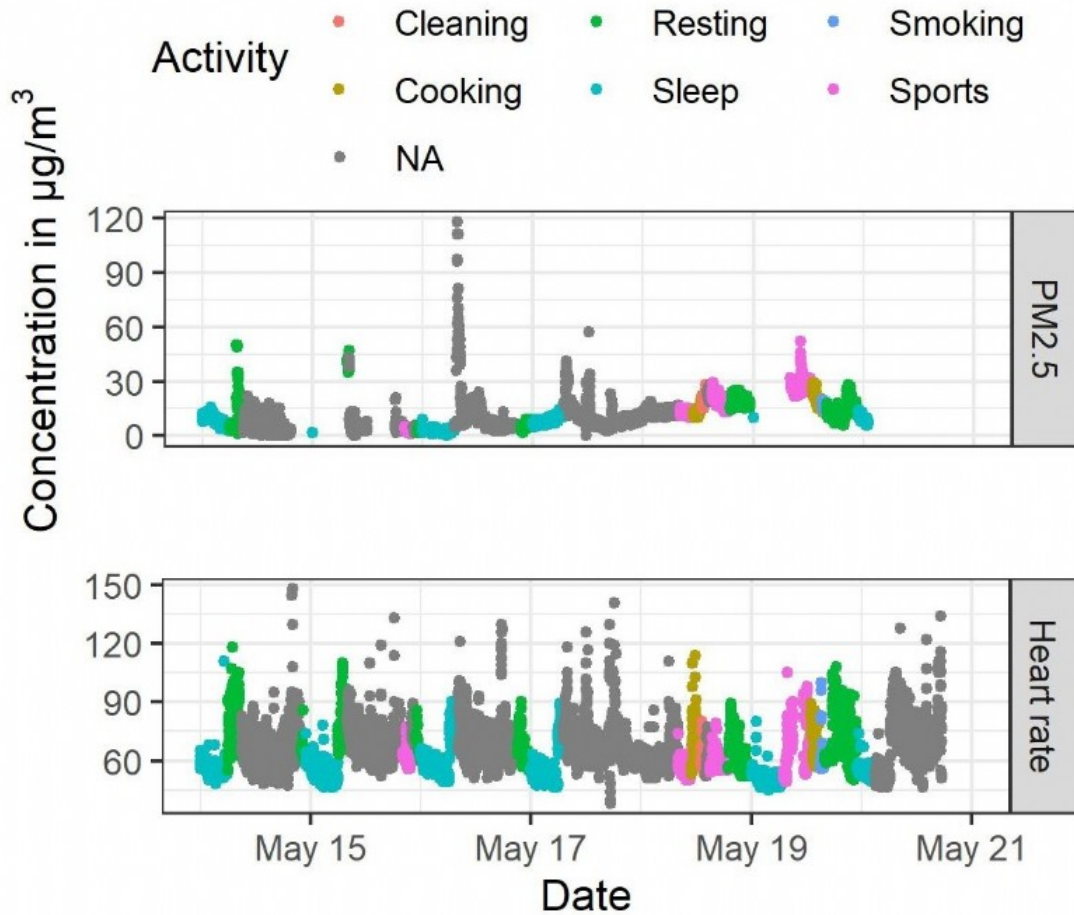


Figure 1. Schematic outline of the ICARUS sampling campaign



*Figure 2. Example of exposure assessment results: PM2.5 concentrations and hearth rate obtained by wearable sensors over a period of one week with indicated activities of volunteer*

# **Air pollution health impact assessment and cost-benefit analysis of win-win policy solutions at the urban scale in the city of Milan**

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## **Summary**

This study aims at presenting the results of air quality improvements on the environment and human health brought by the potential implementation of five selected policy options as win-win solutions at the urban scale in the city of Milan (Italy). To this end, for each of the selected policy, the following effects have been evaluated: (a) change in emissions of major air pollutants; (b) change in emissions of greenhouse gases (GHGs); (c) changes in ambient concentration of air pollutants; (d) changes in the exposure to air pollutants; (e) changes in the associated impacts on human health; (f) cost-benefit analysis and cost-effectiveness analysis. The impacts of the five selected policy options were carried out under the assumption of RCP4.5 scenario for climate change.

## **Introduction**

Many cities worldwide are affected by air pollution, while being themselves major contributors to the emissions of air pollutants and GHG. Effective policies and measures to reduce emissions have to consider the interest of citizens for clean air and rely on the feasibility of interventions designed to achieve these goals. Numerous epidemiological studies have found an association between air pollution and a wide range of adverse health effects in the general population; the effects have ranged from subtle subclinical effects to premature death. Air Pollution Health Impact Assessment (AP-HIA) aims to estimate the risks of past, current or future exposure to air pollution and of changes in exposure that may result from planned policies or policy options together with the Cost-Benefit Analysis (CBA) and Cost-Effectiveness Analysis, specifically taking into account the impacts of air pollution as well as the GHGs on health and the environment of the measures and policies.

## **Methodology and Results**

Spatially distributed (1\*1 km) business-as-usual (BAU) emission inventories for the major air pollutants were developed for years 2015, 2020 and 2030 for the city of Milan. The emissions values (E) were disaggregated by sector groups/subgroups/activities and by type of fuel based on the expected changes in activities (A) and emission factors (EF) for each sector ( $E = A * EF$ ). The derived emission inventories fed the WRF-Chem model to estimate air pollution concentration levels. According with Milan city

stakeholders, five key policies/measures with different time horizons (2020-2030) aiming at reducing air pollutants and GHGs emissions in different sectors were selected: TRANSPORTS (1) Low Emission Zone (Area B) and (2) Conversion of all public buses to electric ones; BUILDINGS (3) Improvement of energy efficiency in existing and new residential flats; ENERGY SUPPLY (4) Photovoltaic, solar power and district heating; LAND USE (5) Planting of 25,000 new trees per year. The new emission inventories for each policy have been provided to the WRF-Chem model to estimate changes in the air concentration levels with respect to the BAU scenarios. Area B, Electric Bus and Building scenarios resulted in lower NO<sub>2</sub> levels, in particular Area B showed a significant reduction also for PM<sub>2.5</sub> concentrations. Health impact assessment was based on the population attributable risk fraction concept making use of the HRAPIE concentration-response (C-R) functions (WHO, 2013). Results showed: (a) the implementation of a Low Emission Zone (Area B) banning the entrance of the most polluted vehicles shows by far the highest health benefit (between 5 and 18 less mortality cases on yearly basis); (b) Electric Bus and Building scenarios show higher health benefits among the other measures (between 2 and 5 less mortality cases on yearly basis); (c) all policies simulated show the highest health impacts in the periods 2031-2035 and 2036-2040 and the lowest ones in the period 2021-2025 most likely due to partial implementation of the analysed policies as well as the prevalent meteorological conditions, which may favour pollutant dispersion across less populated areas. CBA compares costs and benefits of a measure by taking an "incremental approach", which means that costs and benefits are computed with respect to the baseline scenario. All costs and benefits are expressed in a common metric, i.e. in monetary values. CBA takes into account both the financial and economic costs and benefits and the performance of the measures presented in table 1 were analysed by computing the Net Present Value (NPV) of total discounted costs and benefits and the Benefit-to-Cost Ratio. Additionally, Cost-effectiveness analysis compared the costs of a measure with the achieved outcomes. Two main indicators of cost-effectiveness were computed and presented to compare costs per tonnes of CO<sub>2</sub> eq saved, with respect to the baseline scenario: Financial cost-effectiveness (FICOSTEF), i.e. the financial cost per tC saved, and Full cost-effectiveness (FUCOSTEF), i.e. the full cost (costs-benefit) per tC saved.

## **Conclusions**

An AP-HIA can aid to answer specific policy questions, in many countries it is required as part of the decision-making process for new programmes, projects, regulations, and policies aimed at improving AQ or that may affect AQ as a side-effect. The findings, as an integrated policy assessment, provides a synthesis in terms of decision-making support for the considered policy areas. Based on these results, further cost-benefit analysis has been performed taking into account additional economic, political and social factors, including costs for the emission source operator and for other actors of society, including health impacts, time losses or gains and wider impacts, finally creating a useful tool for policy makers and for an improved compliance to the measures by citizens.

## **Acknowledgement**

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**Keywords:** Air Pollution, Health Impact Assessment, policies, emissions

## **Fine particulate matter chemical composition and sources in 6 European cities: The ICARUS Project**

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Particulate matter air pollution deriving from traffic, industrial emissions, oil combustion, biomass burning and other anthropogenic activities as well as natural sources comprises one of the major global concerns. PM<sub>2.5</sub> is an air pollution metric widely used to assess air quality, with the EU having set targets for reduction in PM<sub>2.5</sub> levels and population exposure. Consequently, one of the major challenges for the scientific community is to identify, quantify and characterize, at the appropriate scale, the sources of atmospheric particles in the aspect of proposing effective control strategies to the public authorities. Although studies for source apportionment are rapidly spreading globally, revealing both PM local and regional origin, the comparability of results among the different sampling sites is often hampered, leading to the need for harmonized source apportionment outcomes from multi-city studies. This study presents the results from PM<sub>2.5</sub> data collected in six European cities (Athens, Brno, Ljubljana, Madrid, Stuttgart and Thessaloniki) in the frame of H2020 ICARUS project, their chemical composition as well as the outcomes of source apportionment application. In particular, PM<sub>2.5</sub> samples collected from three different sites in each city (traffic, urban background and rural) were chemically analyzed for ions, heavy metals, organic/elemental carbon (OC/EC) and Polycyclic Aromatic Hydrocarbons (PAHs). The chemical composition data was introduced in PMF (Positive Matrix Factorization) and Lenschow approach models with the scope of identifying the main groups of sources and estimating their contribution to PM<sub>2.5</sub> concentrations. PM<sub>2.5</sub> limit value (WHO daily limit: 25µg/m<sup>3</sup>; annual EU target value: 25µg/m<sup>3</sup>) was exceeded in 50% of the sampling days at Athens’ sites, 10-28% at Brno sites, 20-48% at Ljubljana sites, 8-37% at Thessaloniki sites. The exceedances at Madrid and Stuttgart sites were less than 7% of the sampling period. It is remarkable that the majority (>70%) of the exceedances were recorded during the winter period.

EPA PMFv.5 and Lenschow approach models were run for each sampling site/city (n=60 samples per site, including warm and cold season). Depending on the case, PMF model resulted in a number of five to eight PM<sub>2.5</sub> sources for each site/city. Biomass combustion contribution to PM<sub>2.5</sub> (11-43%) indicated

the prevalence of the source during winter/fireplaces-burning periods, without excluding biomass combustion emissions from agricultural activities. Fuel oil combustion source (contribution 8-27%) presented almost similar factor profiles among the sites but different temporal variation. In the majority of the cases, traffic was represented by two different factors: traffic-exhausts and traffic non-exhausts. Traffic-exhausts contribution ranged between 6% (Thessaloniki rural) and 32% (Ljubljana traffic site). In all cases, the source contribution was higher at the traffic sites of the cities except for Athens, where the maximum value was found for rural site, where frequent transit of heavy vehicles was reported. Traffic non-exhausts source, including anthropogenic dust sources such as elemental materials emitted from vehicles brake pads, tires and mechanical parts, presented different factor profiles among the several sites. Its contribution ranged between 3% (Athens rural site) and 25% (Ljubljana urban background site, though including soil dust too). A secondary aerosol source (9-34%) was identified either as secondary sulfate only, either as secondary sulfates and nitrate (when inorganic aerosol is represented rather than sulfate exclusively). Finally, two natural-origin sources were identified: Soil dust associated with elements from the earth's crust presented different profile among the sites, even in the same city. Sea salt source contribution appeared with the minimum values (1-4%) in Athens, Ljubljana and Thessaloniki cities. Lenschow approach indicated that around 40% of PM<sub>2.5</sub> sources are coming from the regional background and 50 % of the PM<sub>2.5</sub> composition is related with traffic. However, the main contribution of this sector was not the exhaust gases but the tyre and brake wear and resuspension of the particles, which means that even zero-emission cars would still, aggravate the air quality inside the cities. The common and simultaneous sampling and analysis procedure in ICARUS campaigns, offered a prospect of a harmonized source apportionment approach, with the scope of identifying the similarities and differences of PM<sub>2.5</sub> source chemical fingerprints across the cities and sampling sites. Traffic, biomass burning and fuel oil combustion are the prevailing sources for PM<sub>2.5</sub> measured in ICARUS cities.

### **Acknowledgement**

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**Keywords:** PMF, source apportionment, PM<sub>2.5</sub>

# **A Comparative Investigation of Temperature Persistence: A Case Study of Western Turkey**

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During the recent years, climate change has become one of the most important problems all around the world. One of the most important indicators of climate change is the increases in temperature. On the other hand, extreme events such as heat waves, floods, droughts, etc. are also increasing in every year. Thus, it is important to conduct studies in order to determine the extent of climate change. In this study, change of persistence in maximum, minimum and mean temperatures were investigated by using conditional probability and duration curve approaches for seven stations that are located in the western part of Turkey. The stations with an altitude of less than 100 meters were considered as maritime stations while the other stations can be described as continental stations. Daily temperature data taken from Turkish State Meteorological Service (MGM) was used for western part of Turkey. The study period was taken to be 1987-2016 for all stations. Total period was divided into three sub periods and changes of persistence as far as sub periods were presented. Long term averages of temperatures were considered as “threshold” values for each station. Station-based results showed that almost all stations have increasing persistence values for all temperature types according to duration curve approach. Similarly, more than half of the stations have increasing persistence values as far as conditional probability approach. On the other hand, period-based results showed that maritime stations have higher persistence values than continental stations, as general. The results of this analysis showed that the methods which were applied can be useful for determining whether any time series has changed with time or not.

**Keywords:** Persistence, temperature, climate change, conditional probability, duration curves, Turkey

# **Determination of Outdoor Thermal Comfort in Rural, Urban and Mass Green Areas in Summer Season with the Rayman Model**

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The areas covered by the residential areas and population in urban areas throughout the World are rapidly increasing. The more livable urban areas are of vital importance for the urban population. In this context, there are many studies on urban heat island and urban thermal comfort. Urban areas; due to the effect of factors such as covered surface areas, less green areas and low wind velocities, they have warmer microclimates compared to rural and green areas. Green areas, besides the aesthetic effects it provides to the people of the city, also provides significant climatic contributions. The effects on air humidity, cooling effects and wind direction are some of these effects. This study was carried out with the measurements taken from meteorological stations established in 3 different areas (urban, rural, mass green area) in Erzurum. The differences in the outdoor thermal comfort of these areas were determined by the RayMan computer model. In 2016- 2017 and 2018, air temperature, relative humidity and wind data were used for hourly measurements during July. Furthermore, by adding cloud closure rates to other climate data, physiological equivalent temperature (PET) values were determined. As a result of the study, the PET values; 23,9 ° C in the urban area, 22,6 ° C in the mass green area and 17,7 ° C in the rural open area was determined. The results indicated that the urban area was 1.3 ° C warmer than the green areas and 6.2 ° C warmer than the rural open area. When the data were evaluated according to the thermal comfort classes, it was seen that only the green areas were in comfortable ranges. In this study, the reasons of low PET in rural open areas and high values in urban areas were investigated and suggestions were made to make urban areas more comfortable and more livable.

**Keywords:** Thermal Comfort, Physiological Equivalent Temperature, Green Area, Urban Heat Island, RayMan



# **Investigating Thermal Comfort of Different Plant and Design Street Scenarios**

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Due to the increase of the population lives in the cities, the negative impact of the traffic of the vehicle and pedestrians on the roads and pavements are also increasing. Safely walking on the city roads and providing a thermal comfort environment for people are extremely important factors for achieving sustainable urbanization. This study aims to investigate numerically the thermal comfort sensation of different narrow and wider street scenarios with different types of plant species using the ENVI-met Soft Model. The Rayman pro-model was utilized to extract the Sky View Factor (SVF) and the Physiologically Equivalent Temperature (PET<sub>OC</sub>) parameters. Field measurements were performed for collecting climate data during the summer and wintertime in 2018. The study was conducted in Erzurum/Dadaskent city located at high altitudes and surrounded by mountains, which is one of the most important winter cities of Turkey. The results indicated that hot stress was found at the wide street scenario without trees and high SVF in the summer, while good thermal comfort level was found in the narrow street scenarios without trees and low SVF in wintertime. At the same time, cold stress is found in the street with a coniferous tree scenario in the wintertime, while good thermal comfort found in the wide Street with leafy trees in summer. However, a street with scotch pine trees (*Pinus sylvestis* L.), which is a coarse-textured plant blocks the wind speed make the street thermally discomfort; while street with birch (*Betula verrucosa* L.) or ornamental trees (*Prunus cerasifera* Atropurpurea), which is light textured plants allow the wind to penetrated makes the street more comfort. The ENVI-met analyzes carried out on streets with 10m and 40m values indicated that there were no significant changes in the temperature values in winter, while the tree-lined street with an average temperature of 40m in summer was found to be 4.3 0C cooler. The results of this study clearly indicated that streets should be directed into the prevailing wind to bring the wind into the city to mitigate the high air temperature and ensuring the wind motion to reduce the hot stress. Working as a multidisciplinary team for establishing a healthy, sustainable, and livable smart urbanization with thermal comfort is highly important.

**Keywords:** Street, outdoor thermal comfort, scenarios, ENVI-met; plants

# **A Research to Determine the Thermal Comfort Ranges of Erzurum City**

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This research was carried out in the city of Erzurum, which is established in an area with a high altitude (approximately 3000 m). The effects of cold stress and perception patterns on people were tried to be determined with the survey study. The survey study was conducted in a centrally located area of the city, and there are many sitting places such as cafes and restaurants in the area. In the study, it has been tried to determine by using RayMan Model and Physiologically Effective Temperature (PET) values. Later, the values obtained were matched with the meteorological data in that region and the comfort of the individuals and the relationship between these values were tried to be determined. As a result of the study, it was found that all comfort intervals are different, sunlight directly affects the comfort value, and the felt and calculated PET values are different. As a result of the study, it was concluded that, with the improvement of thermal comfort conditions of outdoor people, their preference for being outside will increase.

**Keywords:** Thermal Comfort, Physiologically Effective Temperature (PET), RayMan Model, Erzurum, Turkey

# **Determining the Spatial Effects of Climate Change in Urban Areas**

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It is known that the effects of excessive warming and climate change occurring on surfaces are mostly in urban areas. Especially in these areas, the impacts are much higher than in rural areas. As a matter of fact, many studies have determined that rural areas are cooler and more bioclimatically comfortable. The effects of climate change on cities are generally known as mitigation and adaptation. In this respect, many studies have tried to reveal the adaptation of cities to the current and expected changes in climate elements by developing green infrastructure in urban areas. In other words, this situation is of vital importance. Reduction refers to many things for carbon neutral or negative cities, especially cleaning of pollutant waste in cities.

With this study, many studies on climate adaptation and reduction in cities around the world in recent years have been researched and in the light of the findings, suggestions are made on what can be done in cities for a healthier world and environment.

**Keywords:** Climate, cities, adaptation

## **Determination of Resilience Levels of Cities in The East of Turkey According to Climate Change Scenarios**

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In general, the scale of global climate change models is too large to evaluate a city. Therefore, the responsible national authorities make estimates for smaller areas. The size and population of cities in the east of Turkey are smaller and less industrialized compared to the cities in western. In this context, carbon emissions of cities in the east of Turkey less than the east of Turkey. The main sources of carbon are domestic heating and traffic. In this study; It is aimed to determine the future climate change expectations of cities by taking into account the results of unscaled luxury climate change models (Regional Climate Projection; RCP8.5 and 4.5). The study area is located east of the city of Erzurum in Turkey. For Erzurum city, past trends and current situation were evaluated in some influencing factors (increase in land use, population, number of motor vehicles, construction site construction area temperature). In order to determine the resistance level of Erzurum to climate change; Population size, urban macroform expansion, number of motor vehicles, indoor area per person ratio and temperature increase were analyzed and a climate change projection was created. As a result of the research; It has been observed that climate change is a very important problem for the future of Erzurum, which is a winter tourism center along with Palandöken Mountain, and that the increasing temperature and changes in the precipitation regime will adversely affect the tourism sector.

**Keywords:** Climate change, urban areas, Regional Climate Change Projection, Turkey

# **Indoor and outdoor air pollution**

## **Analysis of culturable airborne bacteria & fungi distribution using GIS based 3D model**

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The research on distribution characteristics of bioaerosols in the indoor environment has the vital significance in improving indoor air quality, preventing and controlling the spread of the disease-related indoor air, especially for lecture theatres which had the characteristic of step height, the more population density, stronger fluidity and the higher risk of infecting some disease. The intention of this study was to explore the distribution characteristics of airborne bacteria and fungi in a lecture theatre with natural ventilation in a university of İstanbul city in spring and gave some suggestions on assessing indoor air quality in universities lecture theatres in İstanbul.

For this aim, the distribution characteristics of culturable airborne bacteria and fungi in indoor air in the lecture theatre were studied with a GIS-based 3D model produced by using TLS based point cloud data. To determine the culturable airborne bacteria (CAB) and culturable airborne fungi (CAF) concentration, “Active Sampling (Impaction) Method” with AES Sampl’air (AES Laboratoire Sampl’air Lite-France) Air Sampler Device was used. Plate Count Agar (PCA) and Potato Dextrose Agar (PDA) were used in order to determine the CAB and CAF values, respectively. General results showed that distributions of culturable airborne bacteria and fungi varied in lecture theater due to the appearance of different indoor points. When the results are investigated, it can be seen that CAB and CAF concentrations are varying in between 1-460 cfu/m<sup>3</sup> and 1-980 cfu/m<sup>3</sup> respectively. Terrestrial laser scanning (TLS) has become a powerful data acquisition technique for high-resolution high-accuracy topographic and morphological studies.

In this study, the Leica ScanStation C10 Terrestrial Laser Scanner (TLS) was used. It is a motorized total station with a pulse-based laser, which measures automatically all the points in the horizontal and vertical fields. It is capable of scanning 360 degrees in horizontal and 270° in vertical. High resolution was applied in the present study, which means that the instrument scans the surface with a 1 mm grid from 1 m distance. High detailed models were accurately generated with terrestrial laser scanning of the target areas. Both the point cloud and the 3D model are georeferenced and to scale, making it possible to collect accurate measurements from within them.

Afterward using this data, the 3D model was generated for creating geometric 3D objects such as architectural models, scale models, interior design items, and functional parts. The 3D model was exported to GIS software. GIS analyses were realized to interpolate the changes of the CAB and CAF values in a mesh model of the conference hall. Additionally, results of 3D distribution were visualized

to improve the impact of the distribution which cannot be obtained directly from the measurements. In the study, the analysis was carried out by using a 3D kriging interpolation algorithm. Results were indicated that the methodology used in this study is sufficient to evaluate 3d distribution of CAB and CAF in a closed area.

**Keywords:** Culturable Airborne Bacteria, Culturable Airborne Fungi, GIS Based 3D Model

# Unravelling the indoor air mycobiome of residences in Athens

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Humans spend most of their day inside their residences. Nowadays, the advancement in technology in combination with life style changes have resulted in construction of air tight and energy efficient buildings. This, in turn, has led to a decreased infiltration of outdoor air inside houses, a fact that contributes to the deterioration of indoor air quality (IAQ). Contaminants of biological origin such as fungi are very common in residential environments. Recently, exposure to fungal components has been of paramount importance, since they have been recognized as triggering factor for respiratory allergies and atopic dermatitis.

A comprehensive study on IAQ was conducted in 6 dwellings across the Athens metropolitan area. The field campaigns covered two monitoring periods: February-March (winter) and May-June 2019 (summer). The investigation was carried out using a Burkard portable volumetric sampler for agar plates with PDA as a nutrient medium to identify the diversity and concentration of airborne fungi on a daily basis. In parallel, an additional device (uHoo sensor) was placed in the participants' living rooms to obtain information regarding the levels of several environmental factors (T, RH, TVOC, PM<sub>2.5</sub>, CO<sub>2</sub>, NO<sub>2</sub>, O<sub>3</sub>).

Airborne fungal community was classified into 24 genera and 4 groups, yeasts, Basidiomycota, Sphaeropsidales and NSF (Non Sporulating Fungi). The genera *Penicillium*, *Cladosporium*, *Aspergillus* and *Alternaria* and the yeasts constituted the dominant constituents. The mean daily total fungi concentration was 739 CFU/m<sup>3</sup> and 931 CFU/m<sup>3</sup> during the winter and the summer period, respectively, while in many cases unusually high values were recorded. Several environmental parameters were statistically significantly related to the indoor mycobiome. Without a doubt, the combination of aerobiological surveys with the monitoring of environmental parameters allows the identification of the conditions of potential biological risk.

**Keywords:** indoor air quality, airborne fungi, environmental factors



## **PAHs in fine particulate matter of six European cities: seasonal and spatial variations and implications for human health**

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Polycyclic aromatic hydrocarbons (PAHs) are carcinogen compounds mainly emitted in urban areas by anthropogenic sources (i.e. traffic, domestic heating, biomass burning). In air, they are partly carried by particulate matter. The aim of this study is to provide novel atmospheric data on PAHs at a traffic, urban background and rural sites in winter and summer across European cities. Six cities involved in the project ICARUS were chosen. The seasonal and spatial variations as well as the implications for human health were investigated.

In this study, 24-h air samples of fine particles (i.e. PM<sub>2.5</sub>) were collected using an active air sampler and quartz fibre filters for 30 days in winter and summer at a traffic, an urban background and a rural site at/near Athens, Brno, Ljubljana, Madrid, Stuttgart and Thessaloniki. The filters were extracted and analyzed by means of gas chromatography coupled to mass spectrometry.

PAH levels were significantly higher in winter compared to summer in all cities investigated. These seasonal variations can be attributed to increased sources such as domestic heating or higher cold-start emissions from traffic, but also lower atmospheric boundary layer and higher gas-to-particle conversion and, probably, longer atmospheric lifetimes in winter. Nitro- and oxy-PAHs, which were also analysed in the samples from Brno and Ljubljana, showed similar seasonal variations.

Concerning the spatial distributions, the winter PAH concentrations found at Brno in central Europe were the highest. In terms of variability within the city, large differences were found among the cities. For example, in Brno, the highest PAH levels were found at the traffic site while the lowest were found at the rural site for both seasons, highlighting that traffic is the most important PAH source within the city. On the other hand, in Athens, the highest PAH levels in winter were found at the rural site, which could be due to the increase in the usage of wood combustion for domestic heating in rural areas of Greece since the economic crisis. In Ljubljana, no significant differences in the PAH concentrations were found between the traffic and the urban background sites which suggest that traffic is not controlling the PAH

levels within the city. In winter, it was found that traffic controlled the nitro-PAH levels in Brno and Ljubljana but not those of oxy-PAHs.

For each of the sites involved, human health risks resulting from outdoor workday inhalation exposure will be evaluated with respect to the risk of developing cancer.

### **Acknowledgement**

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**Keywords:** PAHs, urban air, human health, traffic

## Concentration and distribution characteristics of culturable airborne fungi in public transport modes in Istanbul

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The concentration and distribution characteristics of culturable airborne fungi (CAF) were investigated in indoor air for four public transport modes (bus, subway, metrobus, and ferry) in İstanbul. Samples were taken from indoor air at each station in all modes for two times a month during a year. The culturable airborne fungi (CAF) concentration was determined with “Impinger Sampling Method” and for this purpose AES Sampl’air (Aes Laboratoire Sampl’air Lite-France) Air Sampler Device was used with Potato Dextrose Agar (Merck 1.10130).

As results, the concentration of CAF ranged from 1 to 740 CFU/m<sup>3</sup> in the bus, 1 to 640 CFU/m<sup>3</sup> in the subway, 1 to 540 CFU/m<sup>3</sup> in the metrobus, and 1 to 360 CFU/m<sup>3</sup> in ferry. Also, fourteen genera of fungi were isolated in all sampled transport environments. Most abundant fungi genus identified were *Penicillium*, *Aspergillus*, and *Paecilomyces*, respectively. The predominant genera identified in indoor air were *Penicillium* spp. (77,69% of total CAF) and *Paecilomyces* spp. (15,03% of total CAF) *Aspergillus* spp. (3,02 % of total CAF), respectively. In bus, %34,04 of isolated CAF, was highest during spring and was lowest during winter with %8,51. Metrobus and subway modes had highest CAF in autumn with %35,48 and %36,36 respectively. But Ferry mode had highest CAF percentage during summer with %47,05.

Results showed that CAF concentrations at bus were higher than the other vehicles indoor air, and fungal levels significantly correlated with the number of passengers ( $p < 0.05$ ;  $r = 0.68$ ) and RH % ( $p < 0.05$ ;  $r = 0.43$ ). The highest and lowest CAF concentration was observed in bus and ferry, respectively.

**Keywords:** Public Health, Airborne Fungi, Bioaerosol

# Fog or Smog: A Transfer Learning Approach to Detect Air Pollution from Images

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Air pollution has a key impact on the health and quality of life. In most of the world a vast majority of the overall population lives in urban areas and in city environment, and low air quality causes serious side effects to health, in highly populated areas the impact is more severe. In regions where the industrialization is at a high level the effects are more significant. The research pointed out that that the air quality decreases directly proportional to the population growth and industrial development. Furthermore industrial production and transportation relies on fossil fuels. The widespread increase in fossil fuel consumption, such as coal, lignite and oil, directly increases the air pollution and the suspension duration of the all particles and cancerous pollutants in the air. Machine and deep learning can be efficiently used in determining the air pollution. This can be done through processing the sensor readings to predict the level of pollutants in the air. The other method that can be used is to use information in the images to predict the level of air pollution. This can be done through multi-band aerial and satellite images and using terrestrial imagery. The terrestrial images can be used either to predict if the city is polluted or not, and there are also further efforts to determine the level of air pollution using terrestrial images. In this study we focused on differentiating between the smog and fog using the deep learning and convolutional neural networks specifically. In the first stage a series of smog and fog images were obtained from the internet for the experiment. The transfer learning approach is used to test whether trained deep neural networks such as Alexnet, GoogLeNet, VGG, Mobilenet, Inception can be successful in predict if the provided image is depicting a regular foggy whether or smog caused by air pollution. The transfer learning aims to apply learned knowledge to new problems. With transfer learning, the machine can take some of what it's learned when classifying an image into account and apply it to a new task. In the fog/smog prediction process the color information forms the key factor in differentiating between the smog of fog. The time of the images taken is also a key factor in the success of the prediction, and the images acquired were selected by eliminating the ones taken at very early morning and sunset. The results indicated that some of the networks were much more successful than others in smog/fog classification. The results of this study can be useful in quick any easy classification of polluted air in urban environments without much effort. The paper provides the details of the experiment and discusses the strengths and weaknesses of the tested CNN algorithms.

**Keywords:** smog, fog, transfer learning, cnn, deep learning

# **Air pollution during 2020 COVID-19 lockdown: study case of main Portuguese Metropolitan Areas**

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In January 2020 World Health Organization declared a global health emergency because of the spread of novel coronavirus disease COVID-19 [1]. To limit the pandemic, many governments enforced country lockdown which led to limitations of people movement, transportation, and even suspended industrial activities. While the pandemic has caused many losses of life and immense damage to our society [2], during that time some news in media have emphasized the possible positive impacts to the state of the environment [3-4]. People confinement, restricted public transport and ceased airlines international flights have resulted in changes in air pollutant emissions. Thus, this work aims to evaluate air pollution changes over the lock down period (between 19th March and 2nd May 2020) in two Portuguese regions (Northern and Lisbon Tejo Valley) that include two largest metropolitan areas.

Provisional air pollution data (PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>2</sub>, SO<sub>2</sub>, O<sub>3</sub>) were retrieved for two Portuguese regions from the portal of public Portuguese database [5] and assessed for five months (January 1 – May31) in 2020 across 46 different monitoring stations (rural, suburban, urban) and under different emission influences (background, traffic, and industrial). For a comparison, the same period of the previous year 2019 was also used. In addition, current Portuguese air quality standards [6-7] that are based on European legislation [8] were used to analyze the possible exceedance.

Results showed that NO<sub>2</sub> was the most reduced pollutant (48 µg/m<sup>3</sup> in 2020 vs.61 µg/m<sup>3</sup> in 2019), most likely due to decreased traffic. For a comparison, in rural zones NO<sub>2</sub> decreased up to 25%, whereas it was 15-35% in suburban and 20-40% in urban areas. Furthermore, significant drop (15–40%) of traffic-related NO<sub>2</sub> was observed during the 2.5 months lockdown, being 55% for the most populated zones. PM were impacted to a lesser degree; still during the lock down of the country traffic-related PM dropped 15-25%. Analyzing the available standards, in 2020 PM<sub>10</sub> daily limit was exceeded 50%, with 80% of exceedances occurring before the lockdown period. SO<sub>2</sub> emissions dropped 10% in 2020 and mainly in urban areas, most likely due to suspended industrial productions. On the contrary, levels of ozone risen during the lock down period (up 15% for urban zones).

Though it is uncertain if the improved air quality will persist in long-term, the COVID-19 restrictions were conducted simultaneously in many countries around the globe which will allow for a rare re-examination of present air quality policies and guidelines. Furthermore, this untypical situation during the pandemic will permit assessment of possible scenarios and strategies for air pollution mitigation. Nevertheless, it is necessary to point out that based on the historical experience the impacts of pandemics have been in general always negative in long term.

**Acknowledgment:** This work was supported by Base Funding – UIDB/00511/2020 of the Laboratory for Process Engineering, Environment, Biotechnology and Energy – LEPABE – funded by national funds through the FCT/MCTES (PIDDAC).

**References:**

[1] World Health Organization (WHO), 2020a. WHO Director-General's statement on IHR Emergency Committee on Novel Coronavirus (2019-nCoV). Accessed online 12.8.2020, available at [https://www.who.int/dg/speeches/detail/who-director-general-s-statement-on-ihr-emergency-committee-on-novel-coronavirus-\(2019-ncov\)](https://www.who.int/dg/speeches/detail/who-director-general-s-statement-on-ihr-emergency-committee-on-novel-coronavirus-(2019-ncov)).

[2] Chakraborty, I Maity, P. 2020. COVID-19 outbreak: migration, effects on society, global environment and prevention *Science of the Total Environment* 728, 138882.

[3] Arora, S., Bhaukhandi, K.D., Mishra, P.K., 2020. Coronavirus lockdown helped the environment to bounce back. *Science of the Total Environment* 742,140573

[4] Rodríguez-Urrego, D., Rodríguez-Urrego, L., 2020. Air quality during the COVID-19: PM2. 5 analysis in the 50 most polluted capital cities in the world. *Environmental Pollution* 266, 115042.

[5] QualAr, 2020b. The observed pollution (in Portuguese). Available at <https://qualar.apambiente.pt/downloads>, retrieved 13.6.–30.6.2020.

[6] Decreto-Lei 102/2010 (in Portuguese). *Diário da República*, 1.<sup>a</sup> série – N.º186, 4177–4205.

[7] Decreto-Lei 43/2015 (in Portuguese). *Diário da República* n.º 61/2015, 1711 – 1713.

[8] European Parliament, 2007. Directive 2008/50/EC of the European Parliament and of the Council on ambient air quality and cleaner air for Europe. *Official Journal of European Union* L152, 1–44.

**Keywords:** environmental pollution, ambient air, COVID-19, lockdown, public health, traffic

# Prediction of PM<sub>10</sub> Concentrations based on Machine and Deep Learning

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Today machine learning is known as a key approach which facilitates prediction of air quality indicators. Neural networks are a set of well-known machine learning algorithms that mimic the information generation and storage procedures of living creatures. Neural networks are used in performing all types of machine learning tasks including classification, regression and clustering. The neural network algorithms are widely applied in all branches of machine learning for conducting various tasks ranging from image classification to prediction of energy consumption in houses. Some tasks such as time series prediction or prediction of information based on the output of a previous sequence have been considered as difficult tasks for traditional neural networks as they do not have the ability to remember their output for a previous time step. This is considered as a key shortcoming of the traditional neural networks. For instance, in speech recognition, a word in a sentence can be predicted easily by looking at the words that occurred previously in the same sentence, or in the preceding sentences. Recurrent Neural Networks (RNNs) are designed to address this shortcoming of traditional neural networks for such tasks. RNNs are networks with loops which help the information from the previous time step to persist and to be fed back to the same network again. RNNs work with success if the gap (i.e. the number of time/sequence steps) between the information to be predicted and the predictor(s) is small. In some cases, this gap becomes very large and in that case, RNNs become unsuccessful in their predictions.

Long Short Term Memory Networks (LSTMs), a special type of RNN have been developed to tackle this weakness of the general RNNs. LSTMs are able to learn from long-term dependencies in data (i.e. where the gap between items is large). LSTM manages this through cell states. Cell states help LSTM network to selectively remember and forget information.

The paper explains the results of a study that focused on the prediction of PM<sub>10</sub> levels using time series analysis. The data used in the study was acquired from the National Air Quality Monitoring Network of Turkey. The network contains 100+ monitoring stations and mobile monitoring vehicles, which store between 10-15 different parameters related to air quality including pollutant concentrations and weather data. The data is stored by the Ministry of Environment and Urbanization and disseminated through an internally developed web application (<http://www.havaizleme.gov.tr>). The data used in this study were acquired from that application and contains hourly readings of pollutants such as SO<sub>2</sub>, NO<sub>2</sub>, O<sub>3</sub>, PM<sub>10</sub> and PM<sub>2.5</sub>, along with weather characteristics. The time period of data is between 2019-2020, and the data contains around 8000 records for a suburb of Istanbul.

Three approaches were implemented in this research to predict PM<sub>10</sub> concentrations in a suburb of Istanbul (Kadikoy). The first approach followed was based on Shallow Neural Networks, the second approach was focused on Deep Learning (RNN/LSTM), and the third one was based on Machine Learning.

The study handled the problem as a univariate time series prediction problem. The objective of the study was to predict the PM10 concentration at a certain time ( $t_n$ ) based on its previous values (PM10 levels at  $t_{n-1}, t_{n-2}, \dots, t_0$ ). In the first approach the PM10 levels were predicted using a shallow neural network namely Nonlinear Autoregressive Neural Network (NAR). In the second approach, a LSTM network is prepared and utilized to forecast PM10 concentrations. In the third stage several regression-based approaches (such as Tree-Based Regression, Support Vector Machines, Ensembles) were utilized to predict PM10 concentration and Automatic Machine Learning (AutoML) is used to adjust the hyperparameters to achieve best prediction results. In the final stage the accuracy of all these three approaches were compared. All coding and tests were done using the MATLAB programming environment. The paper presents the findings of these three PM10 prediction approaches and also the comparison of the findings.

**Keywords:** PM10, Neural Networks, LSTM, Machine Learning, Deep Learning



# **NPAHs and OPAHs in the atmosphere of two central European cities: seasonality, urban-to-background gradients and gas-to-particle partitioning**

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Nitrated and Oxygenated polycyclic aromatic hydrocarbons (NPAHs and OPAHs) are emitted by anthropogenic and natural sources. They can also be secondarily formed in the atmosphere via oxidative reactions.

The aim of this study is to provide novel atmospheric data on NPAHs and OPAHs at each a traffic (T), an urban background (U) and a rural (R) site collected in winter and summer 2017 at/near Brno, Czech Republic and Ljubljana, Slovenia. The seasonal and spatial variations as well as the gas-particle partitioning of these compounds were also investigated.

Unlike 11 OPAHs which were all consistently detected, only 9 out of the 18 targeted NPAHs were consistently found in the air samples. The total (gas and particulate) concentrations of  $\Sigma 9$ NPAHs at the three Brno sites were ranging from 7.3  $\mu\text{g m}^{-3}$  to 2888  $\mu\text{g m}^{-3}$ . The particulate concentrations of NPAHs measured at all sites were ranging from 0.01  $\mu\text{g m}^{-3}$  to 3008  $\mu\text{g m}^{-3}$ . OPAHs exhibited higher atmospheric levels with total and particulate concentrations ranging from 176  $\mu\text{g m}^{-3}$  to 45053  $\mu\text{g m}^{-3}$  and 1.7  $\mu\text{g m}^{-3}$  to 31193  $\mu\text{g m}^{-3}$ , respectively.

Significant seasonal variations were observed for all NPAHs and OPAHs. Indeed, the winter-to-summer ratios of the particulate concentrations across all sites were 4.2-67.7 for  $\Sigma 9$ NPAHs and 3.7-101 for  $\Sigma 11$ OPAHs.

The particulate mass fraction of NPAHs and OPAHs seemed to follow vapour pressure. Higher particulate fractions were observed at the traffic site compared to the urban background or rural sites for some NPAHs and OPAHs.

In winter, a strong traffic to rural gradient of NPAH concentrations was observed in the Brno area. Indeed, the T/UB and T/R ratios were 3.3 and 12.2, respectively. In summer, the corresponding figures were 0.7 and 4.8 suggesting that the secondary NPAH source (photochemistry) was more significant at the urban background site (advection of photochemically aged pollution). At Ljubljana, the T/UB ratios

were 2.5 and 22.5 in winter and summer, respectively. For OPAHs, the T/UB and T/R ratios of total  $\Sigma 11$ OPAH concentrations in Brno were 0.8 and 3.1 in winter and 0.2 and 1.7 in summer, respectively. At Ljubljana, the T/UB ratios of the particulate concentrations of  $\Sigma 11$ OPAH were 0.9 in winter and 3.3 in summer.

### **Acknowledgement**

This project was supported by the European Union's H2020 Framework Programme (ICARUS project) under grant agreement No – 690105 and by the RECETOX (LM2015051) and ACTRIS (LM2015037) research infrastructures funded by the Ministry of Education, Youth and Sports of the Czech Republic and the European Structural and Investment Funds (CZ.02.1.01/0.0/0.0/16\_013/0001761 and CZ.02.1.01/0.0/0.0/16\_013/0001315).

**Keywords:** PAH derivatives, seasonal variations, spatial variations, gas-to-particle partitioning

# PM exposure using portable sensor data and human respiratory tract deposition modelling

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The aim of the study was to present the results of a personal exposure assessment methodology, which involved a personal sensor campaign, aiming to refine PM exposure using low-cost portable sensor data, exposure and human respiratory tract deposition modelling. A custom-made monitoring device was developed for measuring 3 fractions of PM (1, 2.5 and 10  $\mu\text{m}$ ), enabling direct assessment of personal exposure. The device is based on an Arduino microcontroller where small sensor-modules are connected. Sensors' performance was improved using a thorough assessment in which not only the hardware but also the information emerging from the sensors' temporal resolution was evaluated using efficient statistical and machine learning methods. In this sense, integration of sensor data with advanced exposure models allows us to significantly differentiate the actual intake to PM among individuals, at levels that are not conceived based on the spatial distribution of air quality monitoring, or among people of different age and activity patterns. In addition, participants wore a physical activity wristband (Garmin Vivosmart 3) that records steps, distance, type of activity, heartbeat and sleeping patterns. Finally, participant positions were recorded using a GPS sensor, integrated into the PM sensors. After validation, the sensors were used to capture daily variability of PM exposure for the participants.

Exposure was further refined by estimating inhalation adjusted intake rate, as well as PM deposition across human respiratory tract (HRT) using the Multiple Path Particle Deposition (MPPD) model. The above methodology was applied in the personal sensors campaign of the HORIZON2020 EU Project ICARUS, where exposure and intake to PM of almost 100 individuals was monitored. The integrated methodology outlined above, allowed us to significantly differentiate the actual intake of the participants, highlighting larger differences than the ones attributed to the spatial differentiation of the fixed station air pollution (difference of ambient PM levels of 50% were translated in intake differences up to 110%). These differences are the result of the differences in PM size fractions that are captured by the sensors and the capability of the HRT model to translate the differences in PM size distribution accounting for the differences in physiology among the participants, finally reflected in intake estimates. Overall, the combination of low-cost sensor technology combined with the proper modelling methods has indeed the potential to revolutionise the field of environmental, exposure and health monitoring, providing high-density spatiotemporal information at the individual level. These devices might not necessarily be apt to regulatory monitoring; however, they can capture variability and exposure differences between different regions and population groups, providing a better understanding of the interactions between environment and human health. This is a very important element for supporting targeted interventions for reducing exposure of vulnerable groups, as well as towards the implementation of precision prevention strategies.

## Acknowledgement

This work has received funding from the European Union's Horizon 2020 under grant agreement No 690105 (Integrated Climate forcing and Air pollution Reduction in Urban Systems (ICARUS))

**Keywords:** particulate matter, low-cost sensors, intake, human respiratory tract deposition

# **Water and soil pollution and control**

# PAHs in arable soils of Serbia: levels, sources and potential health risks

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Soil is considered as a primary sink for PAHs which are constantly accumulated and remained a long-term period in this environment compartment causing to health concern for several decades. Namely, soil is valuable indicator of PAH occurrence in the environment because these pollutants are poorly soluble and can be absorbed by soil organic matter. Moreover, humic substances in soil have important role in the retention of PAHs in this medium, contributing that soil might be considered as natural reservoir of these pollutants which can cause adverse effects on the development of soil organisms and generate human risk through different pathways exposure such as inhalation, ingestion, dermal contact. In the last decades many studies are conducted to determine the level of PAHs in the soil for urban and industrial purposes. However, the investigations of agricultural soil for conventional and organic production from rural regions particularly from developing countries as Serbia are scarce. Thus, this study presents a preliminary survey of occurrence and levels of 16 polycyclic aromatic hydrocarbons (PAHs) in arable soils used for conventional and organic production in northern and central part of Serbia. The total concentration of 16 PAHs varied between 55  $\mu\text{g kg}^{-1}$  and 4584  $\mu\text{g kg}^{-1}$  in soil for conventional production and between 90  $\mu\text{g kg}^{-1}$  and 523  $\mu\text{g kg}^{-1}$  in soil for organic production. The average level of 7 carcinogenic PAHs was 617  $\mu\text{g kg}^{-1}$  in soil for conventional and 112  $\mu\text{g kg}^{-1}$  in soil for organic production, accounting for 52% and 47% of the total PAHs, respectively while the risk from the accumulated PAHs in both soil types has mainly originated from seven carcinogenic PAHs, since average Toxicity Equivalent Quotient (TEQ) values calculated for sum of 16PAHs and sum of 7cancPAHs were almost the same. According to the Canadian Soil Quality Guidelines, the risk caused by PAHs was a negligible whereas less than 5% of the analyzed soil samples had concentrations above safe limit of TEQs (600 ng/g). Moreover, values of HI were above the threshold value of 10 in only 6% of the analyzed soil samples pointing out the low ecological risk found in the investigated region. Exposure of farmers assessed through carcinogenic (TCR) and non-carcinogenic (THQ) risk did not exceed the acceptable threshold (TCR $<10^{-6}$  and THQ $<1$ , respectively).

**Keywords:** PAHs, arable soils, risk assessment

## The effect of glisinebetaine application of four cold season grass species under salinity stress

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From floods and droughts to ocean acidification, changes in the level, oxygen content and salinity of the water and rising sea levels, the impacts of climate change increases the pressure on water sources and are expected to intensify in the coming years. In the semi-arid regions of the world, such as the Mediterranean Region, it is problematic to find sufficient quality water for irrigation. This leads to the use of groundwater with chlorine compounds, which contain excessive amounts of soluble salts. In this context, it is a priority to develop new drought and salinity resistant plant species and to find ways to increase the salt tolerance of existing species. In particular, drought and salinity stress are widespread problems in turfgrass management due to the limited useable of fresh water for irrigation and the increased use of reclaimed water sources for irrigating lawns. Glycinebetaine (GB) is an osmoregulant which found in chloroplasts of halophytes enhance the salt tolerance of plants by decreasing osmotic potential for cellular water retention. We examined the effects of foliar application of GB on growth and quality of Kentucky bluegrass (*Poa pratensis*), perennial ryegrass (*Lolium perenne*), red fescue (*Festuca rubra rubra*) and tall fescue (*Festuca arundinaceae*) grown under salt stress. This four cool season turfgrass species were grown non saline and saline conditions (6 ds m<sup>-1</sup>), and were sprayed with 0.00 and 2,28 gr L<sup>-1</sup> in greenhouse in 2019. GB application enhanced turfgrass quality, colour and positively effect chlorophyll content, clipping yield and shoot growth of species under salinity stress. In conclusion, exogenous GB application might be recommended in lawn areas where waste and non-potable water is used for irrigation and with this application, the pressure on water resources might be trying to reduce.

**Keywords:** Climate change, Landscape irrigation, Cool season turgrasses, Salinity, Mediterranean Region.

# Occurrence of organophosphate flame retardants in aquatic environment of Northern Greece

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Flame retardants are chemical additives incorporated into combustible materials to prevent a fire or to delay its start. The use of these substances has proved to be lifesaving and also a key factor preventing injuries and property losses. Organophosphate flame retardants (OPFRs) are esters of phosphoric acid which are mainly used as additives in flammable materials to prevent fire, as well as plasticizers in various materials. They have replaced toxic brominated flame retardants, but they might exhibit negative effects. People are exposed to OPFRs in their everyday life through skin contact, ingestion of dust, inhalation and dietary intake, and may have potential adverse health effects. Therefore, further study is needed due to their widespread use and easily release.

The aim of this project was to investigate the occurrence of OPFRs in the aquatic environment of the area of Thessaloniki, Northern Greece. Three categories of OPFRs were selected for monitoring; alkyl-, aryl- and chlorinated-OPFRs. Samplings were conducted during the period of 2019-2020. Surface water samples were collected from rivers and streams which were discharging into the Thermaikos Gulf, Thessaloniki. Coastal samples were also taken from different spots from Thermaikos Gulf. Solid phase extraction technique was applied, followed by gas chromatography-tandem mass spectrometry (GC-MS/MS).

A wide range in OPFRs concentrations was observed in rivers and streams, depending on the urban and industrial activities in their catchment area. The most frequent and abundant OPFRs in surface waters were tris(2-butoxyethyl)phosphate, tri-n-butyl phosphate, tris(2-chloroisopropyl)phosphate and tris(chloroethyl)phosphate.

## **Acknowledgements:**

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**Keywords:** flame retardants, OPFRs, occurrence, surface water, seawater, GC-MS/MS



# Detecting Pipeline Deformations by Underwater Photogrammetric Techniques

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Pipelines carrying oil, gas or deep-sea waste water discharges are generally located on seabed. In time, fishing activities, marine constructions, excavations or natural corruptions may cause cracks on the pipelines. For preventing a sea pollution, inspecting the condition of these pipelines is critically important.

Underwater photogrammetry is a useful solution for three-dimensional modelling of underwater objects such as sea structures, pipelines, ship wrecks, cultural heritage or marine life forms. Three-dimensional data of an underwater object can define the object's shape, whereas displacements or deformations are determined by three-dimensional data analysis of the subject. Conventional acoustic measuring devices such as multi-beam echosounders or side-scan sonars are generally less accurate and have low resolution however; underwater photogrammetric measurements have higher resolution and more accuracy.

This study describes all steps of the process for determining pipeline deformations by means of underwater photogrammetric techniques. The first step is determining the position and course of the pipeline with side-scan sonar measurements. According to side-scan sonar images, pipe's diameter and route can be measured. The second step is underwater camera calibration. Camera calibration parameters are determined in this step. The third step is diving into water for taking stereo images. Photographs can be taken by scuba divers or ROVs (remotely operated vehicle) according to depth.

The last step is to evaluate the stereo pairs to observe the cracks or any faults. At the stage of data acquisition, stereo images were taken with the photogrammetric test field for scaling, and a USBL (Ultra-Short Base Line) beacon is used for underwater navigation. A digital photogrammetry software is used for three-dimensional modelling and evaluations. As a result of the study, defect on the pipe was measured and modelled remotely. It has become possible to calculate the amount of liquid spill per time and water pollution, as well as manufacturing the part required for repair.

**Keywords:** Underwater photogrammetry, deformation, water pollution, 3D data analysis

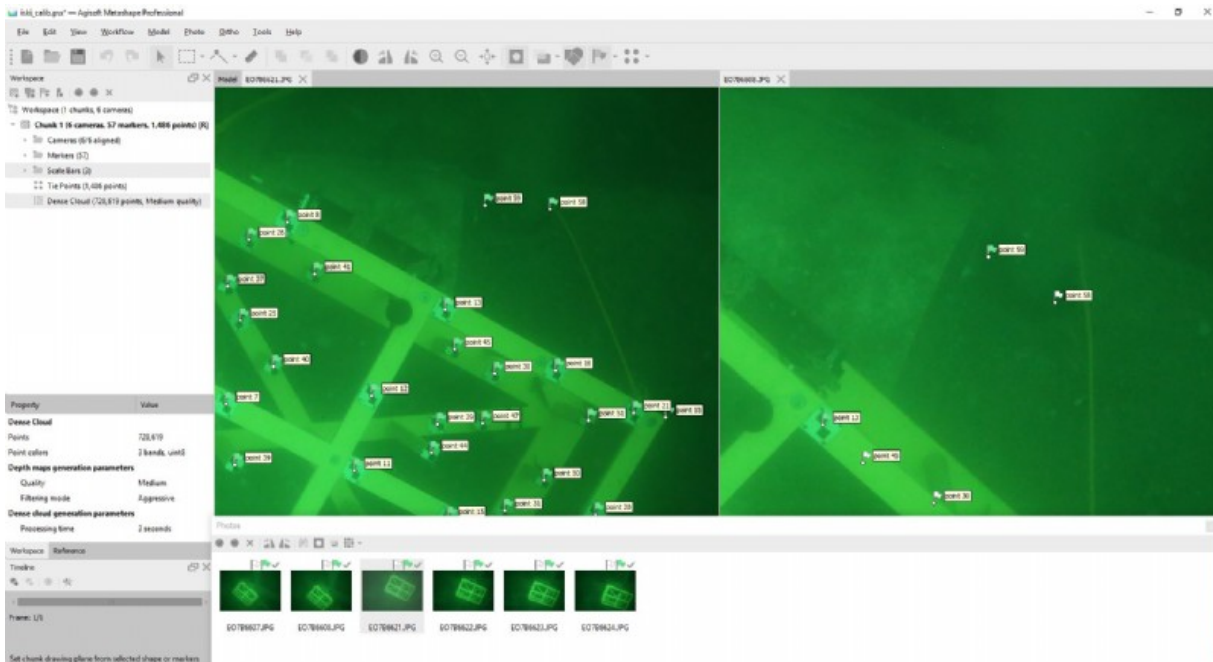


Figure 1. 3D Modelling and Evaluation of a hole on the Waste Water Pipe

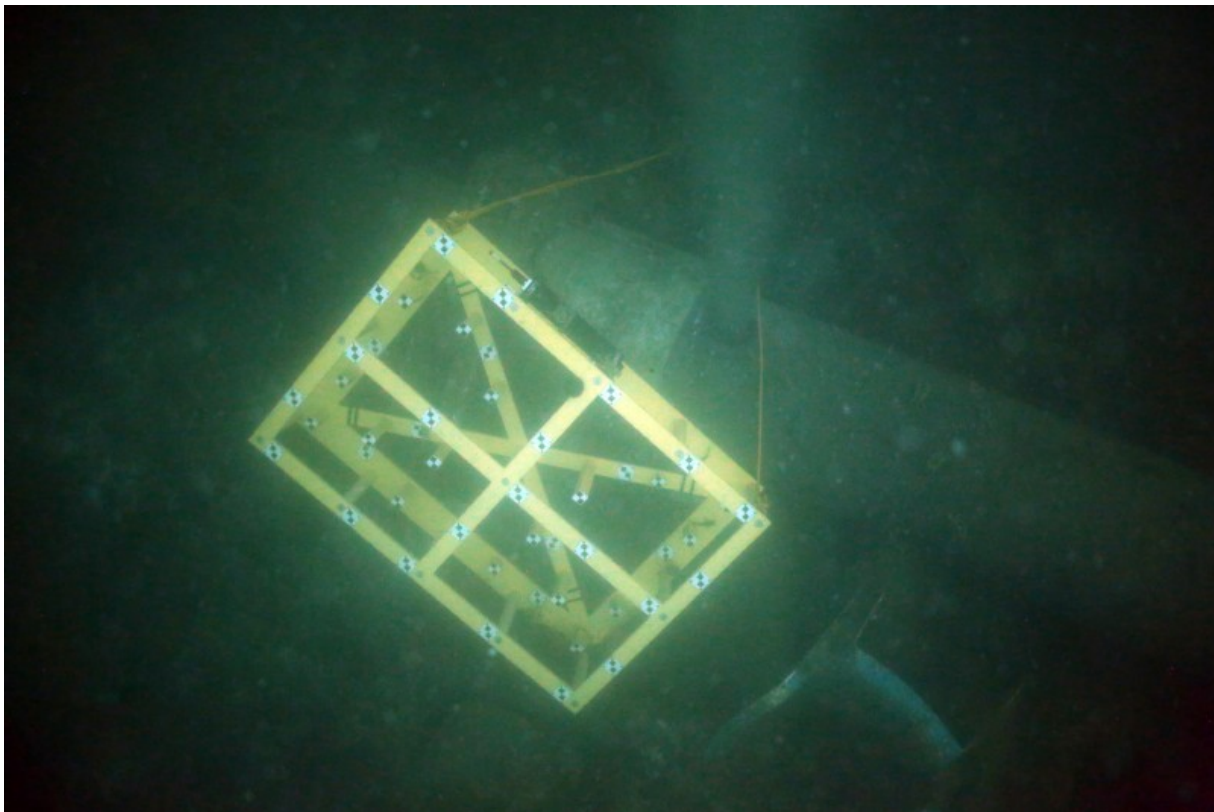


Figure 2. Stereo-Photo Taking Session with Photogrammetric Test-Field

## **A study of the post fire effects on dissolved organic matter in a coastal residential area**

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Wild and urban fires are episodes with significant cost for human life and property. Moreover, a fire occurrence is an important environmental disturbance. The environmental impacts of fires affect atmospheric, terrestrial and aquatic ecosystems. The release of carbon dioxide, black carbon, brown carbon, ozone precursors, volatile and semi-volatile organic compounds and nitrogen oxides as well as the direct emission of toxic pollutants and the formation of other contaminants, as the air is transported, affect seriously the air quality. The introduction of fire effluents in the soil takes place via a primary or secondary pathway with the deposition of contaminants from the plume down to the ground. Post-fire results may include the contamination of plants via polluted soil or/and irrigation wells tapping a contaminated aquifer. Fire effluents in the water can travel away disrupting a nearby water mass. Hazardous chemicals find their way into the marine environment via water runoff. There is a pollutant accumulation in marine biota and noxious substances deposition to the seabed. Especially in the Mediterranean region, fire is a significant element in the formation of stable soil organic matter. Soil organic matter apart of being a key parameter in the soil chemistry, it also shapes the physical and biological properties of the soil. Soil organic matter builds soil structure, creates soil aggregates, accommodates water, absorbs and releases soil nutrients, controls carbon cycle and supports soil biological diversity. Fire affects the soil organic matter in various ways. The content of soil organic matter changes according to various parameters including the intensity of fire, the type of fire and the soil moisture. Some variations are found in the soil water repellence. The abundance of humin fraction increases with the loss of the humic and fulvic acids fractions. There is a production of black carbon. The insolubility and the aromaticity of humic materials increases with a considerable loss of oxygen-containing functional groups.

Dissolved organic matter (DOM) is ubiquitous in terrestrial and aquatic ecosystems though it corresponds only to a small proportion of the total organic matter in soil. DOM is the most active and mobile form of organic matter influencing various biogeochemical processes of aquatic and terrestrial ecosystems and therefore having a substantial role in the natural environment. The high ecological significance of DOM is related to its ability to hydrologically carry carbon between different reservoirs. Dissolved organic matter is a complex mixture of chemical groups. It includes a hydrophilic fraction containing carbohydrates, carboxylic acids and peptides/proteins, as well as a hydrophobic fraction containing almost entirely the aromatic moieties of DOM. Various environmental contaminants may bind to DOM causing an increase to the potential ecological risks of dissolved organic matter to soil, water bodies and biota. The role of DOM in chemical and biological processes depends on its molecular structure. Dissolved organic matter contains chromophoric (CDOM) compounds that absorb light and fluorophoric (FDOM) ones that absorb and emit light. Knowing the wavelength ranges at which fluorescent groups both absorb and emit light we can get more detailed chemical information than by absorbance only. Therefore, fluorescence spectroscopy has been well established as a useful tool for the identification and characterization of organic matter. Conventional fluorescence techniques measure single emission and

excitation spectra that cannot explain satisfactory the complex organic systems. Total luminescence (3D) spectra, based on the simultaneous collection of fluorescence data over a range of diverse excitation and emission wavelengths, produce excitation/emission matrix spectra with detailed information. Moreover, the calculation of optical indices allows more conclusions to be drawn. The indices are the humification index, the index of recent autochthonous contribution and the fluorescence index. Higher humification index indicates an increase degree of humification, a greater level of DOM complexity and a condensed nature. The value of the index of recent autochthonous contribution depends on the concentration of  $\beta$  fluorophore, which is characteristic of autochthonous biological activity. The fluorescence index serves to distinguish the sources of DOM.

The objective of this study is to reveal the impacts of fire on DOM extracted from soil samples from an area experienced a catastrophic fire with many casualties. The area is characterized as a coastal one divided almost equally to residential and forest parts. It hosts substantial construction works and intensive agricultural activities. A number of marine coastal surficial sediment samples was added to the terrestrial soil sample set for the better assessment of the situation. The dissolved organic matter was extracted from the samples under gentle extraction conditions. It includes water-extracted organic matter and organic matter from pore waters. Fluorescence spectra were obtained using a Perkin-Elmer LS 55 luminescence spectrophotometer equipped with the WinLab4.00.02 software for data processing. More specifically, conventional spectra and fluorescence excitation-emission matrices were recorded and the three optical indices, the humification index, the index of recent autochthonous contribution and the fluorescence index, were calculated. Results were thoroughly studied in order to assess the effects of fire on the dissolved organic matter and the environmental health of the area.

**Keywords:** Aromaticity, DOM, Fire, Fluorescence, Impact, Soil

## Elaboration and characterization of Cordierite/Anorthite supports for membranes filtration

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In the present work, porous ceramic membranes were prepared with various mass fraction of Ghassoul clay, oxides (stoichiometric input) and calcareous algae (porosity agent) for wastewater treatment. Algae-free samples were employed as blank specimens. Porous microstructure was achieved by burning the organic matter. The hardening/sintering of the ceramic bodies was performed using a double heat treatment at 1250°C. High physico-chemical performances were reached. To do so, several analysis techniques were used such as X-ray diffraction (XRD), thermogravimetric analysis (TGA-TG), Fourier-transform infrared spectroscopy (FTIR) and scanning electron microscope (SEM). The results showed that the neoformation process involved the original clay minerals together with carbonates and quartz. SEM micrographs proved that the porosity was mainly controlled by the formations of interlocking structure combined with molten zones. In addition to that, filtration tests carried out on a textile effluent pointed out that all of turbidity, BOD and COD were reduced considerably. Moreover, dielectric properties revealed that the sintering process was more active à 1000°C and above. Ceramic membranes with good characteristics were successfully manufactured in specific conditions and were tested accordingly.

**Keywords:** Cordierite/Anorthite membrane, Microstructure, Clay minerals, Algae and filtration

# **Assessment of Water Quality Evaluation Performance of Geostatistical Techniques**

**Firdes Yenilmez**

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Limited water resources and cost of field studies force scientists to find new approaches to evaluate the water quality of surface waters. The assessment of water quality in unmeasured locations using known values reduce the time and cost of field studies. There are different geostatistical techniques to evaluate the values in unmeasured locations. The performance of these techniques affects the water quality values calculated in the unmeasured locations. Therefore, selection of the suitable method for being studied system is critical for correct results. Karacaören-II Dam Reservoir which is a relatively deep reservoir located in Burdur, Turkey. While the average depth of the reservoir is 20.5 m, the surface area of the reservoir is 2.34 km<sup>2</sup>. It is one of the most important natural recreational and culture fishing area in the region. Although Karacaören-II Dam Reservoir has been constructed for irrigation and supply energy in the past, the reservoir is considered as a drinking water supply for Antalya in near future. However, it was mentioned that the reservoir suffers from eutrophication problem in recent scientific studies. So, the evaluation of water quality in the reservoir with different geostatistical techniques will facilitate the work of the managers to determine precautions and improve the water quality.

In this study, the performances of geostatistical techniques in the evaluation of water quality in Karacaören-II Dam Reservoir is assessed and compared with some metrics. Water quality clusters are compared and strengths and weaknesses of the methods are discussed.

**Keywords:** Geostatistical techniques, Karacaören-II Dam Reservoir, water quality

# **Water Quality Evaluation Based on The Water Quality Index Method in Karacaören-II Dam Lake**

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The calculation of water quality index instead of evaluating water quality parameters separately is an easy way to determine water quality classes. The water quality index expresses the total water quality by taking the weighted average of the pollutant concentrations. Hence, even the ordinary people can quickly get an opinion about water quality with the index value. Furthermore, temporal change of quality at a certain surface water can be easily followed at the same point with the help of water quality index value. Moreover, water quality index can change at different places in the same water body and give a sign about the entrance points of pollution sources. There are a range of different water quality index methods but NSF (United States National Hygiene Foundation) indexing method is one of the most commonly used one.

In this study, the water quality index in Karacaören-II Dam Lake is calculated using NSF indexing method. Karacaören-II Dam Lake is planned to provide drinking and potable water in Antalya in the near future. Therefore, water quality index value in the lake can be used to inform the public about water quality of the lake. Moreover, the areas which represents poor water quality can be quickly determined by the help of water quality index value and can point out the locations to take action. The results obtained from this study showed that the water quality index represented middle class water quality in most of the reservoir. Thus, immediate measures should be taken to improve the water quality in the reservoir to achieve good water quality mentioned in Water Framework Directive.

**Keywords:** Karacaören-II Dam Lake, water quality index, water pollution

# **Ecotoxicity and biodiversity**



## **Impacts of climate change on an endemic medicinal-aromatic plant: *Phlomis chimerae* from Antalya, Turkey**

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The negative effects on nature is increasing together with urbanization and industrialization day by day. The damage to natural resources and the increase of harmful gases due to human activities cause global warming and effects of global warming appear as climate change in the biosphere. The changing climate has a big potential on plant population growth, species distributions and the ecological environment in which they interact. Global climate change adversely affect on natural landscapes and water sources such as drought, desertification, extinction of biodiversity, species and gene resources. As a result, species have difficulties adapting to changing climatic conditions, which pose a threat to them. Turkey has a geography that shows a fairly wide spread in terms of both endemic, aromatic and many other plants because of the different climatic conditions which it has. The climatic change factor disrupts the ecological structure of the ecosystem, causing damage of the continuity of medicinal aromatic species such as other species which used in many industries (pharmaceuticals, cosmetics, etc.). Ecological niche models (ENMs) allow to predict the possible effects of climate change on future distribution of the species populations. This method enables the analysis of environmental and climatic conditions to determine the geographical / spatial distribution of appropriate areas for species future existence, especially species whose distribution are narrow, endemic or threatened. The aim of this study was to predict the impact of climate change on an endemic medicinal-aromatic species located in Antalya (Turkey), *Phlomis chimerae*. It's naturally located from sea level up to 1100 m and LR (cd) category (Lower risk; requiring protective measures and conservation dependent) according to IUCN Red List Categories. Also *P. chimerae* is unconsciously collected by the local people and currently face to the anthropogenic threat, overgrazing and urbanization. GPS records of the species distribution areas collected from literature, herbarium records and field studies. Ecological, edaphic, topographic and climatic variables of the distribution areas were used as predictors. As a result, some appropriate habitats will be changed and a large habitat will be lost. The species is predicted to have a narrower distribution area than today according to the model. In order to ensure the continuity of the species, it is necessary to protect the genetic resources by taking into consideration the geographical distribution analysis and to take the necessary precautions.

**Keywords:** Ecological niche models (ENMs), endemic species, medicinal and aromatic species, conservation biology, biodiversity.

# **Toxicity of a neonicotinoid insecticide (Thiamethoxam) against the adult females *Gambusia affinis*: impact on metric indices and biomarkers during a sexual rest period**

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Neonicotinoids, broad-spectrum systemic insecticides, are the fastest growing class of insecticides world-wide and are now registered for use on hundreds of field crops in over 120 different countries. The environmental profile of this class of pesticides indicate that they are persistent, have high leaching and runoff potential, and are highly toxic to a wide range of invertebrates. Therefore, neonicotinoids represent a significant risk to surface waters and the diverse aquatic and terrestrial fauna that these ecosystems support. In this study we have highlighted the effect of one of the most widely used insecticides in agriculture against crop-biting and sucking pests: Actara (25% active ingredient "Thiamethoxam") for a non-target species during a sexual rest periods of its life cycle. *Gambusia affinis* (Baird & Girard, 1853), a freshwater Culiçiphage fish introduced into Algeria as part of the biological control of mosquito larvae of medical and environmental interest. Among these insecticides, Thiamethoxam (Actara 25 WG) is a second generation neonicotinoid insecticide, which belongs to the subclass of thianicotinyl. The fish are particularly sensitive to pollution. Among the fish species used to evaluate the quality of freshwater systems, the mosquitofish, *G. affinis* (Poeciliidae, Cyprinodontiformes).

Therefore, the main goal of the present study is to investigate the effects of thiamethoxam on metric indices and enzymatic activities of Glutathione S-transferase and Acetylcholinestrace in adult females of a *G. affinis* after chronique exposure (28 days) at different concentrations (10, 20 and 40 mg L<sup>-1</sup>) under laboratory conditions. Statistical analysis by the tukey test showed a significant increase in the enzymatic activity of GST on the 14th and 21st days and significant decrease in the enzymatic activity of AchE from the first day of the treatment; however, the results showed no significant differences in metric indices (CF, GSI and HSI). It is deduced that the effect of Thiamitoxam is greater at the high concentration 40 mg L<sup>-1</sup> compared to the others and it can affect this non-target fish species.

**Keywords:** Thiamethoxam, Gamubias affinis, Metric indices, GST, AChE

# **Ecotoxicological risk assessment of two pesticides on a non-target shrimps *Palaemon adspersus* (Decapode, Palaemonidae): Toxicity and biomarkers**

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The present study was aimed to assess the potential hazards of two commercial formulations of pesticides such as Actara® (Thiamethoxam ) and Herbasate (Glyphosate) on the non-target organisms shrimps *Palaemon adspersus* (Rathke, 1837) (Decapoda, Palaemonidae). Actara® (25 g in 100 g of thiamethoxam insecticide) belongs to neonicotinoids, which is the most widely used insecticide class for controlling various insect pests in the world and Herbasate (360 g/L of glyphosate) is a no selective, systemic herbicide, ranked among the most extensively used agricultural chemicals worldwide. In this context, the sublethal (LC10, LC25) and the lethal (LC50, LC90) concentrations against shrimp *P. adspersus*, were estimated. Then the sublethal effects of the both compounds were investigated in laboratory conditions on the activity of glutathione-S-transferase (GST) and acetylcholinesterase (AChE), biomarkers of oxidative stress and neurotoxicity, respectively. The compounds were added farmed sea water adult *P. adspersus* at different concentrations and mortality was recorded after 96 hours of exposure. Measuring the enzymatic activity (mM/ min / mg protein) of GST and AChE was performed in the control and treated with Actara® and Hebasate after for 96 hours of exposure. The data obtained reveal a significant increase in the activity of GST and a significant decrease in specific AChE activity. The both compounds at the sublethal concentrations showed an acute toxicity with a dose effect; also induction of GST and inhibition of AChE on this non-target species.

**Keywords:** Toxicology, *Palaemon adspersus*, Insecticides, Thiamethoxam, Herbicides, Glyphosate

# **Energy, environment and sustainability**

# Urban Landscape Planning Approaches and Reflections on Ecodesign with Perception of Landscape Ecology

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Landscape ecology, which is closely related to the spatial changes based on the interactions of bio-physical processes and thus focuses on the relations between spatial approaches and the functions of ecosystems, constitutes an important framework for urban landscape planning. This framework, which encompasses ecological patterns, ecological functions and process interactions, is an effective guide for planning sustainable landscapes.

In this research, the concept of urban landscape planning, which focuses on the components of space, society and environment, has been considered within the scope of landscape ecology. The major problems such as the formation of urban heat islands and the transition of rainfall to surface runoff in urban environments due to changes in climate and topography conditions should be handled with a holistic perception. In this respect, urban landscape planning provides an important framework for managing environmental problems in an urban environment. By using this framework, the problems that arise due to the urban topography and microclimatic changes are mentioned and solutions are proposed by using Eco-Design criteria, in Beşiktaş which is a district of the metropole İstanbul. Priority has been given to problems such as the formation of urban heat island and the transition of rainwater to surface runoff.

Landscape analysis and evaluation needs to be handled with a holistic approach in order to provide sustainable suggestions. Because a landscape is a whole in which complex processes take place in very close relations.

**Keywords:** Urban Landscape Planning, Landscape Ecology, Holistic Approach, EcoDesign, Urban Heat Island, Rainwater Runoff

## **Combined investigation of indoor climate parameters and energy performance of a winery**

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Wineries present significant interest on a research level, combining Indoor Air Quality (IAQ) issues related with substances emitted through the wine production, as well as the need for minimizing conventional energy consumption (optimizing energy performance). In the proposed work, experimental and theoretical analysis is presented, aiming at achieving both targets, that of improved indoor climate and energy performance. An extensive measurement campaign was implemented, regarding indoor climate thermal parameters, as well as concentration of substances (CO<sub>2</sub>, VOCs, NO<sub>2</sub>) affecting IAQ. The results of the parameters were exploited for the assessment of indoor climate; special mention should be given to the increased CO<sub>2</sub> concentration during the fermentation process. In the development of the energy model, data from indoor climate measurements regarding thermal parameters were utilized; moreover, values of specific parameters related to the efficiency of the individual devices were determined and the energy consumption was correlated to the number of bottles produced, according to the practice followed in the relevant bibliography. The model was used to formulate and evaluate proposals for reducing the energy consumption of the winery. The proposals include the use of Renewable Energy Sources (RES) and, in particular, the installation of a photovoltaic array on the roof of the premises, as well as the exploitation of plant residues as biomass. Finally, an economic and technical study was carried out to determine the performance of the above proposals and the expected pay-back period.

**Keywords:** winery, energy analysis, IAQ, indoor thermal climate

# **Analysis of Net Ecosystem CO<sub>2</sub> Exchange by Eddy Covariance Method over Canola Canopy**

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In the world which has continuously developing in terms of population and technology, greenhouse gas amounts emitted to the atmosphere have a steady increase, consequently. Therefore, determination of greenhouse emissions in different areas is important for creation and control of the greenhouse gas budget inventory of countries to take the precautions against global climate change. Agriculture is one of these areas to be investigated, especially in countries like Turkey where greenhouse gases emitted from agricultural areas have a large share in the whole budget. Thus, in this study, it was aimed to present the net ecosystem CO<sub>2</sub> exchange between atmosphere and biosphere by field measurements in Kırklareli, Turkey using eddy covariance system during a growing season (covering 258 days) of canola which is one of main oilseed crops of Thrace Region including the experimental area. In order to determine net carbon sink of canola crop, net ecosystem exchange (NEE), ecosystem respiration (Reco) and gross primary production (GPP) variations were obtained by examining different phenological stages. According to the results, carbon sink was mostly observed between flowering and maturity stages while NEE, GPP and Reco during whole growing period were found as -3.5, 10.8 and 7.3 gC m<sup>-2</sup> d<sup>-1</sup> respectively.

**Keywords:** Carbon sink, greenhouse gas, oilseed crop, Turkey

# Utilizing Automated Machine Learning for Classification Levels of Occupancy in Buildings

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The knowledge of occupancy status (i.e. being occupied or not) of an indoor space and the information about number of occupants inside a building, flat or a room is very important in order to understand the use patterns of the indoor spaces that would in turn lead to estimate energy consumption of buildings including consumption of electricity (for heating, cooling and lighting purposes), and consumption of fossil fuels for heating purposes. Furthermore the knowledge about occupancy of an indoor space would very much contribute to the decision-making capabilities of first responders in situations such as a fire.

In order to successfully understand the use patterns for indoor spaces, occupancy status and occupancy levels for each space needs to be known. The occupancy status of an indoor space can be classified as binary as being empty or occupied. Occupancy levels are ordinal and can be classified such as “low occupancy”, “medium occupancy” or “high occupancy”. Regardless of the classification approach that would be taken (occupancy status/or occupancy levels), the process requires utilization of information acquired from an indoor space.

The information about the occupancy status of an indoor space can be acquired real time i.) by cameras, ii.) depending on usage patterns of appliances (i.e. air conditioning units, lights, heaters), iii.) by gathering the location of a person that is being tracked, iv.) by making use of information collected by sensors.

In the first approach both the occupancy status and the occupancy levels can be determined by image recognition and segmentation techniques. This first approach provides more accurate results but requires different types of cameras to be operated 24/7 in all indoor spaces which would not be reasonable in terms of privacy, in addition, establishing such a monitoring system for every building is not economically feasible. The second approach requires a set of smart home appliances to be installed in all indoor spaces. This approach can be utilized in modern buildings, but it would not be economically feasible for all building as it would require lots of expenditure to be done to install smart home appliances. In the third approach the location of a person who can be tracked (by Beacons or WiFi signals) can be acquired, but as this would require a permission from that person, the number of people inside a room can not be determined accurately unless all people grants the permission to be tracked, furthermore this process usually requires the person to carry a mobile phone with himself/herself, which would not be a practical case mainly in houses. The fourth approach is making use of information acquired by sensors for determining the occupancy status and levels. This approach is economically very feasible, easy to implement, and would not cause any privacy problems, as it is not focused on tracking the people one-by-one as in approaches i. and iii. Furthermore, this approach would also enable to determine the occupancy levels which makes it superior to approach ii., where only occupancy status can be determined.

In this fourth approach Machine Learning (ML) algorithms can be utilized to determine the occupancy



status and levels of the indoor space based on data gathered from various sensors. Machine Learning can be defined as a set of approaches focused on deriving meaningful information from data, based on human guidance or autonomously. Automated machine learning (AutoML) deals with automating the time consuming, iterative tasks of machine learning model development.

This paper presents results of a research that was focused on utilizing automated machine learning for classification of occupancy levels in buildings and indoor spaces. The dataset used in this research contains 1324 readings of 4 sensors and the level of occupancy recorded manually at the time of each reading. The data was collected during a 6-month experiment and includes readings from a sound level sensor, light level sensor, a temperature/humidity level sensor and an air quality level detection sensor (MQ 135).

Based on this data, the levels of occupancy (as being low, medium or high) is predicted using AutoML tools such as Weka (where 9 algorithms have been tested), MATLAB (where 24 algorithms have been tested), BigML (where tree-based algorithms have been tested) and RapidMiner (where 7 algorithms have been tested).

The classification made by the AutoML tools and tested algorithms were very accurate, and some algorithms even provided an accuracy up to 99 % in correctly classifying the occupancy level based on the 4 sensor readings. Following the background, paper will elaborate on the classification tests on each AutoML tool and discuss the strengths and weaknesses of each tool and the algorithm implementations in each tool.

**Keywords:** Machine Learning,Occupancy,Indoor,Building,Classification

# Comparison of the success rates of different study scales in ANN-based urban climate simulations

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Providing sustainable growth in rapidly urbanized cities makes it essential to monitor of the changes in urban areas and predict the problems that are coming with growth. Especially, the usage of simulation techniques, which have become widespread as a return on technology, has an important role in follow-up and prediction of development.

One of the most recent of these techniques is artificial neural networks. Due to to the ability of learning and remembering like a human in defining the nonlinear problems with the layers and neurons it contains, ANN gives very successful results in geographical analysis and modeling. In recent years, the use of ANN simulation models in local climate researches have become widespread.

In this study, it was investigated whether ANN simulations are more successful in small or large areas. In the study that was conducted on the local climate by handling surface temperatures, the northern region of the European side of Istanbul, which has lots of land-use changes was used as the study area. The third airport which was constructed recently and its near surround was used as a large scale and its wide surround was used as a small scale sample. The success rates of these two areas with different scales were evaluated by comparing the relationship between the surface temperature simulation realized by the same ANN parameters (neuron-layer-activation function) and original data.

**Keywords:** Urban climate, simulation, artificial neural networks, remote sensing, GIS

# Multi-Label Classification Application for Environmental Monitoring Applications with Deep Learning Approaches

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Environmental monitoring programs are widely spread out all over the world for the last decades. Also, it has become important more and more by every year due to limited natural and other resources on Earth. Deep Learning(DL) approaches are being more popular bypassing every year in many industries with computer vision. Applying DL methods can count as a way for less time and money consuming. They are also more rapid for calculations and analysis for many phases in image processing and computer vision. Classification maps are one of the main output types of environmental monitoring programs. In this study, different deep learning approaches are conducted to remotely sensed data and land-use and land-cover (LULC) maps are produced. Different CNN models are used for deep learning on the same datasets. After the learning phase, hyper-parameters, fine-tuning are determined and optimization type is chosen. Lastly, predictions are done on the test data in order to produce Multi-Label Classification maps. The developed DL models are applied to the other site area for testing. Moreover, object-based image analysis (OBIA) methods and classification approaches are applied to the same test-site area images. At the end of the study, overall accuracies (OA) for each class are calculated. As for performance metrics, F1 score and OA are compared to each other quantitatively.

**Keywords:** Remote sensing, Multi-Label Classification, Deep Learning

# Clustering Urbanization Form via Fractal Dimension Analysis

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Since the 20th century, cities have been accepted to have a chaotic structure consisting of many subsystems related to political, social, economic life, and space. This chaotic structure that repeats itself independently of scale has a fractal geometry. Developments in the field of geographic information systems in the last 30 years have provided great conveniences in examining this structure of cities with fractal dimension analysis. The geometrical shapes of buildings, streets, and blocks that create the physical city form constitute at the same time the fractal urban geometry. The study aims to determine the complexity level of the city by calculating the fractal urban geometry. The fractal dimension values of the buildings, roads and zoning blocks were calculated and the geographical distribution of these values were examined by statistical methods. In this context, the fractal dimension values of fractal urban geometry components were calculated separately in the study area consisting of 65 neighborhoods. A two-step cluster analysis was used to determine how these obtained fractal values dispersed geographically within the study area.

**Keywords:** sustainability, environment, urban form, fractal, fractal dimension

# **Innovative environmental and safety studies for advanced nuclear energy systems, in the frame of a sustainable European Union energy programme**

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Nuclear energy is part of the energy mix of half of the EU Member States. In those countries that choose to use it, nuclear has a role to play in ensuring the security of electricity supply. In this context, the Energy Union Strategy and the European Energy Security Strategy stressed that Member States need to apply the highest standards of safety, security, waste management and non-proliferation as well as diversify nuclear fuel supplies. Doing so will help achieve the objectives of the 2030 climate and energy framework.

The EU is currently one of the three major economies that generate more than half of their electricity from low-carbon energy sources (about 58%), half from renewables and half from nuclear.

Most of the nuclear-related planned activities in the short and medium term in the UE deal with reactor safety, nuclear fuel cycle, waste and decommissioning. The back-end of the fuel cycle will need increasing levels of attention: it is estimated that more than 50 of the 129 reactors currently in operation in the EU are to be shut down by 2025/2030. Based on the latest information provided by Member States, the largest 20 European nuclear operators estimated that nuclear decommissioning, radioactive waste management and disposal will be “the main question” until 2050 in the EU. The recent Communication on the Integrated Strategic Energy Technology Plan (SET-Plan) further details that the priority for nuclear energy is to support the development of the most advanced technologies to maintain the highest level of safety in nuclear reactors and to improve the efficiency of operation, the back-end of the fuel cycle and decommissioning.

In fact, the rapid rise in nuclear energy use outside the EU (China, India, etc.) also means that the EU needs to maintain its global leadership and excellence in the technology and safety domains, also via the development and finalization of the ITER project, a first-of-a-kind nuclear fusion device being now built in France and aimed at the technological demonstration of fusion power reactors with cutting-edge technology.

As underlined by European research and industrial stakeholders, retaining technological leadership in the nuclear field is possible only if interested Member States maintain diverse and sufficiently funded nuclear research capabilities. However, it will not be easy for Europe to retain leadership in all areas in view of the significant increase in nuclear generating capacity in other regions of the world. This underlines the importance of cooperation at European level, especially in areas such as the expertise on safety of advanced and innovative reactors.

The ITER project is a key step on the way to establishing fusion's future role in energy scenarios after 2050: the EU has a leading role in ITER, that will have to be maintained.

Some of the relevant activities in these fields, carried out by our research group will be briefly reported.

- 1) Waste management and radioactive safety studies for advanced fission and fusion power plants.
- 2) Experiments and models for the safety characterization of blanket liquid breeders and materials: tritium inventory, transport and measurements.
- 3) Development of compact high-field advanced fusion reactors (ARC project).
- 4) Behaviour of nuclear materials under irradiation: neutron-induced radioactivity, radiation damage.

**Keywords:** Nuclear energy, environmental impact, safety, EU energy programme, nuclear fusion, ITER

# Building Extraction with VHR Remote Sensing Imagery through Deep Learning

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Land-use changes generally are becoming through to urban classes from natural land cover classes. Remote sensing is a common technology for such monitoring systems. Automatic or semi-automatic applications are becoming wider and wider in most of the fields with developing artificial intelligence over time. Building extraction from aerial photos and satellite imagery through deep learning is a new era for observing planned and unplanned urbanization, land-use changes. Besides, traditional other methods in image processes such as supervised and unsupervised classification; deep learning presents a robust and needs less operator process. In this experiment, the WHUDBE dataset is used, the dataset contains 57 different spatial resolution images (31 pan-sharpened). Also includes 7 different Chinese regions imagery and sensors are QuickBird, Gaofen-2, WorldView2 with resolution of 0.6, 0.8, 0.5 meters. Bands are Red, Green, Blue, and Near-Infrared. The dataset is split into train, test, validation, and test parts. Deep learning approaches conducted to the dataset various CNN models: Xception, Resnet50, ResNet18, Segnet, Unet, Mobilenetv2. Selecting variations of the training options (different batch sizes, epoch numbers, backbone types, etc.) the optimized parameters are determined. When this determining phase, validation info as training and loss is used as well. After the training process, the test phase is conducted, and evolution metrics are calculated as mean F1 score, precision, recall, iou, and global accuracy. According to the results, ResNet8 and Xception models yielded better than the others. Results are shown as tables and evaluated quantitatively also with time performances of the models. Observing the urbanization spread is one of the crucial topics for environmental monitoring and applications. Deep learning applications are proposed more efficiency throughout the years.

**Keywords:** Building Extraction, Semantic Segmentation, Deep Learning

# **Environmental economics, policy and education**



## **Raising the environmental awareness for sustainable food systems in Primary and Secondary Education**

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This work deals with the presentation of a new educational scheme called NextGen FoodTech. The proposed educational scheme is addressed to Primary and Secondary Education students, with the aim of raising the environmental awareness and acquiring skills in the areas of Science, Technology, Engineering and Mathematics as well as non-technical / 'soft' skills. Specifically, the action is broken down into 3 sub-axes: the application of Precision Agriculture methods to pilot crops in the facilities of Ellinogermaniki Agogi, the exploitation of 3D food printing technology for the creation of high nutritional value snacks and the simultaneous establishment of an integrated dissemination strategy supporting project's promotion at National and European level addressed to primary stakeholders, i.e. the agri-food sector, the scientific community and the public in general. In this context, organic vegetable crops cultivation systems will be established, using state-of-the-art tools to carry out experimental procedures and disseminate useful practical information on best agricultural practices while conducting experiential workshops and demonstrations of the technological equipment. At the same time, students will be trained in food engineering and cutting-edge technologies such as 3D food printing while vegetables / fruits grown and harvested will be used as raw material in a 3D food printing device to produce a variety of nutritional snacks. Overall, the actions taken i.e. land cultivation, understanding and use of new technologies, creativity satisfaction, promotion of collaborative models and interaction with major Greek research institutes will have a positive impact on students and thus on society. The ultimate goal of the proposed educational activities is to understand and familiarize students with Precision Agriculture methods and 3D printing with emphasis on the utilization of food value chains and by-products in the light of their zero waste management strategies through leveraging innovative technologies. The educational activities that will be carried out will bring tangible results, thereby encouraging the systematic engagement of students with scientific and environmental issues from an early age, while allowing the younger generation to connect with the production process, technology and innovation. and the adoption of environmental consciousness and behavior. The 'open school' approach to society and local challenges will be adopted. Students and teachers will learn about the scientific methodology by interacting with research agencies and other social actors working on real social challenges. The school becomes a hub for the creation of reusable educational content, utilizing tools developed for this purpose as well as networking teachers together. Finally, the training of teachers within the school-wide context will be supported by linking educational policy makers and the school's operation as a certified training center.

All of the above are in line with EU research and innovation policy development in line with recent international policy developments, including the Sustainable Development Goals (SDGs) and the COP21 commitments. The above policy framework - FOOD2030 - was established after the Milan World Trade Fair 2015 and is based on key food and nutrition security priorities:

**NUTRITION** for sustainable and healthy diets: Ensuring that nutritious food and water is available, accessible and affordable for all. It involves reducing hunger and malnutrition, ensuring high levels of food safety and traceability, reducing the incidence of non-communicable diet-related diseases, and helping all citizens and consumers adopt sustainable and healthy diets for good health and wellbeing.

**CLIMATE** smart and environmentally sustainable food systems: Building climate smart food systems adaptive to climate change, conserving natural resources and contributing to climate change mitigation.

**CIRCULARITY** and resource efficiency of food systems: Implementing resource-efficient circular economy principles across the whole food system while reducing its environmental footprint. Circularity is applied for sustainable and resource-efficient food systems and food losses and waste are minimised throughout.

**INNOVATION** and empowerment of communities: Boosting innovation and investment, while empowering communities. A broad innovation ecosystem leading to new business models and value-added products, goods and services, meeting the needs, values and expectations of society in a responsible and ethical.

**Keywords:** sustainability, ESD (education for sustainable development), science education

# **School as site of food experience and food system transformation**

**Sofoklis A Sotirou, Katherina Riviou**

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Food systems present many challenges globally, such as obesity, malnutrition and hunger, scarce resources, climate change, and waste management. These issues are especially relevant to young people as they are among the most vulnerable population segments to suffer the current and future consequences of these challenges. Schools have a unique role to play in enhancing responsible citizenship, as well as influencing the well-being of the students and the active contribution of future proofing our food systems.

Taking as departure in the EC Food 2030 Research and Innovation Policy Framework, the EU's commitment under the Paris Agreement and the UN Sustainable Development Goals (SDGs: 2,3,4,11,12,13,17) and having as principle the well-being of our students we have set up EA school as an Open School; an innovative open hub for the local community following the Responsible research & innovation principles. Our goal is to explore new approaches for overcoming the growing divide between consumption and food knowledge by engaging schools in (re-)connecting young people with the land as well by strengthening the link between urban and agricultural communities, while providing hands-on learning opportunities for the citizens of tomorrow.

To this end, the innovation focus of our Open School lab is:

- (1) Social innovation by engaging schools in (re-) connecting young people with land and nature and strengthening the link between urban and agricultural communities by developing the dialogue between schools and food actor networks,
- (2) Community empowerment providing hands-on learning opportunities for the food-smart citizens of tomorrow
- (3) Cooperating solutions for using leftovers in school canteens and kitchens.

So far, we have been:

- Following the Open Schools for Open Societies (OSOS) methodology already implemented in our school and all-around Europe under our coordination.
- Developing food-related educational projects in the curriculum following pedagogical innovative approaches (hands-on projects implemented with and for the local community). These projects are linked to the EC Food 2030 agenda, and we address issues related to school canteens, the school garden, (food) waste and management, healthy and sustainable nutrition, etc.
- We became part of the European Initiatives Fit4FOOD 2030 and FoodSHIFT2030. These are ambitious citizen-driven initiatives aiming at the transition of the European food system towards a low carbon circular future, including a shift to less meat and more plant-based diets. With this goal we are following the quadruple helix model involving researchers, innovators, industries, users/citizens and government and collaborating with local stakeholders, part of the local, regional and national Food and Nutrition ecosystem, representatives from all fields (NGOs/Citizen Organisations/SMEs/ Policy-makers/ Research institutes) active in the areas of

Agriculture, Food distribution, Health, Environment. We are designing and implementing a dissemination strategy that will ensure the effective communication of results and outcomes. EA is already leading the Athens City Lab for raising awareness for the FOOD 2030 EC policy has implemented workshops with representatives from all the above types of stakeholders, the outcomes of which have been communicated to policy stakeholders as well as integrated in suggested pilot modules being tested in the school and educational activities.

In this context the impact of our activities will be measured on:

- Modified student dietary choice behaviours to adopt less meat-based options and environment-friendly lifestyle
- Enhanced 21st century skills and competences in students allowing greater “green” jobs employment opportunity
- Reduced school canteen and public kitchen food waste (by 15%)
- Facilitated summer school for teachers of primary and secondary fostering the adoption and multiplication of such activities in other contexts too.

**Keywords:** science education, formal education, informal education

# **Evaluation of Zero Waste Management in University Campuses, A Case Study for Marmara University Anadoluhisari Campus in Turkey**

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With the rapid increase of the population living in the world and the increase in limited resource consumption, waste management has started to gain importance rapidly. With the increase in waste production, waste management policies have started to be implemented. "Zero Waste Management" stated as the reassessment of the wastes generated as a result of production and the prevention of waste during the formation by reviewing the causes of waste generation" has become an important environmental policy.

The motivation of this study is to evaluate to what extent the most educated/growing individuals of the society can adopt this practice by evaluating the applicability of ZWM in university campuses. In this concept Marmara University Anadoluhisari Campus in Turkey was selected as a pilot area. For this purpose, the waste resources and quantities collected within the campus were determined first, then by applying the ZWM system, the waste was collected separately as paper, metal/plastic, glass and irreversible waste inside and outside the building. In addition, a total of 1200 students, 40 academic staff and 50 administrative and cleaning personnel were surveyed to measure the awareness of the applications carried out within the scope of ZWM by students and academic and administrative staff. According to the obtained results, the amount of waste collected was 295.54 gr/per.day which were non-recyclable (100%) before the ZWM application. After applying ZWM, the amount of non-recyclable waste was reduced to 31%. The wastes were collected as 9% glass, 11% paper, 35% metal / plastic, 14% organic throughout the campus. For dining hall 42% of the waste collected was collected as metal / plastic and 22% was re-evaluated as compostable organic waste (Table 1). Within the ZWM study carried out on the campus, it was determined that an annual income of 6.793 \$ could be obtained from the recycling of wastes. In the survey there were 25 questions conducted for the purpose of measuring awareness. Among the questions in the survey, the first of the two questions that would qualify the study was "What would you do with your recyclable garbage (such as plastic water bottle)?" 45% of the student, 39% of the administrative staff and 29% of the academic staff answered "I'll throw it in the trash" (Figure 1-a). To the question of "Is Zero Waste Management applied on the campus?" 22% of the students, 37% of the academic staff and 41% of the administrative staff answered "Yes" to the question. In the study (Figure 1-b), it was concluded that ZWM can be applied in universities, but in order to be successful, it is necessary to carry out the stages of knowledge and awareness.

**Keywords:** Waste Management, Zero Waste Management, University Campus

Figure 1. Answers to the questions asked in the survey a) "What would you do with your recyclable garbage (such as plastic water bottle)?", b) "Do you think Zero Waste Management is applied on the campus?"

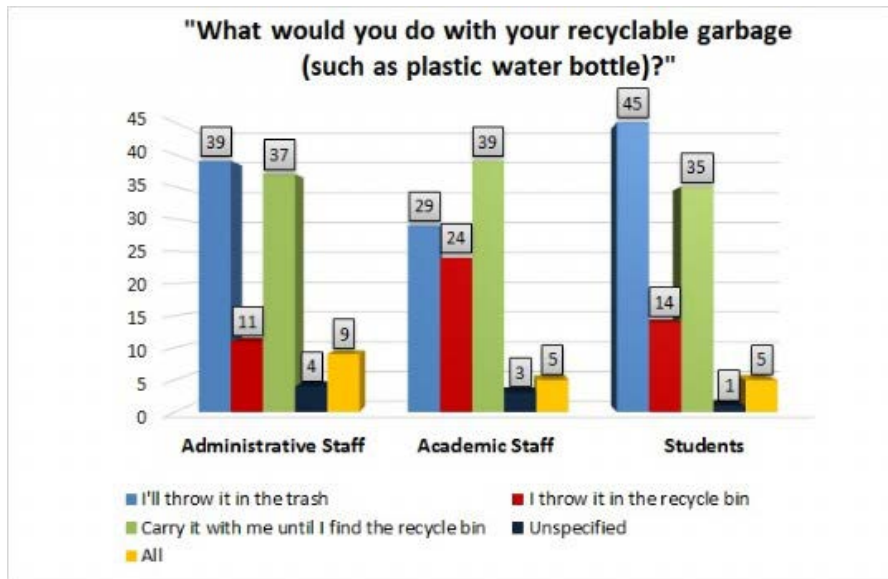


Figure 1-a

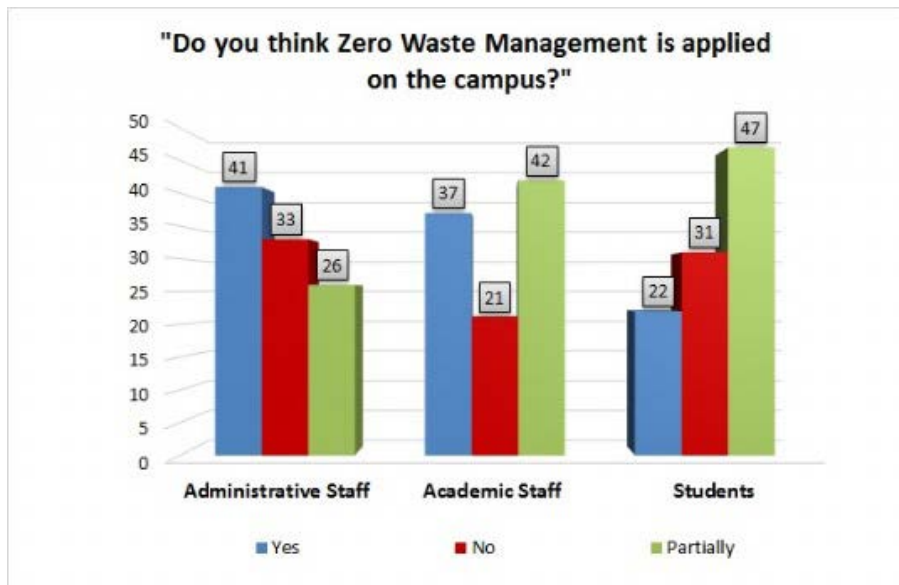


Figure 1-b

Table 1. Total amount of waste before and after ZWM on the campus (gr/person.day)

Collected Waste (gr/person.day)	Glass	Paper	Metal/Plastic	Compostable Organic Waste	Non- Recyclable Waste	Total
Before ZWM	-	-	-	-	193.20 (100)	193.20 (100)
After ZWM	28.39 (9%)	30.43 (11%)	104.35 (35%)	40.23 (14%)	92.14 (31%)	295.54 (100%)

# **The Mediterranean Engineering Schools Network Advances Changes in Gender Equality at the Mediterranean Higher Engineering Education**

**Anastasia Zabaniotou<sup>1,2</sup>**

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Engineering Education is currently undergoing changes: It needs to address the climate change and other challenges, integrate sustainability, diversity, and gender equality. The study emphasizes the role of the strategic network of Mediterranean Higher Education Institutions of Engineering (RMEI), in inspiring and catalyzing gender equality changes at member-institutions of the Mediterranean countries. The network was established by Mediterranean Engineering Schools, and it is based on a self-assembling collaboration, common vision, sharing of knowledge and good practices and integrates gender equality in interventions for sustainable development of the region. RMEI has achieved a gender equality community of practice, due to its commitment on SDGs, and the support of the TARGET project (aiming at a reflexive transformation of Higher Education Engineering Institutions on gender equality). By adopting a transdisciplinary and multi-stakeholder approach, a gender equality policy statement approved by the member-institutions leaders who are committed to the UN world agenda 2030. Formal and informal cultural changes are being catalyzed complying with the network's vision for Sustainable Development. By unraveling the links between gender equality and sustainability, and harvesting the synergies of gender equality with other SDGs innovations, the network achieved to mobilize human resources for the creation of a community of practice and to integrate gender equality dimensions in interventions for sustainable development. Finally, the network's co-creation processes and interventions, challenges, barriers, and lessons learned are shared.

## **Acknowledgements.**

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## **References**

Anastasia Zabaniotou, 2020. Towards gender equality in Mediterranean Engineering Schools through networking, collaborative learning, synergies and commitment to SDGs-The RMEI approach. *Global Transitions*, 2, 4-15.

ANGELA WROBLEWSKI, AND ANDREA LEITNER, 2011. Equal Opportunities Policies at Austrian Universities and Their Evaluation: Development, Results and Limitations. *BRUSSELS ECONOMIC REVIEW - CAHIERS ECONOMIQUES DE BRUXELLES VOL. 54 (2/3) SUMMER - AUTUMN 2011*.



# **Natural and man-made environmental disasters**

# **Analyzing Effects of Burned Forest Areas in the Neighboring Patches with Use of Data-sets from Google Earth Engine: Case Study of Izmir Forest Fire**

**Nusret Demir, Serdar Selim**

Department of Space Science and Technologies, Chair of Remote Sensing, Antalya, Akdeniz University

The quality of a landscape patch is directly related to the biodiversity and the land uses adjacent to the patch. In other words, the land use of neighboring patch can have a multifaceted effect on that patch. While these neighborhoods increase the biodiversity of the landscape patch, its connection with other patches, also cause degradation and loss of habitat. Therefore, when evaluating the quality of the landscape patch, neighboring relations should be taken into consideration. In this study, neighboring relationships of forest patches in existing land cover were analyzed with use of data-sets from Google Earth Engine which is a cloud computing platform. The data have been selected from Izmir which is the biggest city in Aegean Region of Turkey, and the neighboring relations have been analyzed. As an example, the forest fire occurred in 18th August 2019 case has been selected which is one of the biggest forest fire happened in Izmir from the past. This burned area is neighbor with the center of Menderes town in East, and the other directions are covered by unaffected forests. The relation between burned area and these patches are analyzed with use of Google Earth Engine derived NDVI data-sets from Landsat 8 from the dates of pre- and post-forest fire event. The burned area has been automatically detected, converted to vector, then the boundary of the patches have been converted to the points. The ratio of the points which belong to the patch with total number of points along the boundary of burned area gives the relationship ratio which is used to evaluate the effect.

**Keywords:** Landscape patch analysis, forest fire, remote sensing, numerical analysis, Google earth engine



Figure 1. Colored Landsat-8 derived NDVI produced by Google Earth Engine Platform (Green: Vegetation, Brown: Non-vegetation) Left: Before Fire, Right: After Fire

## **Flood Mapping of Agricultural Fields with Use of SAR Images**

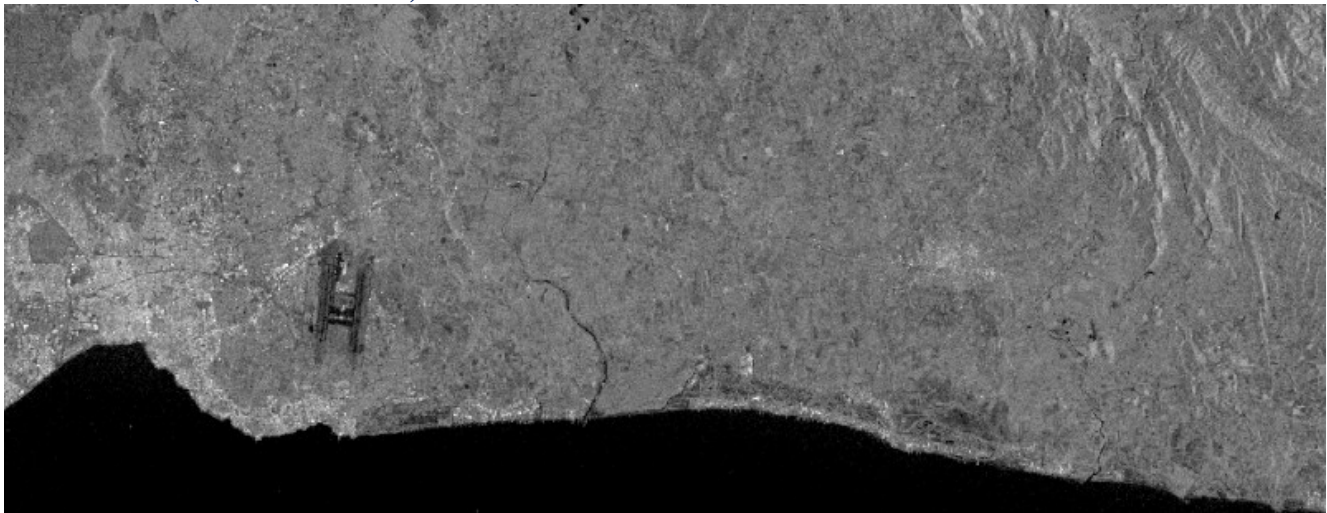
**Nusret Demir**

Department of Space Science and Technologies, Chair of Remote Sensing, Antalya, Akdeniz University

Synthetic aperture radar images have a big potential to detect the flooded areas since they have capability to penetrate in all weather conditions. Radar signals do not penetrate from water, and highly penetrate from soil with high moisture. This property gives opportunity to detect the flooded areas from SAR data. Radar image has capability to identify water surface beneath a vegetation canopy or without any standing vegetation which is fully covered by water by the flood. Antalya face heavy rains and storms, even hurricanes generally during winter, and the agricultural fields are affected by the flood. Many greenhouses and open agricultural fields are affected every year, thus they need to be precisely detected to identify the damage and the fields which were destroyed. In this study, a recent flood happened on January 6th 2020, has been analyzed, and the effected fields are detected with three methods which are CART (A Classification and Regression Tree), Random Forest and Support Vector Machines (SVM). The used data are from Sentinel 1 Synthetic aperture radar (SAR) satellite. It has C band data, and two satellite A and b, each has 12 days temporal resolution, that allows acquiring data every 6 days over the equator. The images were speckle filtered first, then training samples were collected. VV polarization has been used as input band. Google Earth Engine has been used to process the data, and the visualization of the results.

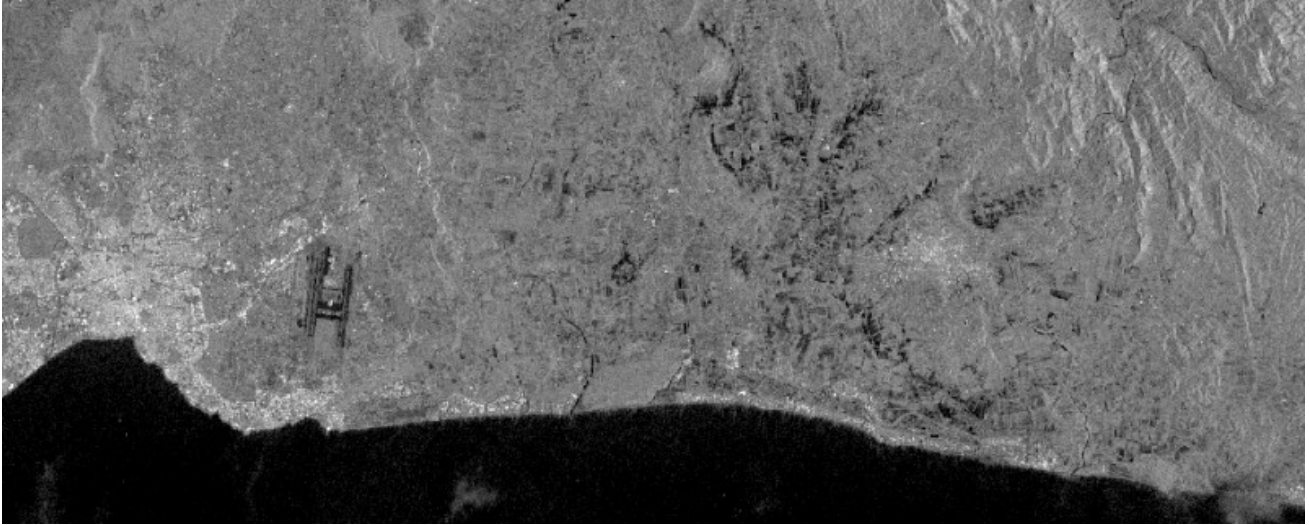
**Keywords:** SAR, flood, Google Earth Engine

**Before Flood (December 2019)**



*Sentinel 1 Image from December 2019*

**SAR Image from the day of flood**



## **Detection and Analysis of Burned Areas With Remote Sensing Techniques: 2019 İzmir / Karabağlar Forest Fire**

**Filiz Bektas Balcık<sup>1</sup>, Ömer Onur Alıcı<sup>2</sup>, Ejder Bayır<sup>2</sup>, Hilal Gökçe Boz<sup>2</sup>, Yasemin Hor<sup>2</sup>, Yiğit Yüksel<sup>2</sup>**

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(Bachelor Student)

Forest fires, whether caused naturally or by human activity can have disastrous effects on the environment. In recent years, due to different reasons, long-term forest fires have occurred and affected quite large areas. These fires cause negative effects especially on ecosystems, landscapes, climate and human life. The precisely and timely extraction of burned areas after forest fire plays an important role in reducing disaster losses, maintaining ecological balance and protecting forest resources. In last twenty years, 33508 hectares of forest area has been destroyed by forest fires in Turkey. Different remotely sensed data have been used to determine the burned forest area accurately and fastly. In this study, İzmir, Seferihisar, Karabağlar forest fire were analyzed by using Landsat 8 OLI&TIRs images obtained before and after the fire (7 August 2019 and 23 August 2019, respectively). Normalized Difference Vegetation Index (NDVI), Normalized Burn Ratio Index (NBR) and Normalized Difference Moisture Index (NDMI) were selected within the scope of the study. Differences of three selected indices were calculated to determine the changes that occurred in the region and a burning intensity map was created. Statistical relationship between land surface temperature and selected indices were analysed by correlation analysis. The performance of the selected indices were compared using error matrix. Based on the results approximately 4000 ha area were affected from the fire.

**Keywords:** Landsat 8 OLI&TIRs, Forest fire, Seferihisar, Burn indices, Land surface temperature

# FireAnalyst: A GIS Based, Early Fire Detection System for Outdoor Fire Disasters Using Mathematical Modelling

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<sup>2</sup>Department of Geomatics Engineering, Istanbul Technical University, Istanbul, Turkey

Fire risk areas such as *High Conservation Value Forests*, *shipyards* and *factories* containing combustible or explosive substances show similarities in terms of fire potential. These critical areas are needed to be appropriately managed, because they are very susceptible to fire outbreaks and consequences of such incidents could be in a disaster scale. Early fire detection, determination of ‘source of fire’ and ‘spread speed of fire’ have vital roles for firefighting in order to prevent it from becoming a disaster. In this proposed system, special detectors with state-of-the-art multi-spectral infrared technology and mathematical modelling algorithms have been utilized to create a smart fire detection system by LabVIEW automation software that can detect fires from a very early stage. The geolocation and behavior of emerging fires in a forest are also estimated with maximum spatial resolution by superposition of the detection areas of multi-spectral infrared detectors. In this study, candidate fire regions are detected for feasibility first. Next, the most suitable detector type in fire detection is determined and used for expanding the fire control area, so as to have the highest positional accuracy in estimating the location of an emerged fire. Thereafter, mathematical models for the position of the detectors are created to have high spatial resolution in detecting the coordinates of forest fire by using libraries of Google Maps APIs in the cloud. The geolocation of the fire and behavior of fire inside the model are then simulated visually on the map portal thanks to an extraordinarily created standalone software called FireAnalyst. Wireless detectors collect fire alarm information from risky areas and send them to the fire operators' mobile devices via wireless network over internet (cloud). This interactive map also contains some useful GIS features, i.e. listing nearby fire stations to source of fire, drawing visual routes to these fire stations and estimation of approximate arrival time of fire engines to fire location according to real-time Google traffic information. Compared to other fire detection systems used today, this study includes new generation features, such as real-time fire detection in seconds, detection of fire source by superposition, determination of propagation speed, direction of fire propagation and cloud-based real-time mobile alarm monitoring mechanism. Moreover, estimation of geolocation of emerged fire by superposition of detection areas of detectors is the main novelty. The proposed system is implemented in “Faruk Yalcin Zoo & Botanical Park” – Darica, Turkey. Experimental results indicated that monitoring fire with FireAnalyst using selected multi-spectral infrared detectors positioned “towards the center geometry” outperformed other fire monitoring systems, providing a significantly shortened fire detection timeframe and high spatial resolution (up to 4.5m) in detecting geolocation of fire in a minimum ~3599.56 m<sup>2</sup> forested area and adds with functionalities like as real-time fire behavior analysis.

**Keywords:** Environmental disasters, wildland fire, fire geolocation, fire behavior, GIS

### Fire Analyst Portal

**Fire Analyst v1.1**

**Alarm State**  
**FIRE DETECTED**  
Fire is now moving to South-East  
Fire Speed: 4 km/h

**05:10 PM 20**

**Fire Analyst Fire Detection System**  
Issued: Technical University  
October 10, 2019

**Detector 1** (Red circle)  
**Detector 2** (Green circle)  
**Detector 3** (Red circle)  
**Detector 4** (Green circle)

**Data Table 1**

Sensor	Name	Date	Hour	Minute	Seconds
Sensor 1	111982 10	08.12.2019	17	50	11
Sensor 2	111982 10	08.12.2019	17	50	12
Sensor 3	111982 10	08.12.2019	17	50	13
Sensor 4	111982 10	08.12.2019	17	50	14
Sensor 5	111982 10	08.12.2019	17	50	15
Sensor 6	111982 10	08.12.2019	17	50	16
Sensor 7	111982 10	08.12.2019	17	50	17
Sensor 8	111982 10	08.12.2019	17	50	18
Sensor 9	111982 10	08.12.2019	17	50	19
Sensor 10	111982 10	08.12.2019	17	50	20
Sensor 11	111982 10	08.12.2019	17	50	21
Sensor 12	111982 10	08.12.2019	17	50	22
Sensor 13	111982 10	08.12.2019	17	50	23
Sensor 14	111982 10	08.12.2019	17	50	24
Sensor 15	111982 10	08.12.2019	17	50	25
Sensor 16	111982 10	08.12.2019	17	50	26
Sensor 17	111982 10	08.12.2019	17	50	27
Sensor 18	111982 10	08.12.2019	17	50	28
Sensor 19	111982 10	08.12.2019	17	50	29
Sensor 20	111982 10	08.12.2019	17	50	30

**Data Table 2**

Sensor	Name	Date	Hour	Minute	Seconds
Sensor 1	111982 10	08.12.2019	17	50	31
Sensor 2	111982 10	08.12.2019	17	50	32
Sensor 3	111982 10	08.12.2019	17	50	33
Sensor 4	111982 10	08.12.2019	17	50	34
Sensor 5	111982 10	08.12.2019	17	50	35
Sensor 6	111982 10	08.12.2019	17	50	36
Sensor 7	111982 10	08.12.2019	17	50	37
Sensor 8	111982 10	08.12.2019	17	50	38
Sensor 9	111982 10	08.12.2019	17	50	39
Sensor 10	111982 10	08.12.2019	17	50	40
Sensor 11	111982 10	08.12.2019	17	50	41
Sensor 12	111982 10	08.12.2019	17	50	42
Sensor 13	111982 10	08.12.2019	17	50	43
Sensor 14	111982 10	08.12.2019	17	50	44
Sensor 15	111982 10	08.12.2019	17	50	45
Sensor 16	111982 10	08.12.2019	17	50	46
Sensor 17	111982 10	08.12.2019	17	50	47
Sensor 18	111982 10	08.12.2019	17	50	48
Sensor 19	111982 10	08.12.2019	17	50	49
Sensor 20	111982 10	08.12.2019	17	50	50

**Data Table 3**

Sensor	Name	Date	Hour	Minute	Seconds
Sensor 1	111982 10	08.12.2019	17	50	51
Sensor 2	111982 10	08.12.2019	17	50	52
Sensor 3	111982 10	08.12.2019	17	50	53
Sensor 4	111982 10	08.12.2019	17	50	54
Sensor 5	111982 10	08.12.2019	17	50	55
Sensor 6	111982 10	08.12.2019	17	50	56
Sensor 7	111982 10	08.12.2019	17	50	57
Sensor 8	111982 10	08.12.2019	17	50	58
Sensor 9	111982 10	08.12.2019	17	50	59
Sensor 10	111982 10	08.12.2019	17	50	60
Sensor 11	111982 10	08.12.2019	17	50	61
Sensor 12	111982 10	08.12.2019	17	50	62
Sensor 13	111982 10	08.12.2019	17	50	63
Sensor 14	111982 10	08.12.2019	17	50	64
Sensor 15	111982 10	08.12.2019	17	50	65
Sensor 16	111982 10	08.12.2019	17	50	66
Sensor 17	111982 10	08.12.2019	17	50	67
Sensor 18	111982 10	08.12.2019	17	50	68
Sensor 19	111982 10	08.12.2019	17	50	69
Sensor 20	111982 10	08.12.2019	17	50	70

**Data Table 4**

Sensor	Name	Date	Hour	Minute	Seconds
Sensor 1	111982 10	08.12.2019	17	50	71
Sensor 2	111982 10	08.12.2019	17	50	72
Sensor 3	111982 10	08.12.2019	17	50	73
Sensor 4	111982 10	08.12.2019	17	50	74
Sensor 5	111982 10	08.12.2019	17	50	75
Sensor 6	111982 10	08.12.2019	17	50	76
Sensor 7	111982 10	08.12.2019	17	50	77
Sensor 8	111982 10	08.12.2019	17	50	78
Sensor 9	111982 10	08.12.2019	17	50	79
Sensor 10	111982 10	08.12.2019	17	50	80
Sensor 11	111982 10	08.12.2019	17	50	81
Sensor 12	111982 10	08.12.2019	17	50	82
Sensor 13	111982 10	08.12.2019	17	50	83
Sensor 14	111982 10	08.12.2019	17	50	84
Sensor 15	111982 10	08.12.2019	17	50	85
Sensor 16	111982 10	08.12.2019	17	50	86
Sensor 17	111982 10	08.12.2019	17	50	87
Sensor 18	111982 10	08.12.2019	17	50	88
Sensor 19	111982 10	08.12.2019	17	50	89
Sensor 20	111982 10	08.12.2019	17	50	90

**Wireless Link Quality** (Graph showing signal strength over time)

**Logical Detector Data** (Graph showing detector status over time)

**Battery Voltage of Nodes** (Graph showing battery levels over time)

**Sensor Data Analysis**

Speed: 0.00 m/s  
Output: 0.00 m/s  
Behavior: 0.00 m/s

**Converted Detection Time**

Time 1: 08:10:11  
Time 2: 08:10:12  
Time 3: 08:10:13  
Time 4: 08:10:14

**Reference Coordinates**

Lat: 40.761123 Long: 29.888884

2019 File Output Path: C:\Users\Bilal\OneDrive\Documents\fire\_analyst\_data.p

FireAnalyst Portal (MS) C:\bin...fire\_analyst\_portal\fire\_analyst

Fire Analyst Portal

# **Mapping of burned areas by using remote sensing algorithm: Izmir- Karabaglar Forest Fire Case Study**

**Asli Sabuncu, Haluk Ozener, Onur Yilmaz**

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Forest fire is one of the most devastating natural disaster all around the world. Forest fire not only harms the environment and ecosystem, but also causes huge and irreversible damage to human health, endangered animals and the country's economy. The western part of Turkey is dominated by the mediteranean climate condition. Between 1937-2019, about 2000000 hectares of forest areas were burnt due to the wild forest fires. Natural conditions also cause forest fires in Turkey, especially during the summer season, along the Mediterranean and Aegean region, where high temperature with low humidity bring about wildfires. Significant increases have been observed in forest fires in the Mediterranean region in recent years. Forest fires occurring especially in this region are twice the fires that occurred in 1970s. In addition, when the statistics related to forest fires were examined, it was observed that the forest area burning in the Mediterranean basin increased up to 600.000 ha annually. Extracting and evaluating the levels of fire severity, fire damages, burned areas from different satellite images (Landsat, MODIS, Sentinel, SPOT, etc.) have been used in many scientific studies with different remote sensing approaches. In this research, Izmir-Karabaglar, which is located in Aegean Region is selected as the case study area. In 2019 August, one of the largest fires was occurred in this region. In this analysis, pre and post- fire Landsat 8 OLI images acquired in August and September 2019 were used to detect the extent of forest fire within the region. The capacity of Normalized Burn Ratio (NBR) and Normalized Difference Vegetation Index (NDVI) indices and differenced Normalized Difference Vegetation Index (dNDVI) derived from Landsat 8 OLI images have been analyzed in order to assess the fire severity. Besides NDVI and NBR indices results, Support Vector Machine algorithm which is supervised classification method was applied to pre and post fire satellite images. Based on the different remote sensing methods of results are compatible and rational.

**Keywords:** Remote sensing, Forest Fires, NDVI, NBR, Izmir Karabaglar Forest Fire, Support Vector Machine



# **Monitoring Urban Sprawl by Multi-temporal Satellite data with remote sensing approaches: A case study of Beylikdüzü istanbul**

**Asli Sabuncu**

Bogazic University, Kandilli Observatory and Earthquake Research Institute Geodesy Department

Istanbul is not only the most populated city in Turkey but also one of the most populated mega cities among the European countries. The main aim of this study is to monitor and map land use land cover changes using multi-temporal satellite data of Landsat satellite images covering Beylikdüzü district using remote sensing technologies for the years 1990, 2000, 2010 and 2020. Beylikdüzü district was selected as the case study area due to the high density of urban growth from the year 1990. 3 Landsat 5 TM imageries were dated 13 June 1990, 23 May 2000, 03 May 2010, and 1 Landsat 8 OLI/TIRS imagery was dated 12 April 2020 were used in order to analyze the data. In this context, Support Vector Machine algorithm which is the most trusted supervised classification method and Normalized Difference Vegetation Index (NDVI) and Normalized Difference Built Up Index (NDBI) were applied to all Landsat data to demonstrate land use and land cover changes in every decade. Five land use classes were detected which were; Open space, Industrial Area, Residential Area, Vegetation and Agriculture. In the class of residential area noteworthy changes was observed from 1990 to 2020. The residential areas increased approximately by a factor of 3 in Beylikdüzü district in a 30 year period. The overall classification accuracies are 87 % with Kappa statistic of 0.84 for the year 1990, 85.10 % with Kappa statistic of 0.80 for the year 2000, 81.15 % with Kappa statistic of 0.73 for the year 2010 and 82 % with Kappa statistic of 0.74 for the year 2020.

**Keywords:** İstanbul-Beylikdüzü, Support Vector Machine Classification, Urban Sprawl, Land Use Land Cover, NDVI, NDBI.

## **Characterization of flash flood impact on environmental using remote sensing approach: Giresun case study**

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Every year, natural hazards especially floods cause a huge amount of damages and the loss of human life. Monitoring and mapping the affected areas flood is one of the most important action needed to asses a risk reduction and to plan emergency response effectively. Satellite data is the most convenient data set in order to map flooded areas by using remote sensing different approaches. In the last 60 years, Turkey unfortunately has suffered several floods along the Black Sea region. In this study, Giresun-Turkey, which is located in Black Sea Region is selected as the case study area. In 2020 August, one of the most devastating flash flood was occurred in this region. After the flash floods in Giresun Province, 10 people died, 5 people are still missing and at least 172 people were rescued. The devastating flash flood water also demolished 17 buildings totally and caused 361 structures slightly damage. In this analysis, pre and post Landsat 8 OLI and Sentinel 2 images acquired in August and September 2020 were used to detect the extent of flash flood within the region. Besides NDVI and MNDWI indices results, Support Vector Machine algorithm which is supervised classification method was applied to pre and post flash flood satellite images. Based on the different remote sensing methods of results are compatible and rational. The outcomes of this research is considered to contribute in the development of risk management plans, preparedness approaches and risk reduction for the case study area.

**Keywords:** Giresun Flash Flood, Landsat 8 OLI, MNDWI, SVM Classification, Natural hazards

## **Cytoprotective effect of melatonin on gonadotoxicity induced by a local linuron herbicide in wistar rats**

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This study was conducted to evaluate the effectiveness of supplementation of an antioxidant Melatonin on oxidative status (antioxidant defense system) in an animal model Showing pathological lesions induced by a local herbicide: linuron.

Indeed, the administration of linuron caused pathophysiology which was revealed on the one hand, by the formation of pre-tumoral cells located within the seminiferous tubes and on the other hand by the reduction of glutathione -S - transferase (GST), and a significant decrease in reduced glutathione (GSH) levels, which are biomarkers of oxidative stress. Melatonin preventive treatment of rats with linuron decreased Significantly the incidence of pre-tumoral lesions, with improved activity of the antioxidant defense status GSH, GST. This suggests that melatonin can act as an effective chemo-preventive agent against Testicular cancer via the reduction of radical attacks on the testicles.

**Keywords:** testicles, melatonin, linuron, oxidative stress.



# **New and emerging technologies for environmental and health applications**

# **A Lower-Cost PM/NO<sub>2</sub> Air Quality Measurement Unit with a Low-Cost Air Dryer for Stationary Outdoor Use**

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An outdoor measurement unit for particulate matter and NO<sub>2</sub> is presented, suitable for stationary use and local data storage on SD-card. In contrast to professional equipment, it uses lower-cost sensors that reduces the cost per unit to less than 500 Euro. The choice of lower-cost sensors in contrast to the very low-cost sensors results from a compromise between measurement accuracy and costs. This compromise appeared to be inevitable when scientific measurements must be executed under high variations of humidity and temperature in the outdoor environment and a matching of results to professional equipment is expected. A field measurement experiment using a prototype unit during a pollution episode in the city of Stuttgart showed a maximum deviation of  $\pm 10 \mu\text{g}/\text{m}^3$  for the measured PM<sub>2.5</sub> concentration compared to reference instrumentation and  $\pm 7.1$  ppb maximum deviation for the measured NO<sub>2</sub> concentration.

## **Introduction**

With the upcoming of low-cost sensors, a lot of commodity devices appeared on the market, especially in Asia. These devices are mostly used as low-cost indicators of air pollution and assist citizens to identify health risks. In western countries, where high-quality air monitoring with spot measurements in larger cities was already in place, the idea popped up to use these low-cost devices for spatial pollution mapping either in scientific applications or in citizen-science crowd-mapping projects [1,2, 3]. For the scientific community, the main concern about the use of this devices is the low reliability of the raw data and the lack of a standard calibration method as well as a well-defined data post processing. The aim of the project was to build a lower-cost PM/NO<sub>2</sub> Air Quality Measurement Unit that can meet a reasonable compromise between measurement accuracy and costs, keeping the budget close to 500 Euro.

## **Methodology**

After an extensive market overview and laboratory tests from some of the reviewed sensors, the sensors OPC R1 and B43F from the company Alphasense for PM and NO<sub>2</sub>, respectively, were selected as the best candidates to maintain a compromise between measurement accuracy and costs. In order to avoid the effects of humidity and the hygroscopic growth of the particles a thermal low-cost dryer was designed to be placed at the inlet of the PM sensor. Furthermore, as shown in Figure 1 a temperature and humidity sensor (HYT221 from IST-AG) was installed to regulate the drying system. Thanks to the dryer, the relative humidity at the OPC R1 sensor can be maintained below 70%. Additionally, it was observed that the dryer of the PM sensor had also a positive effect on the relative humidity seen by the NO<sub>2</sub> sensor, avoiding the influence of the extremely high humidity in the signal of the working electrode. The box was placed close to a busy road for a period of three months. The reference instruments used were a particle size analyser /aerosol spectrometer Model 180 from Grimm and NO<sub>2</sub>/NO/NO<sub>x</sub> Monitor Model 405 nm from 2B Technologies.

For QA/QC gravimetric measurements of PM<sub>10</sub> and PM<sub>2.5</sub> fractions as well as calibration with gas bottles were performed for the dust monitor and the NO<sub>x</sub> monitor, respectively.

## Results

From the whole measurement period two parts were selected, one was used as a calibration phase where the different parameters were calculated with help of the reference instruments and the validation phase where these coefficients were implemented on the data from the sensors to be compared with the data from the reference instruments. The table 1 compiles the summary of results. For the PM sensor, a simple linear regression between the raw PM<sub>2.5</sub> values and the reference instrument seemed to be enough to get a reasonable correlation ( $R^2=0,85$ ). The validation period cover the night of New Year's Eve and the 2nd of January, when a fog event took place. As shown in the figure 2, the PM<sub>2.5</sub> values of the OPC R1 follows the same trend as the reference instrument. Even during the fog event, the dryer keeps the PM<sub>2.5</sub> values really close to the reference, avoiding the water droplets to be counted as particles and having a maximum of 10  $\mu\text{g}/\text{m}^3$  difference among them. For the NO<sub>2</sub> sensor, a good matching was also seen when applying the same method to the raw data. However, better results can be obtained by running a multi-variate regression including the humidity and temperature variation (see figure 3). As shown in table 1, the maximum deviation of the sensor data to the reference can be kept below 7 ppb of NO<sub>2</sub> .

## Conclusions

The application of a low-cost thermal gas dryer proved to be essential to effectively remove the effect of relative humidity in the PM sensor as well as the hygroscopic growth effect induced by high humidity phases. For the NO<sub>2</sub> sensor, a linear, threedimensional regression-based compensation for the sensor sensitivity provides a good matching between the lower-cost measurement unit and the reference instrument.

## References

- [1] Aboubakr Benabbas et al.; Measure particulate matter by yourself: data-quality monitoring in a citizen science project; J. Sens. Sens. Syst., 8, 317–328, 2019
  
- [2] Matthias Budde et al.; SmartAQnet: remote and in-situ sensing of urban air quality; SPIE Remote Sensing, 2017, Warsaw, Poland
  
- [3] Luftdaten Selber Messen; OK-Lab Stuttgart <https://luftdaten.info>

**Keywords:** Low-Cost Sensors, particulate matter, NO<sub>2</sub>, outdoor air quality; Low cost dryer

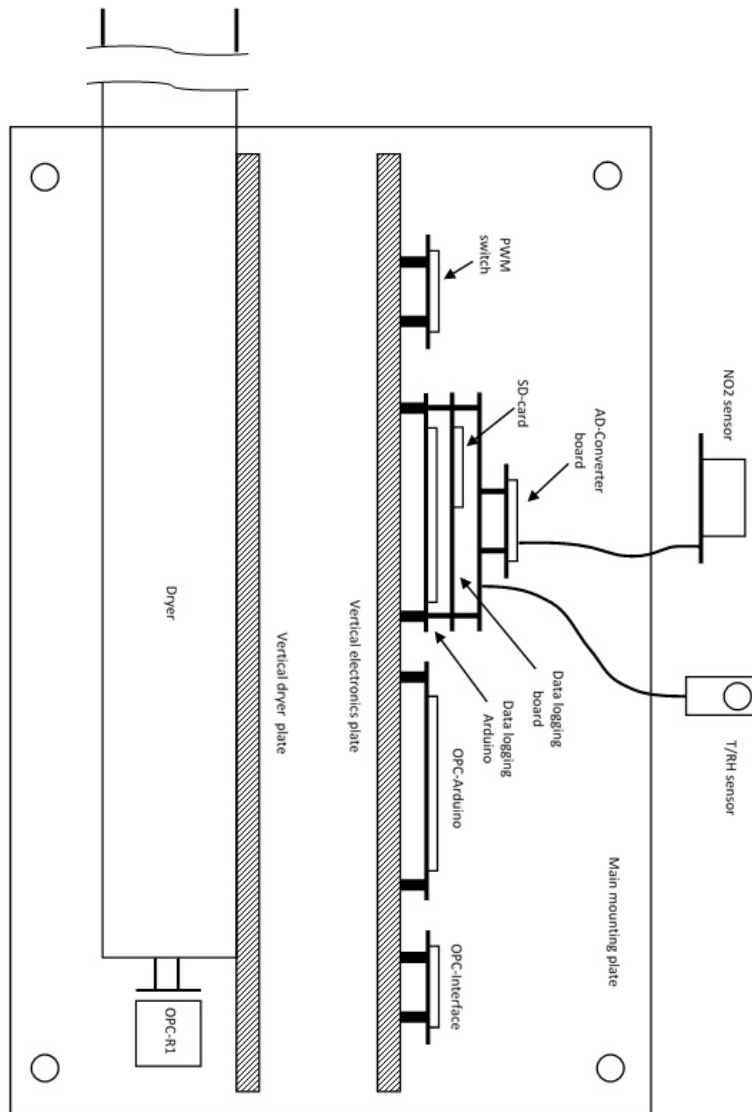


Figure 1. Schema of the measurement unit

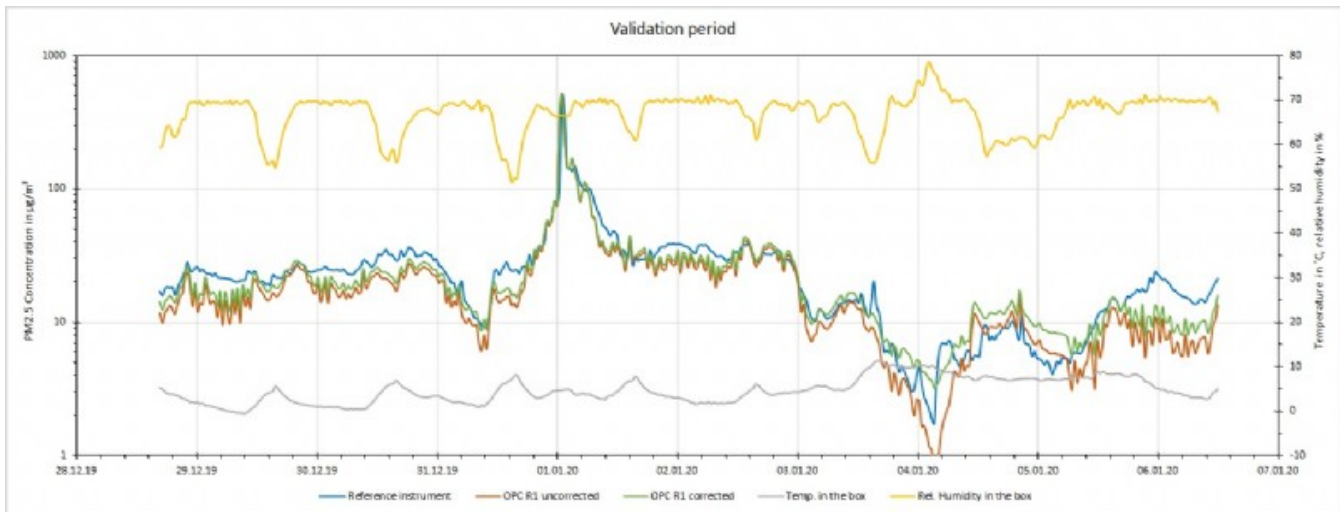


Figure 2. PM2.5 validation period

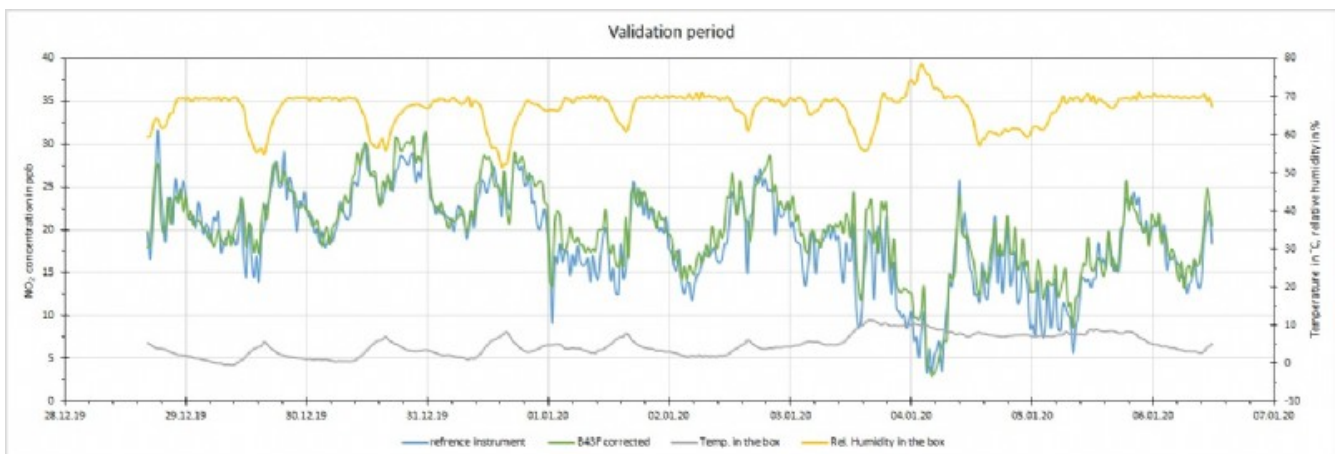


Figure 3. NO2 validation period



Table 1. Summary of results

PM2.5 - OPC R1		NO2 -B43F	
Calibration phase	02.12.19 – 16.12.19	calibration phase	02.12.19 – 16.12.19
<i>Coefficients from one dimension linear regression</i>		<i>Coefficients from multi-variate regression</i>	
Correction factor	0,989	Offset	-754,517
Offset	2,59	WE (LSB)	0,026
R <sup>2</sup>	0,85	Temp (°C)	-0,128
<i>Coefficients valid for the following conditions</i>		Rel. Humidity (%)	-0,305
Temperature range in °C	-2 – 16	R <sup>2</sup>	0,928
Humidity range in %	41 – 91	<i>Coefficients valid for the following conditions</i>	
PM2.5 range in µg/m <sup>3</sup>	0 – 35	Temperature range in °C	-2 – 16
Validation phase	28.12.19 – 06.01.20	Humidity range in %	41 – 91
R <sup>2</sup>	0,92	NO2 range in ppb	0,4 – 41
RMSE in µ/m <sup>3</sup> (excl. New Year's Eve)	6,16	validation phase	28.12.19 – 06.01.20
Maximum deviation in µ/m <sup>3</sup> (excl. New Year's Eve)	10	R <sup>2</sup>	0,82
Temperature range in °C	-0,5 – 11	RMSE in ppb	2,4
Humidity range in %	51 – 78	Maximum deviation in ppb	7,1
PM2.5 range in µg/m <sup>3</sup>	1,74 – 497	Temperature range in °C	-0,5 – 11
		Humidity range in %	51 – 78
		NO2 range in ppb	3 – 32

## **Advanced QSAR for use in biokinetic models with special focus on neurodevelopmental disorders**

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The purpose of the study is to develop quantitative structure-activity relationships (QSAR) using artificial intelligence techniques, such as neural networks (ANN) and multiple linear regression (MLR) in order to optimize the parameterization of the physiologically based-biokinetic models (PBBK) aiming to improve accuracy on exposure estimation for “data-poor” compound, mainly related to neurodevelopmental disorders. In this study, QSARs were developed using Abraham’s solvation equation combined with LFER and PaDEL molecular descriptors in order to model certain tissue:blood partition coefficients, elimination half-life and Michalis-Menten kinetic properties of environmental chemicals. The input data for the development of the models included the values of molecular descriptors for 199 environmental chemicals. Experimental values were collected from literature. The first set of descriptors, LFER, included molar refractivity (E), solubility (S), acidity (A), basicity (B) and McGowan volume (V), which describe the LFER equation. The second dataset, PaDEL, consisted of 1444 1D and 2D descriptors. These descriptors are related to the molecular structure of the chemicals and are characterized as constitutional, topological, geometrical or electronic.

For the statistical analysis of the modeling, genetic algorithm multiple linear regression and artificial neural networks were used and compared. The statistical coefficient of determination (R squared), the cross-validation coefficient of determination based on Leave-Many-Out and Leave-One-Out cross-validations (Q squared) and the mean squared error (MSE) were used as validation parameters in selecting the most proper statistical analysis technique. Those metrics indicated that the use of PaDEL descriptors and the ANN outperform the rest of the methods resulting in more accurate predictions. Specifically, PaDEL descriptors outweigh LFER descriptors in terms of goodness of fit, robustness and predictive ability of the models, while ANNs outweigh MLR in terms of performance. To conclude, QSAR models can be successfully used to fill the gaps of the “poor data” chemicals and therefore positively contribute in determining health and safety risks of known and newly designed compounds by minimizing time and uncertainties of the design process as well as testing, societal and industrial costs.

**Acknowledgements:** This work was supported by the Operation Programme (ESPA) in Human Resources Development, Education and Learning Co-funded by Greece and the European Union. Number of Scholarship: 99037

**Keywords:** QSARs, Multiple Linear Regression, Artificial Neural Networks, Linear Free Energy Relationship, PaDEL descriptors

## **Various environmental themes**

# **Photocatalytic TiO<sub>2</sub> coated Ahlat Stone for self-cleaning and de-polluting applications**

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Nanomaterials and nanotechnology find new applications in the construction industry, related to the photocatalytic of semiconductors such as TiO<sub>2</sub> and ZnO. Anatase form of nano TiO<sub>2</sub> is perhaps the most well-known photocatalytic semiconductor which possesses a strong oxidizing capability under the UV and partly in the VIS region of the sun spectrum. Ahlat stone is the natural stone, a volcanic ignimbrite, which can be found in Eastern Anatolia Region of Turkey around Ahlat and have been used in this region as a main construction material (Ertuğral, 2017). In addition, there are many cultural heritage monuments in this region that were constructed and built by using Ahlat stone such as Ahlat Tombstones and Cupolas that are settled as an open air museum thus they are open to environmental deterioration affects. Our previous study on Ahlat stones (Ertuğral & Günay, 2019) was on the conservation of Ahlat stones by coating a thin SiO<sub>2</sub> layer by using sol-gel nanotechnology. Antibacterial and self-cleaning TiO<sub>2</sub> sol-gel coatings on various materials have also been studied by our group in years. Ahlat stones were coated with TiO<sub>2</sub> suspensions by dip-coating and spray-coating techniques. TiO<sub>2</sub> suspensions were prepared by using nano Anatase powder which suspended in water medium around pH:2, then the coated Ahlat stone samples were dried at 100°C. To study the photocatalytic efficiency of TiO<sub>2</sub> coatings, Rhodamine B (RhB) solution was used. All samples coated with nano sized TiO<sub>2</sub> exhibited a significant photo degradation. Contact angle measurements and SEM (Scanning Electron Microscopy) studies were also carried out and the results of the studies will be given and discussed.

**Keywords:** Ahlat stone, Self-cleaning, De-polluting, Photocatalysis, TiO<sub>2</sub>, RhB

## **What can convection-permitting climate simulations (CPCSs) tell us differently about future climate change?**

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Using parameterization to represent certain special processes like convection bring about the majority of uncertainty in regional climate model (RCM) simulations. However, numerical modeling at a convective permitting scale offers the opportunity to solve the convection processes adequately and improve the representation of atmospheric conditions. The main objective of this study is to examine how CPCS affect future climate projections compared to  $0.11^\circ$  resolution. The COSMO-CLM (CCLM) simulations are performed by triple nesting setup with  $0.44^\circ$ ,  $0.11^\circ$  and  $0.0275^\circ$  horizontal resolutions. The information for lateral boundaries of coarsest nest is provided by a global model MPI-ESM-LR. İstanbul and its vicinity is selected as an investigation area because it has mixed topography that includes both mountains, lowlands and sea-land contrast. Present day conditions cover 1991-2005 period since the computational cost still remains as limiting factor to conduct CPCSs. The climate change is taken into account by employing the current extreme IPCC scenario, RCP8.5 (Representative Concentration Pathways 8.5) for the periods of 2041-2060 and 2071-2090. 20-year changes of 10 climate indices, which are TN10p, TX10p, TN90p, TX90p, R10mm, R20mm, CDD, CWD, Rx1day and Rx5day, throughout İstanbul are presented with their values in the reference period. When the improved simulations are compared with  $0.11^\circ$  resolution, the highest difference is found in cool days (TX10p) and warm days (TX90p). The fine projections predict not only higher cool days but also lower warm days for both future periods. The most prominent difference among the precipitation indices appears in the number of consecutive dry days (CDD) that is expected to be 10 days longer at the end of 21st century compared to coarser resolution.

**Keywords:** Convection-permitting, Climate simulations, Extremes, CCLM, RCP8.5

# **The Extraction of Vegetation from Aerial Point Clouds Using Object Based Image Analysis**

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Extraction meaningful information from three-dimensional (3D) data is the important study area in photogrammetry and computer vision. Different methods have been developed in the literature to classify the point cloud. Some methods use point cloud directly for classification but processing of point clouds has some disadvantages, such as the high computational cost and the required high memory usage. In order to overcome these constraints, methods have been developed to adapt 2D segmentation to 3D segmentation. In this study, point cloud classification was proposed with an Object Based Image Analysis (OBIA) based method. The potential of the OBIA method for point cloud classification will be examined. Object based classification of very high resolution satellite image will be projected to Airborne Laser Scanning (ALS) point cloud. Thus, it is aimed to benefit from different band characteristics of satellite image. Bergama in Izmir province of Turkey was selected as study area. Especially, vegetation classification will be studied. Height information of trees is important for designing structures such as power transmission lines. Point clouds have a great potential in determining the height of trees and the structure of the vegetation because they contain geometric information thanks to their three dimensional structure. In the conclusion part, overall accuracy and F1 score will be calculated and accuracy analysis will be performed.

**Keywords:** aerial point cloud, OBIA, vegetation, satellite image, segmentation

## **Analysing the impacts of land cover changes on land surface temperature in northern İstanbul between 2009 and 2017**

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Dense and unplanned growing of industrial areas, anthropogenic activities, settlements, artificial surfaces and decreasing of green areas have been negative impacts on Urban Heat Island (UHI) phenomena. UHI has important role on air quality, heat stress and it is directly related with human health and life quality. Land Surface Temperature (LST) calculated from remotely sensed data thermal bands, has very important role for UHI practice. The aim of the study is to use of remote sensing technique and geographical information system (GIS) to analyse the relationship between changing land cover and land surface temperature in İstanbul. 2009 and 2017 dated Landsat 8 OLI&TIRs images were used to determine the land cover and LST changes in northern İstanbul, Turkey. In order to determine the LST changes mono-window method were conducted for selected two years. Supervised classification method was applied to determine the land cover of the test region. The impact of land cover changes on LST were examined by using remote sensing data and GIS tools such as Hotspot analysis. The results showed that land cover categories were changed and statistical analysis were showed the relation between changes and LST values of the test region. A significant negative relationship exists between green areas and LST with a high correlation coefficient of  $r$ . The results of study shows the high potential of remote sensing and GIS to determine urban growth as well as relates growth impact on the climate of the city.

**Keywords:** land surface temperature, Supervised Classification, Hotspot Analysis, Remote Sensing, İstanbul

## **Effect of NAO on the evolution of zonal wind structure**

**Asli Ilhan, Deniz Demirhan, Yurdanur Ünal**

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NAO The North Atlantic Oscillation (NAO), fluctuation in the subpolar Icelandic low and the subtropical Azores high has feedbacks of zonal mean zonal wind. At the Northern Hemisphere NAO is powerful during winter. Hence wintertime regional and hemispheric weather systems is altered by such an impact. Negative and positive phases of NAO mainly modulate the local cyclonic and anticyclonic wave characteristics in the troposphere. Additionally it manipulates the zonal asymmetric characteristics of the middle atmosphere. On the other hand alterations due to NAO in the middle atmosphere need further investigations. In this study the impact of NAO on the zonally asymmetric zonal wind field is analyzed. Zonally asymmetric zonal winds up to 100km for winter and summer is examined between 2006-2100 using CMIP5 MPI-ESM-MR RCP4.5 scenario data for extratropical and polar latitudes. A relationship between the winter NAO and zonally asymmetric zonal wind of the subsequent winter is established in the troposphere and middle atmosphere separately.

**Keywords:** North Atlantic Oscillation, zonal wind, CMIP5, RCP4.5



## **Variation of polar stratospheric zonal wind during Quasibiennial Oscillation period**

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Quasibiennial Oscillation (QBO) is the deceleration and then changing direction of the stratospheric zonal winds at the equator in a period from 28 to 30 months. QBO is divided into two phases westerly (QBO-W) and easterly (QBO-E). QBO-W is 4 times more powerful than QBO-E phase. QBO at 30hPa and for the latitudes between 5°S ile 5°N is calculated by using zonal wind data from CMIP5 MPI-ESM-MR RCP4.5 scenario between 2006-2099. Zonal winds representing QBO-E and QBO-W phases are examined separately. It is found that zonally asymmetric zonal wind characteristics in both phases of QBO is different from each other. In the QBO-E phase, mainly showed a wave-1 structure, in QBO-W phase, it occurred to be in wave-2 structure.

**Keywords:** Quasibiennial Oscillation, CMIP5, RCP4.5, QBO

# **Short and Long-term Assessment Change of Lake Kuyucuk Ramsar Site with Satellite and Meteorological Data**

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The Ramsar Convention on Wetlands of International Importance especially on waterfowl habitat is an international agreement for the conservation and sustainable use of wetlands. It is also known as the Convention on Wetlands. Ramsar sites embody internationally important wetlands that contain the most productive ecosystems of the earth. As of February 2020, there are 171 contracting parties, 2386 designated sites covering over 253 million hectares. In the last half-century, nearly 1.3 million hectares of wetlands have lost their ecological and economic functions in Turkey. Wetlands have destroyed in an irreversible manner day by day. Turkey became a party of the International Ramsar Convention in 1994 and accepted the declaration that protects the wetlands as Ramsar Area with the management plans and ensuring its sustainable use. Under the Ramsar Convention, currently, Turkey has 14 wetland areas as Ramsar Sites that have been taken under protection in different years. Lake Kuyucuk is a small shallow lake located in the Arpacay district of Kars Province that is placed Eastern Anatolia Region of Turkey (40° 45'N 43° 27'E). It has an area of 245 hectares and a maximum depth of 13 m. The shallow lake supports a broad variety of bird species for being situated on the Asian-European bird migration routes and it was determined that 232 bird species used the area. In respect to these ecological specialties of the lake, Kuyucuk has been classified as an Important Bird Area and Key Biodiversity Area. Besides that, Lake Kuyucuk was declared as Wildlife Development Area in 2005 by the Ministry of Agriculture and Forestry. In 2009, Lake Kuyucuk was recognized as Turkey's thirteenth Ramsar site. Lake Kuyucuk has been designated as the 13th Ramsar region since it is the resting and breeding place of 10 endangered species and many bird species. In the study, long term temporal change of the Lake Kuyucuk was examined by using Landsat MSS, TM and OLI sensor images. Lake surface area change was examined from the satellite images for the years of 2009 and 2019. According to that, the surface area of the lake has decreased from 201.65 ha to 8.41 ha that means 99.95% area loss. It is observed that Lake Kuyucuk has been lost within a decade and almost disappeared in the year 2019. In this study, also the short-term temporal change in one year was examined by using the Sentinel 2 MSI images. Meteorological data including precipitation and evaporation values for a year were considered in the evaluation of the results obtained from the satellite images. It is seen that there is water in a small area in the lake with the effect of precipitation in spring, and the lake gets dry due to evaporation in summer. Besides that, the general assessment of climate change and the impacts on Lake Kuyucuk was examined with long term meteorological data.

**Keywords:** Ramsar, Kuyucuk, Landsat, Sentinel 2, Wetland

# Juxtaposing Environmental ethics and Bio-ethics: Issues and Trends

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Bioethics can be defined as the systematic study of the moral dimensions, including moral vision, decisions, conduct, and policies of the life sciences and health care and it employs several methodologies in an interdisciplinary setting. In brief, bioethics is about right-doing or doing what ought to be done. Bioethics can be conceptualized in philosophical terms and/or in theological terms. Sometimes, bioethics exclusively focuses on the applied ethics to medicine, or to the value-based medicine. The big questions that emerge in the foreground deal with the value of life and the resulting social arrangements that are necessary to sustain priorities. Allocating funds in healthcare is a typical example where bioethics thrives.

Nowadays, bioethics becomes more and more influential in scientific research areas but scientists and people familiarity with this term is trivial or even superficial. For example, it is not always understood the degree of association between consumption patterns and their wider environmental impacts on the quality of life.

On the contrary, Environmental ethics is concerned with the moral relations that hold between humans and the natural world. The ethical principles governing those relations determine people's duties, obligations, and responsibilities with regard to the Earth's natural ecosystems. On the basis, that environmental ethics define man's moral obligation to environment, there is an urgent need to explore the likely synergies and trade-offs between these duties and the consequent attitudes towards the environment.

This paper is concentrated on the determinants of how scientists' moral stance is affected, and affect at the same, environmental quality and future prosperity. Also it presents the relation of environmental ethics and bio-ethics behavior amongst scientists. For this purpose 200 questionnaires distributed to scientists and according to the results most of the respondents claimed: a) that there is no connection between environment and ethics and b) that there is no role of bioethics to environmental protection.

**Keywords:** bioethics, environmental sustainability, environmental protection, environmental education, environmental law

## **The application of technology of effective microorganisms (EM) in metal corrosion**

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Metals are extremely useful in our everyday lives and are used in a wide range of situations as they are the basic building materials in every artificial construction made by man. Corrosion is defined as ‘an irreversible interfacial reaction of a material (metal, ceramic, polymer etc) with its environment which results in consumption of the material or in dissolution into the material of a component of the environment. Corrosion in metals can lead to the structural fatigue or failure of bridges, pipelines, and plane fuselages. Removing corrosion or rust of metals is of technical, economic, environmental, and aesthetical importance. Nowadays, the use of environmental friendly products for removing corrosion or rust layer effectively is required. Natural Technology involves a combination of various occurring microorganisms mostly used or found in foods, known as effective microorganism (EM and it can be considered a natural technology and has no known diverse effects on plants, animals, human after over five decades of application. Also, EM consists of a wide variety of effective, beneficial and nonpathogenic microorganism of both aerobic and nonaerobic type coexisting and they are produced through a natural process and not chemically synthesized or genetically engineered. They consist of natural and non-genetically modified microorganisms. EM microorganisms are available in a liquid solution consisting mainly of lactic acid bacteria, photosynthetic bacteria, various types of yeast and yeasts. More than 80 different microorganisms co-exist in the original preparation of active microorganisms (EM). They consist of three basic groups: a) yeast, b) lactic acid bacteria and c) photosynthetic bacteria. Yeast causes fermentation and produces vitamins and amino acids. Lactic acid bacteria cause fermentation of organic matter and produce organic acids that inhibit the development of pathogenic viruses. Photosynthetic Bacteria are the key to EM and they help maintain balance with other beneficial microorganisms, allowing them to coexist and complement each other. The basic principles of action of active micro-organisms (EM) deal with the principle of dominance and the fermentation principle. The key actions of active microorganisms (EM) are purification, antioxidant capacity and fermentation. Purification deals with degradation of dead organic matter and the stopping of decay processes. Antioxidant capacity deals with the collection of free radicals of oxygen. Finally, fermentation deals with the conversion of organic residues into valuable raw materials. The implementation of EM creates an environment in which the beneficial - regenerative microorganisms are predominant and this results their alignment with the neutral ones, due to their tendency to follow those that prevail. The aim of this study is to record if EM microorganisms can remove metal corrosion - rust and if they contribute to the disappearance of oxidation. The experiment was carried out in a laboratory based on an agreed protocol. The protocol specified specific conditions, such as brightness and sampling time. A collection of screws with high and nearly the same degree of oxidation have been performed. These screws were placed in liquid EM microorganisms in experimental vessels with three different compositions/ratios and the rate of oxidation reduction recorded. The comparison was made with

photographic material at regular intervals, and under specific conditions that were required during the experimental stage. The experimental results of this study showed that EM microorganisms can remove metals' corrosion or rust. Also this study showed that after corrosion removal it is required to cover the screws with corrosion protection coatings.

**Keywords:** effective microorganisms, metal corrosion, healing metal corrosion, ecological healing of metal corrosion, environment

# **Spatiotemporal Variation of Quasi-Biennial Oscillation (QBO) in Stratospheric Winds by Wavelet Analysis**

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Tropical stratospheric zonal winds is alternated by an oscillation named quasi-biennial oscillation (QBO). The direction of the stratospheric easterly winds at the equator changes and becomes westerly every 28-30 months on average. QBO extends from 30km to the tropopause where finally it dissipates. QBO has almost a regular downward propagation but sometimes easterlies cease at around 30km level for several months. So downward movement of easterly phase of QBO is rather irregular. On the other hand, the amplitude of the easterly phase is twice the westerly phase. In this recent years temporal and spatial changes are detected in the each phases of QBO. The focus of this study is the variability in the duration and the location of the quasi-biennial oscillation from 2006 to 2100. In this study, zonal winds over 0-10°N and between 100-10hPa pressure levels are investigated by using CMIP5 MPI-ESM-MR RCP4.5 simulations. It is observed that the duration of the QBO period is shortened by 25% and there is a reduction in the amplitude of the tropospheric extent.

**Keywords:** cmip5, quasibiennial oscillation, periodicity, stratosphere

## **Inter-comparison of Quasi-Biennial Oscillation in RCP4.5 Scenario with Three Different Models**

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Quasibiennial Oscillation (QBO) defines a shift in the zonal winds from westerlies to easterlies. QBO is mainly located between 100-10hPa over the tropics. Such an alternation of the zonal winds takes place with a period of approx. 28 months. The future quasibiennial oscillation is characterized by decreases in amplitude by %20-%30. Variability in the amplitude is mainly dependent on the model estimations. It is well-known that CMIP5 models HaDGEM2-CC, and MPI-ESM-MR show a realistic results in examining the climate variable. Hence in this study RCP4.5 scenario CMIP5 models, including GFDL-ESM2G besides HaDGEM2-CC and MPI-ESM-MR is used to evaluate the future changes in the amplitude of QBO. The focus of the research mainly lies on the QBO in winter-spring seasons, between 2006-2100 for the reason that during these seasons QBO has a stronger signal in the mid-high latitudes. Slight changes are found between the models.

**Keywords:** GFDL-ESM2G, HaDGEM2-CC, MPI-ESM-MR, CMIP5, Quasi-Biennial Oscillation, Stratosphere

# **Evaluation of The Tourism Potential of Kars (Turkey) Province with Swot Analysis**

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The aim of this study is located in the east of Turkey, to determine the tourism potential of a famous name in Kars province in recent years. As a research method; Internal Analysis (Strengths and Weaknesses) and External Analysis (Opportunities and Threats) method, SWOT Analysis, were used in determining strategies for planning, implementing and managing tourism activities in Kars. In this content; Within the scope of SWOT analysis, a questionnaire prepared with 5-point Likert type questions was applied to 120 people who live in Kars and know the city, including the expert group. In the evaluation of the questionnaire conducted by interviewing the participants, the mean and standard deviations of the variables were determined by using the T test and the significance levels were examined with the ANOVA Test. As a result of the research; The tourism potential of Kars province was evaluated. As a result of the study, cultural accumulation as a heritage to the future with a historical and sustainable understanding with the development of activities such as mountain, plateau, agriculture, culture and ecotourism in rural settlements in the region, which has an important potential in terms of tourism.

**Keywords:** Tourism, Tourism Potential, SWOT Analysis, Kars, Turkey



## **Microplastics characterization and impact on small fish: The case study of Thermaic Gulf**

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Microplastics (MPs) are detected worldwide in the marine environment. Because of their small size, can be transferred from the marine environment to organisms, and subsequently pass through the trophic transfer. Ingestion of microplastics has been documented in many seafood species from various places around the world, including fish, bivalves, and mussels (Toussaint, Raffael et al. 2019). The aims of this study are (i) to quantify the number of microplastics with diameter range between 100  $\mu\text{m}$  to 5 cm in beach sediments and surface water of Thermaic Gulf, (ii) to identify their spatial distribution and polymeric characterization and (iii) to investigate the presence of MPs in marine organisms. A total of 25 water surface samples were collected at 500 m, 5 km and 10 km distance from the coast during the winter (February - March 2018). Surface samples were collected using neuston net with cod end (300  $\mu\text{m}$  mesh size). For beach sediment sampling, box corer grabs were used. In order to ensure representativeness of the samples, 126 samples were collected from five different collection points across the coastline of the Thermaic Gulf. Finally, a total of 75 fish were sampled from Thermaic Gulf. The examined fish species were, *S. colias*, *T. trachurus*, *C. linguatula*, *B. boops*, *S. pilchardus*, *E. encrasicolus*, *S. maena*. The total length and wet weight of fish was recorded. The gills and the gastrointestinal tract of each specimen were separated and weighted. For plastic particle analysis, samples were observed under a stereoscope with a LED light and measured with micrometer ocular lens. Plastic particles were characterized and classified by colour, size and shape. Additionally, the polymer fingerprint was detected using RAMAN spectroscopy.

A total of 20000 microplastics have been isolated from all 25 surface water samples, with a range of 190 to 6500 total particles per sample. The average concentration was 1.88 items/ $\text{m}^3$  or 750,846 items/ $\text{km}^2$ , and the highest concentrations are found within a distance of 10km from the shore and in the area of Epanomi. The most predominant color is white and the most frequently found shape is fragment. The majority of microplastics have size between 1.0 - 1.5 mm. Regarding the beach sediments the average concentration was 28.67 items/ $\text{m}^2$ . Plastic fragments were found to be primarily isolated plastic particles. Polyethylene (PE) and Polypropylene (PP) were the most abundant chemical species. The examination of seven different fish species showed the negative consequences of the microplastics presence in aquatic ecosystems. In all examined fish, microplastics were found in gills and the gastrointestinal tract. The highest concentration was found in the *C. linguatula* population,  $0.45 \pm 0.11$  items/g, while *Trachurus trachurus* had the lowest one  $0.74 \pm 0.5$  item/g. Therefore, this indicates that the bathypelagic fish are the most affected in comparison with the mesopelagic and the epipelagic fish. In this case, the most predominant color was white and the most predominant shape was fiber. The presence of larger microplastics in fish's organism could suggest their further fragmentation and presence in edible parts of fish.

This study reports the results of a monitoring campaign of microplastics in three different media. Given the significance of Thermaic Gulf's port and its morphological features that generate important quantities of waste originating from the South European countries the evaluation of plastics' presence in Thermaic Gulf is mandatory to apply strategies to reduce the quantity of microplastics in its waters.

#### **REFERENCES**

Toussaint, B., B. Raffael, A. Angers-Loustau, D. Gilliland, V. Kestens, M. Petrillo, I. M. Rio-Echevarria and G. Van den Eede (2019). "Review of micro- and nanoplastic contamination in the food chain." *Food Additives & Contaminants: Part A* 36(5): 639-673.

**Keywords:** microplastics, Thermaic Gulf, water, sediment, fish

## **First Report of *Clasterosporium pistaciae* in Turkey**

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*Clasterosporium pistaciae* M.B. Ellis is a dematiaceous anamorph fungus. *Clasterosporium pistaciae* causes serious damage to *Pistacia lentiscus* L. (Anacardiaceae) plant species in Southern Anatolia. During field studies, necessary morphological and ecological properties of the sample species were noted and they were photographed. Fungi specimens and host plants were collected in Manavgat (Antalya, Turkey) between the years of 2015–2017. The host specimens were prepared according to established herbarium techniques. Macro and microscopic features of this microfungi were given. In this study *Clasterosporium pistaciae* recorded for the first time on *Pistacia lentiscus* in Turkey.

**Keywords:** first report, *Clasterosporium pistaciae*, Turkey

## **Biological Degradation of Historical Buildings**

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Historical monuments are one of our important cultural values transferred from past to present. The ability of these monuments to preserve their existence in a healthy way is very valuable in sociological and cultural terms. However, over time, degradation and wear are observed due to various factors, which may be of physical, chemical or biological origin. In addition to the surface color changes, sediment formation, changes in chemical composition, mechanical effects and changes in environmental conditions, microorganisms living on these historical structures also have a large share in this degradation. In this study, previous studies on biological factors, which have a great importance in the degradation of historical artifacts, both in our country and in the scientific world, are presented.

**Keywords:** Biological Degradation, Corrosion, Monuments

## **Use And Effect of Essential Oils in the Maintenance and Preservation of Historical Monuments**

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Historical buildings are cultural assets that have been left until today as the legacy of civilizations. Since these structures cannot be maintained well, deterioration occurs in the form of surface color changes, oxidations, change of chemical composition in time due to environmental, climatic, mechanical and biological factors; they lose their architectural, historical and aesthetic features. Microorganisms living on historical buildings have a great share in these deteriorations. Historical buildings are exposed to both mechanical and physiological effects of microorganisms; The acids they secrete disrupt the structure of the stones by mechanical drilling or by multiplying in the stone, causing them to crumble by breaking. Thanks to its antimicrobial feature, it interacts with microorganisms and causes structure and function changes. It is not preferred because chemical components are applied to historical buildings, as they will cause structure and color changes and loss of appearance. For this reason, the effects of the antifungal properties of essential oils on the development of micro fungi that cause corrosion in historical artifacts, based on biological control methods, have been utilized. The antimicrobial properties of essential oils will also shed light on future biological control studies.

**Keywords:** Antimicrobial effect, Essential oils, Historical monuments

# **VIRTUAL POSTER PRESENTATIONS**

# Indoor climate assessment and energy analysis of a warehouse and sorting unit for agricultural products in Northern Greece

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One of the key challenges facing the agricultural sector nowadays is the economic and sustainable development of the sector, alongside respect for the environment and the rational use of all forms of energy. In agriculture, high energy demand is not the case during cultivation, rather throughout transport, processing, packaging and especially conservation. Warehouses are characterized by significant refrigeration loads, while thermal comfort issues are also of interest, given the low temperatures workers face. The proposed work deals with the analysis of the energy behavior of a rural cooperative, namely ASEPOP Velvento, in Northern Greece, as well as with the methods and practices that could contribute to the overall reduction of energy needs. A reliable energy model was formulated, consisting of the models of the various subsystems and processes; the determination of basic parameters involved in the model was made according to data obtained from the technical specifications of the equipment, observation of the processes and measurements. The model was validated on the basis of actual consumption, as derived from PPC's tariffs. The results demonstrate a reliable and detailed mapping of the different processes' energy consumption. Along with the energy analysis, the thermal comfort conditions and indoor air quality, regarding CO<sub>2</sub> concentration, were investigated, presenting the measurements of the basic parameters carried out in the facilities and the results of the questionnaires completed by the workforce. The energy model is exploited for the evaluation of specific interventions, towards the upgrade of indoor climate and reduction of conventional energy consumption; interventions include the installation of PV panels.

**Keywords:** warehouse, refrigeration, energy analysis, indoor thermal climate, IAQ, PV

# Indoor environment and energy performance analysis of an office building in Northern Greece

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The building sector represents a significant portion of total energy consumption globally, noting that this share for the EU is around 40%. Nevertheless, energy saving potential in buildings is high, indicating that for building offices, which is the case of this work, the largest amount of energy is spent on heating and cooling spaces, as well as for lighting uses. In the proposed work, the analysis of the energy performance of an office building is presented; the selected building is the Commercial and Industrial Chamber of Kozani, in Northern Greece. The investigation aims to improve indoor environmental conditions, and reduce energy loss through the building envelope, as well as conventional energy consumption, while also generating energy from renewable energy systems, thus achieving an overall reduction of the corresponding CO<sub>2</sub> emissions.

Dynamic simulation is implemented for the analysis; more specifically, the building of the study is represented in Revit Autodesk, while the building performance simulation is run in the Green Building Studio (GBS). Firstly, the building envelope is examined with regard to the restrictions of KENAK, that is the responsible regulation for the adoption and implementation of the European Performance Building Directive in Greece, regarding thermal insulation. Moreover, experimental equipment was placed in the building, to evaluate the actual thermal comfort conditions, indoor air quality, namely CO<sub>2</sub> concentration, and lighting performance. The required, for the analysis, technical characteristics of installed HVAC systems were determined through inspection. The results of the developed model were validated with regard to actual energy consumption data.

The investigation concludes on energy interventions that improve thermal insulation, HVAC systems performance and after all the energy efficiency of the building. The renovated building will save considerable amounts of energy, on reduced operating cost, will offer improved indoor environmental conditions, while contributing to environmental protection, as verified by the estimated reduction of CO<sub>2</sub> emissions on a level of 45%.

**Keywords:** Energy analysis, Indoor environmental conditions, Office building, Dynamic simulation



# Phthalates concentration in house dust of Kozani city (Greece): Exposure estimation and their association with building characteristics

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Dust is present in every single house or generally in indoor places and potential can act as a reservoir for many kinds of pollutants such as phthalates. Phthalates or phthalic acid esters are ubiquitous indoor pollutants distributed among gas phase, airborne particles and settled dust. Phthalates are introduced into the environment only by anthropogenic sources (Orrechio et al 2013). Phthalates can be found in personal care products as solvents, plasticizers in various polymers especially PVC, wall coverings, certain paints, vinyl floor coverings, electronic devices, medical devices, food packages, toys, cable and other products. Humans can be exposed to phthalates through various ways: inhalation of gaseous or particle bound phthalates, ingestion products-containing food phthalates, or dermal contact with phthalate-containing material such as clothes, PVC gloves or house dust. The contribution of house dust to exposure, especially in young children, also needs attention because of the high concentrations that were found house dust samples (Wensing et al., 2005).

In this study, samples of dust from several houses of Kozani city, were analyzed for phthalate concentration in association with buildings characteristics through detailed questionnaires. Sample were taken from the vacuum cleaner of the houses and extracted with ethyl acetate and analyzed with GC-MS in SIM mode. Phthalate levels range from 10.57-221.19  $\mu\text{g/g}$  for Di-iso-butyl phthalate (DiBP), from 4.03-264.91  $\mu\text{g/g}$  for Di-n-butyl phthalate (DBP), from 0.72-20.22  $\mu\text{g/g}$  for benzyl-butyl phthalate (BBP) and from 62.73-1233.54 for Di- (2-ethylhexyl) phthalate (DEHP). Associations have been examined using parametric and nonparametric tests using SPSS statistical tool.

## References

Orecchio S., Indelicato R., Barreca, S., 2013. The distribution of phthalate esters in indoor dust of Palermo (Italy). *Environ Geochem Health* 35:613–624.

Wensing, M., Uhde, E., Salthammer, T., 2005. Plastics additives in the indoor environment—flame retardants and plasticizers. *Science of the Total Environment* 339, 19–40.

**Keywords:** Phthalates, indoor air, exposure, building characteristics

# Air quality into cabin environment of different passenger cars: effects of car usage, fuel type and ventilation/infiltration conditions

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Indoor air, undoubtedly influenced by ambient air, gain interest the last decades due to the fact that people generally spend more than 80% of their time indoors (Wang et al., 2007). A considerably amount of this time is spend inside vehicles cabins (~ 8% of the daily time) making this particular environment of special interest because of passengers exposure to hazardous pollutants. As an example, Volatile Organic Compounds (VOCs) concentrations have been found in higher levels inside vehicle cabins than in outside cabin ambient air. In addition to IAQ, the relevant literature has also been very detailed regarding thermal comfort investigation in vehicle cabins. Thermal comfort in cars presents specific complexities if compared to the case of buildings.

In this study two used passengers (car A and B) cars with different type of fuels (diesel and Liquefied Petroleum Gas), were investigated for the air quality and thermal comfort of their cabin. In addition air samples near their exhaust were taken in order to compare compounds found indoor. More specifically 12 VOC, and CO<sub>2</sub> were measured inside the cabin when the cars were stopped, when idle, and when they are driving in medium and heavy traffic with various ventilated conditions. Thermal comfort also was investigated while driving the cars in the city of Kozani. The factors that affecting in cabin pollution was investigated including among others type of fuel, ventilation conditions and driving conditions. As it is showed, the air around the diesel exhaust is less influenced by the emission of the engine exhaust compared to LPG fuel. The most abundant compound near diesel exhaust was benzene while for the LPG and ULP was toluene. Concerning the interior trims of the two cars, car A with most of fabric surface showed less VOC concentration for all the measured compounds, than car B with most leather interior surface ( $\Sigma\text{VOC}_{\text{meas}}$  of 15.69 and 154.17  $\mu\text{g}/\text{m}^3$  respectively). The ventilation mode appear to be an important issue for in cabin VOC concentration when the car is stopped and the engine is on, where opened windows reduce the in cabin VOC level compared to open one.

## References

Wang, S., Ang, H.M., Tade, M.O., 2007. Volatile organic compounds in indoor environment and photocatalytic oxidation: state of the art. *Environ. Int.* 33 (5), 694–705.

**Keywords:** VOCs, vehicle cabin, ventilation mode, driving conditions, fuel type

# Assessment of High Nature Value farmlands with ground thermal imaging techniques: the case of Mediterranean olive groves in Naxos Island, Greece

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In the Mediterranean region, a variety of traditional agroecosystems can be found as a result of the continuous interaction between human activities and the natural environment. One of the most significant agroecosystems in this area is the traditional olive grove, which is considered a part of the High Nature Value farmlands (HNVf) in Europe, as it contains the key elements associated with the concept's definition; a combination of low-intensity land use, presence of semi-natural vegetation, and land cover diversity. However, traditional olive groves and their ecosystem services are constantly declining, mainly due to the impact of intensification of agriculture (olive monocultures have replaced the traditional olive orchards) and land abandonment. A lot of effort has been made both through legal instruments of the olive producing countries as well as targeted research on traditional olive groves, to monitor the state and pressures exerted on them, but up till now it is still a challenge. In this research, in order to assess traditional olive groves' state, in a typical Mediterranean environment, a combination of field measurements and ground thermal imaging techniques were used. Specifically, a set of olive trees from a HNV olive grove in Naxos Island, Greece, was selected and specific morphometric traits, related to their architecture and vigor along with meteorological and topographical parameters of the study area, were measured. Additionally, for each olive tree, a set of thermal variables was extracted and analyzed using general linear models. To identify homogenous tree groups, hierarchical clustering was performed. Results revealed significant associations between thermal variables and trees' morphometric traits. The olive trees' classification showed that three general groups with similar characteristics existed, and statistically significant differences between the cluster groups, were observed. The introduction of thermal image analysis on olive tree's surface, combined with a set of morphological, environmental and topographical parameters, provided a methodological framework in studying the state of traditional olive groves. In parallel, the classification findings can make a significant contribution towards identifying of olive trees' health state. Finally, the trees' classification based on their morphological characteristics, can make their comparison possible and enables the categorization of their health state at a population level.

**Keywords:** Infrared thermography, traditional agroecosystems, olive trees

# Trace element concentrations in sediments and their impact on trace element contents in mussels from Boka Kotorska Bay, Montenegro

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Due to the high tendency of trace element accumulation, sediment contents of these contaminants are much higher than those found in seawater. Thus, sediments represent a possible secondary source of toxic metals to the water column and to living organisms. Because of that, trace element analysis in sediments are of a crucial importance for marine environment quality assessment. However, the concentrations of trace elements in sediments don't provide the information about their bioavailable fraction. Living organisms, especially mussels, are therefore widely used as bioindicators of marine trace element pollution, or seawater pollution. Mussels accumulate a wide range of trace elements from the environment, so their contents can be impacted by trace element contents from sediments.

The concentrations of fourteen elements (Al, Ba, Cd, Co, Cr, Cu, Fe, Li, Mn, Ni, Pb, Sr, Zn, and Hg) were determined in sediment and mussel samples from Boka Kotorska Bay, in order to discuss about sediment quality of this area and to evaluate the impact of the sediment presence and its trace element contents on their concentrations in mussels. Samples were taken from three locations in the autumn season of three years (2014, 2015 and 2016). Trace element concentrations were determined by an inductively coupled plasma – optical emission spectrometer, a direct mercury analyzer, and by a graphite-furnace atomic absorption spectrometer (Cd in sediments). A Pearson correlation coefficient, PCA, and CA were applied on the obtained data to characterize and differentiate among the observed sediment samples. The correlation analysis was also used to identify possible impacts on the mussels' trace metal concentrations.

The results showed that sediments from inner bay locations (smaller grain size) had higher concentrations of almost all trace elements. However, very high concentrations of Sr were found in sandy sediments from the location near the open sea. Thus, the negative correlations between Sr and all other elements were observed for sediment samples. Also, high Sr contents were found in mussels from the same location near the open sea, indicating its natural origin at this location. While the rest of the elements in sediments from this location were found in much lower concentrations than in sediments from other two locations, trace element contents in mussels from the location near the open sea were the lowest. Therefore, the correlation analysis showed negative relationship between trace element contents in sediments and mussels, with the exception of Cd, Cu, Pb and Sr. The most significant positive correlation was found between Pb contents in sediments and mussels, indicating an anthropogenic influence on Pb concentration in the marine environment.

**Keywords:** trace elements, sediments, mussels, Montenegrin coast

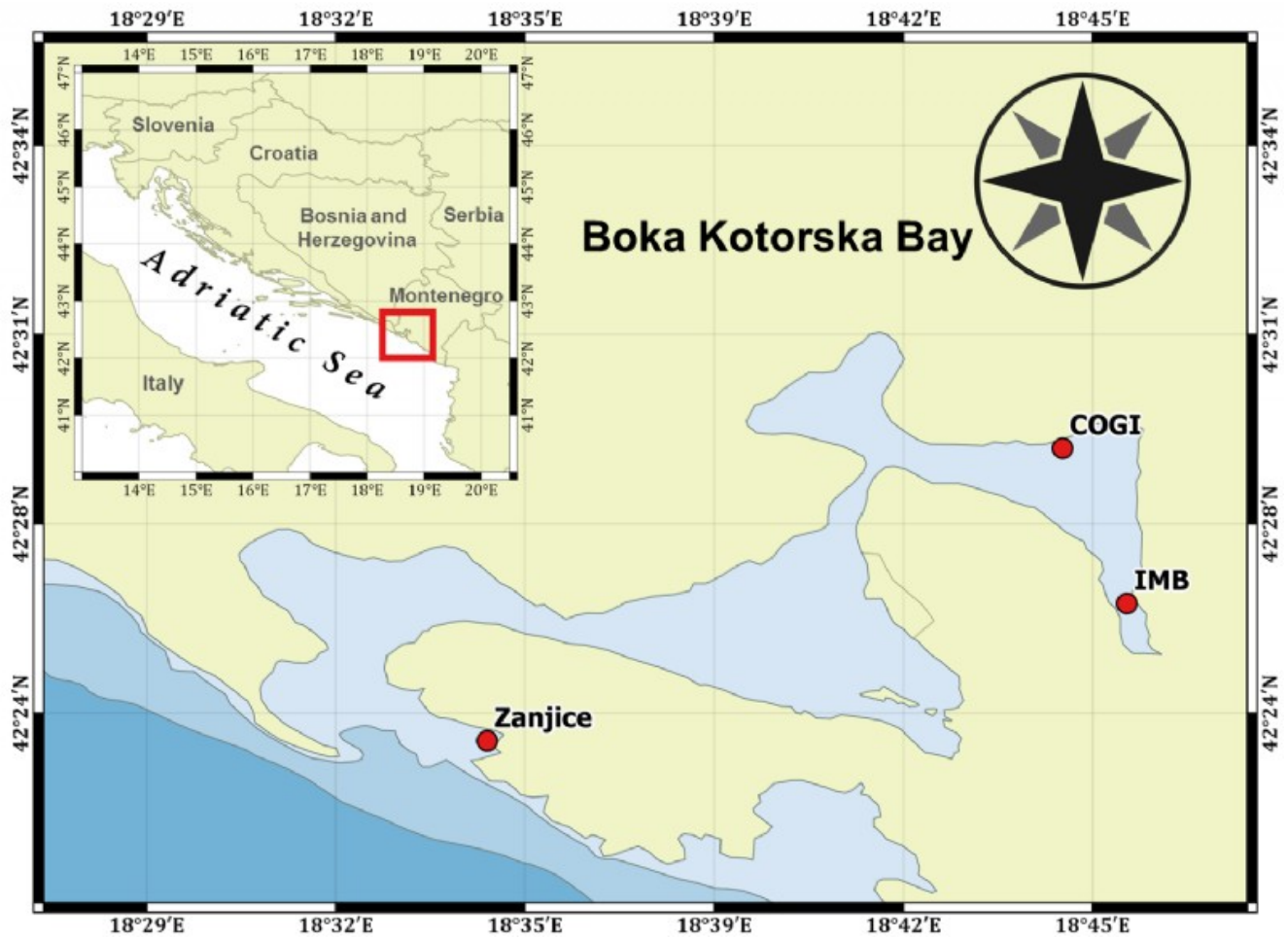


Figure 1. Map of studied area

## Sampling strategy and data analysis for long-term monitoring of formaldehyde and other aldehydes in an urban area

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Seasonal variations of carbonyl compounds were investigated at two sampling sites (Institute for Combustion and Atmospheric Pollution, ICCA and Rectorado) in the atmosphere of Ciudad Real, a small city in central southern Spain. Air samples were collected for one year from February 2015 to February 2016 using passive samplers. Between the eleven carbonyls identified formaldehyde, acetone and acetaldehyde were the most abundant carbonyls accounting for 34%, 20% and 14 %, respectively of the total concentration of carbonyls. The total concentration of carbonyls detected ranged from 2.35 to 22.46  $\mu\text{g m}^{-3}$  with an average of  $6.89 \pm 4.7 \mu\text{g m}^{-3}$ . For the main carbonyl compounds, statistical differences were found between ICCA and Rectorado sampling points in autumn and winter. Diurnal variation has also been investigated in summer and winter at ICCA. Formaldehyde, acetaldehyde and acetone showed a clear seasonal pattern with significant higher levels in summer. These values imply the presence of significant photochemical reactions in summer to produce carbonyls. The average ratio of formaldehyde to acetaldehyde (C1/C2) was found to be  $2.3 \pm 1.0$  at ICCA and  $2.1 \pm 0.6$  at Rectorado representing typical values for urban areas. However, in our study the C1/C2 ratio is lower in summer than in winter due probably to the intense photochemical conditions that destroy formaldehyde faster than acetaldehyde. Meteorological parameters, criteria pollutants and carbonyls were correlated using Spearman's correlation coefficients in each season. Results showed that secondary formation of carbonyls from photochemical processes and vehicle emissions were important sources of carbonyls in spring while direct emissions (vehicles and heating systems) were the major source of carbonyls in winter. The total propene-equivalent and the total ozone formation potentials were also calculated.

**Keywords:** carbonyl compounds, formaldehyde, seasonal variation, urban area, statistical analysis

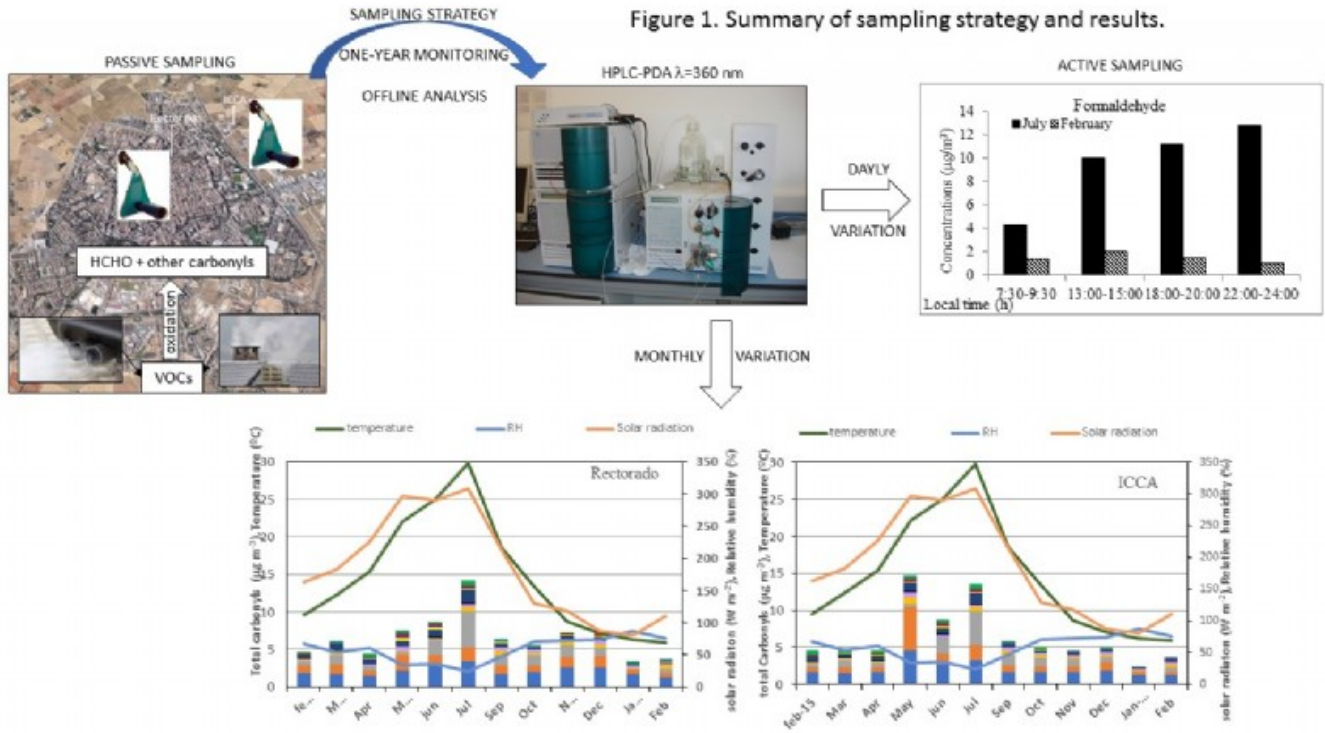


Figure 1. Summary of sampling strategy and results

# Effects of Biofuels and Renewable Resources on Environmental Protection and Its Relationship with Agriculture

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Energy, as well as being one of the important factors affecting the environment, contributes greatly to the economic and social development and industrialization of countries. Global warming, resulting from the intensive consumption of non-renewable energy sources, is a global threat that affects the world in a negative way. This threat also brings with it global climate change, which raises concerns about agricultural areas moving to unproductive latitudes, melting glaciers, increasing disasters such as floods and droughts. Therefore, in order to minimize the effects of global warming, countries started to benefit from renewable energy sources such as wind, solar, water, biomass, biogas, hydroenergy, marine currents and geothermal, which can be recreated in the balance of nature. These resources, which are also subject to the Kyoto Protocol, are important because they are domestic resources in countries' energy policies, they reduce emissions in the fight against global warming, they are environmentally friendly and contribute to the elimination of environmental concerns and be more economical in terms of costs. Moreover, the ability of wind and sun to produce cost-free and continuous electrical energy; biomass can recycle organic matter much more quickly; use of biofuels in the transportation sector; use of geothermal in electrical energy, chemical production and industrial heating; and hydroelectric energy provides low-cost electricity generation that does not create air pollution, enabling incentives for renewable energy investments around the world. Turkey is very rich in wind, solar and biomass potential thanks to its coastal areas, open lands and mountainous areas, and is which ranks first in the field of geothermal energy and has a high hydroelectric power potential. In this context, the study explores the necessity of careful use of energy sources and how this situation can be achieved and shows that renewable energy sources are sustainable and eco-friendly. Efforts to reduce the impact of energy consumption on climate change and renewable energy investments that increase energy productivity are an indication of increasing environmental awareness.

**Keywords:** Renewable Resources, Environment, Agriculture, Energy Consumption



# Heavy metal pollution in bottom sediments in coastal area of Montenegro

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Heavy metals in marine sediments have natural and anthropogenic origin. Their distribution and accumulation are influenced by sediment texture, mineralogical composition and desorption processes, as well as by physical transport. Marine sediments are very important accumulation site of metals in the coastal areas. Therefore, in order to assess a degree of pollution in the marine environment, the analyses of these metals are very important. Metals like arsenic, cadmium, chromium, mercury, nickel, and lead are often considered indicators of anthropogenic influence and may pose a potential risk to the marine environment. Also, many authors have demonstrated that the evaluation of metal distribution in marine surface sediment is important due to high pollution with heavy metals. Montenegrin coast (Southern Adriatic Sea) is also under a great impact of anthropogenic factors and the activities on the shore. Because of that, the aim of this study was to determine the concentrations of iron (Fe), manganese (Mn), zinc (Zn), copper (Cu), nickel (Ni), lead (Pb), chromium (Cr) and mercury (Hg) from the coast of Montenegro in order to increase the knowledge on metal levels in this area, which has not been studied very much. The sediment samples were collected at three locations from the Montenegrin coastline during 2019 in four seasons, Fig 1. The elements determinations were performed by means of an atomic absorption spectrometer - SHIMADZU 7000 (F-AAS and HG-AAS). The main objectives of this work were to determine spatial distribution of major and minor elements and to estimate the pollution level using the geo-accumulation index (Igeo), contamination factor (CF) and pollution load index (PLI).

The concentration range obtained in mg/kg was 6347-12586 for Fe, 307-410 for Mn, 9.2-42 for Zn, 7.2-15.2 for Cu, 42.5-79.8 for Ni, 9.2-26.7 for Pb, 34.6-89.2 for Cr, and 0.015-0.081 for Hg. Considering all the investigated metals and sampling sites of this study, the obtained mean values decreased in the following order: Fe>Mn>Ni>Cr>Zn>Pb>Cu>Hg. The calculated CF values for surface sediments of the Montenegrin coast were found to be low for all elements and investigated locations. Moderate CF values of Pb were recorded for all investigated samples. The geo-accumulation index values of Ni calculated for all seasons showed that all locations were considered uncontaminated to moderately contaminated. Regarding other elements, all locations were considered uncontaminated, according to Igeo values. The PLI values, which in this study ranged from 0.27 to 0.74, confirmed that bottom sediments were generally unpolluted with metals. Low PLI values at these locations implied no appreciable input from anthropogenic sources.

**Keywords:** Metal Pollution, Sediment, Assessment, Montenegrin coast

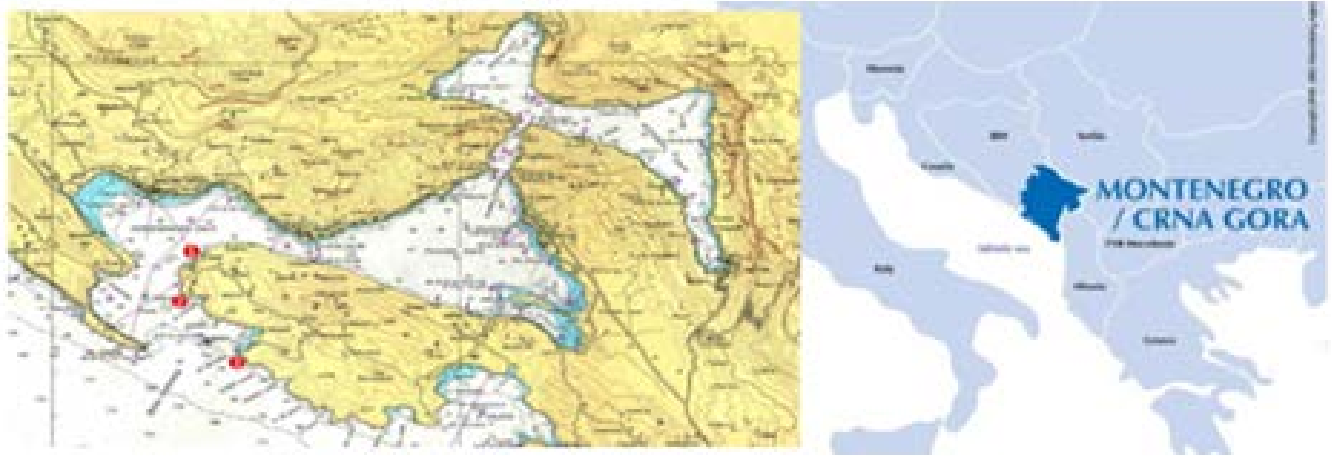


Figure 1. The map of investigation

## **The effect of political and economical instability on environmental policy of Turkey**

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Political instability and economic development are highly interconnected concepts with each other. On one hand, increasing political uncertainty leads to diminishing amount of investment and thus deceleration of the economic growth. On the other hand, the worse the economic conditions in the country, the easier government collapse and encountering with the instable conditions would be inevitable. This situation directly affects the governments' effort to deal with the climate-induced problems. Therefore, environmental protection and its sustainability generally stay in the background in the agenda. In this study, we investigate the relationship between political and economical instability and implementation of environmental policies in Turkey. Main aim is to investigate whether there exists a negative relationship between instability in a country and determination of the government in the implementation of environmental policy. Empirical analysis has been conducted by using Turkish data from 1990 to the current year. Unlike other studies, we have created a model that includes indicators for political and economic instability by combining different metrics and macroeconomic factors. Finally, in the result section, government policies to provide sustainable environment have been discussed.

**Keywords:** Political instability, environmental policy, economical instability, climate governance

# Winter Sports Tourism and Climate Change in Mediterranean Region

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In the World, annually, estimated 300-350 million (another report 400 million) people participate skiing, while 67 countries offer equipped and snow covered outdoor ski areas, in 20 countries there are 90 indoor snow centers. However, due to the anthropogenic warming, the impact of global warming and the decrease in snow reliability in terms of ski tourism supply and impact assessment studies to understand the vulnerability of winter sport tourism have gained importance. The reliability of natural and artificial snow is among the subjects examined within this context. Winter sports tourism, which is claimed to be affected by global warming, is predicted to be shorter winter season, which runs from November to following year's April, according to the 30cm 100days rule in different countries. In relevant literature, to determine the issue, to take measures and to produce long term projections on the basis of supply and demand side, models such as Tourism Climate Index, Holiday Climate Index and Mountain Tourism Meteorological and Snow Indicators are used. In a research, it is predicted that snow conditions for 2021-2050 will be sufficient in the higher regions of the mountain (2350- 2950m) and not sufficient in the lower regions. Similarly, it could be said that ski resorts in the higher parts will gain importance with the increase of the snow line. Also, in order to summarize general economic contribution of winter sports tourism, multiplier impacts of winter sports activities, report prepared for the U.S., direct, indirect and induced impacts is adopted to this study. Despite limited data for the countries in the Mediterranean region, winter sports equipment revenue was found throughout the region. Although there are studies in the literature on the impact of climate change on winter sports tourism and short-medium-long term projections, studies focusing on Mediterranean countries are limited. In general, information on European Mediterranean countries such as snow conditions, tourism supply and demand, may be obtained in part and from some reports and European Commission's sources, but information on many Middle Eastern and North African countries, that have Mediterranean coasts, is not available. The aim of this study within this context is to determine the situation of winter sports tourism in the Mediterranean. The study adopted the qualitative research method and secondary sources were used in the compilation study. Document analysis was conducted to evaluate general situation of winter sports tourism type and demand-supply side of climate change. Issues, which to determine the potential of winter tourism for Mediterranean countries such as overcoming the seasonality of tourism and to benefit from the mountains in sustainable tourism, and also to assess impact of climate change on winter tourism is recommended for conducting future studies.

**Keywords:** Winter Sport Tourism, Winter Tourism, Winter Tourism in Mediterranean Region

# Sound Agricultural Practices in Turkey. Environmental Impact on the Enhancement of Soil Fertility

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Since the Neolithic period, agriculture has been the primary economic activity for humanity. The rapid increase in the world population led to an increase in the demand for food where agriculture and agricultural production became of prime importance. As urbanization and industrialization in Turkey and worldwide gained momentum from the 1950s, agricultural land has become compromised with a significant portion of agricultural land losing its primary function. Today, demographic pressures and demands by the tourism industry continue to increase. In this case, the future of agriculture land and its economic value, in Turkey, threatens prospects for higher agricultural production. To maintain the viability of agricultural activities to meet growing population demands, an increase in the available agricultural land and the conservation of soil fertility are a prerequisite.

There must be good agricultural practices and an increase in organic farming in Turkey. Even though there had been relevant improvements, it is not sufficient. In addition to these practices, the use of chemicals that are not harmful to human health in the IV and higher-class soils, which have agricultural limitations due to various physical conditions, will have positive effects on the product quality, as well. In this study, we examined developments showing good agricultural practices in terms of human geography, in recent years. In addition, we will survey which types of polymers can be used to increase soil fertility and what are the possibilities to obtain them naturally from renewable resources that are environmentally compatible.

**Keywords:** Turkey, Geography, Population Growth, Urbanization, Good Farming, Soil Yield of Polymer.

# Improvement of permeability by using nano materials in landfill sites

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Natural and compacted clays used in landfills are generally used as ground and top coverings and in the formation of side berms. Clay soil layers are effectively used to adsorb contaminants such as leachate and organic liquids. In the previous researches; it is stated that as a result of leachate passing through the clay soil, the structure of the clay soil deteriorates and the changes occur in the permeability of the ground over time. Therefore, it was found that the clay soil alone was not sufficient to provide impermeability. In this study, it was aimed to improve the clay soil properties with a nanomaterial in order to prevent the permeability of the ground subjected to the leachate.

For this purpose, kaolin and nano material were used as clay and leachate samples obtained from Kemberburgaz - Odayeri Landfill on the European side of Istanbul were used. Different and varying amounts of nanomaterials were added to the clay sample. The obtained samples were subjected to compaction by standard methods and placed in the reactors. The permeability of the soil sample was investigated experimentally by passing leachate through the reactors. At the end of the study, the addition of nanomaterials to the clay soil decreased the permeability of the clay soil.

**Keywords:** leachate, compacted clay, permeability

# Environmental Conditions and Geographical Indication Products Marketing in Agriculture in Turkey

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Recently geographical indications have started to become a very important concept in commercial life and consumer market. In other words, a 'geographical sign' means a high-quality symbolic product according to similarities, shaped by natural conditions or human and economic conditions of a particular geographical location. In order to protect the natural environment and human health, fertilizers and intensive agricultural techniques are the least used. The effect of natural conditions on agricultural production is dominated by a certified form of agriculture. The potential of organic agricultural products to be a geographic brand name becomes quite high and is of great importance. In this study, the economic value of agricultural land in Turkey, an important feature of the climate for cultivating and nurturing high agricultural products, such as topography and soil conditions were investigated existing environmental and natural conditions. Marketing and promotion of these products to both EU member countries and other peripheral countries. At the same time this work has brought a new perspective by considering the geographical location and conditions of the concept of geographical indications, the overall evaluation made by marketing activities and contribute to the economy of the country of origin of these products were examined products in Turkey.

**Keywords:** Turkey, Geographical Indication, Marketing, Environmental, Condition, Agriculture.

## **Evaluation of the ecological balance water flowrate effects on fish passages: examination in Rize – Turkey**

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Hydroelectric power plants built on rivers in order to supply the energy demand due to the needs of industrialization have started to create irreversible damages on migrating fish. Therefore, the reproduction and development of fish species have been suppressed, and even some species have completely disappeared. The linear and horizontal continuity of a river system is ecologically important. Fish passages help water creatures to pass over interferences like dams and embankments and they are the structures that facilitate the migration on water sources. Fish passages are important but not sufficient in terms of river continuity. Another important factor affecting the ecological life during the operation of hydroelectric power plants is Ecological Balance Water Flow. Ecological Balance Water Flow is known as the rate of the flow in rivers that necessary for the sustainability of its habitat. Many HEPs has been begun to be established in the Eastern Black Sea Region because of its renewability, low maintaining and operating costs and long physical life. Ecological Balance Water Flow and fish passages in the HEPs of Rize have been examined by the help of the environmental reports and on-site inspections. In this study, it was determined that, in order to protect ecosystems from HEP's adverse effects, fish passages should be fully functional; ecological balance water flow should be arranged to authentic conditions of drainage basin, and drainage basin planning should be completely prepared.

**Keywords:** Hydroelectric Power Plants, Ecological Balance Water Flow, Fish Passage.



# Tourism Oriented Urban Transformation and Environmental Effects on the Mediterranean Coast: The Case of Turkey

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The intensive use of coastal areas extends to the first civilizations. The use and value of the coasts has increased continuously due to the fact that the coasts are suitable for industrial activities, being close to some raw material resources and having suitable facilities for transportation and transportation. In addition, the establishment of cities close to the coast, coastal resources and natural beauty has been discovered. Thus, the coasts became one of the first natural areas with recreational and tourist attraction. Especially in the 1980s, a rapid development process has started in the coastal areas with sea-sand-sun tourism, which has been increasingly effective. Although changes in tourist expectations and needs have led to the development of alternative types of tourism, the most intense interest is still seen as coastal tourism, which is also the source of mass tourism. In addition, increasing demand for tourism types such as marina and yacht tourism, cruise tourism, marine tourism and coastal tourism increases the coastal density.

Uncontrolled development of urbanization and tourism activities brings along problems such as concentration of the population on the coastline, environmental pollution, concretization and deterioration of natural life. In order to eliminate or minimize these problems, new urban transformation studies have started. In this study, realized and planned urban renewal work on the Mediterranean coast, were examined by tourism and environmental dimension, then it focused on the transformation samples coast of Turkey. In the study findings, it is concluded that urban transformation is necessary for the efficient, environment-oriented, sustainable use of the coasts and the requirements required for the transformation studies not to cause greater environmental problems are presented within the scope of the recommendations.

**Keywords:** Urban Transformation, Tourism, Environment, Coastal Tourism

# Effects of Pesticides and Chemicals on Environmental Pollution, Agriculture and Health

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Different methods such as cultural fight, biotechnical fight, physical fight, biological fight, chemical fight are applied in the method of fighting diseases and pests. Chemical fight should be last in the rankings of the application of these methods. Pesticides are mixtures of substances used to prevent, control or reduce harmful organisms. The fact that pesticides are a quick and effective solution against diseases and pests causes this method to be used in the first place, but this malpractice threatens living health and does not have a solution. When the disadvantages of pesticides are examined, it is seen that they not only harm the soil and the environment, but also harm earthworms, natural enemies, birds, bees and marine creatures. The damage to humans can be much more serious in the form of kidney, liver diseases, nervous system damage, chromosomal abnormalities, fetal deaths and even cancer. Since pesticides are overused, resistance development is in question and doses increase every time. In order to prevent this situation, a different drug should be used every year, fewer doses should be used, the time required for harvesting should be observed to and the use of non-chemical applications should be used. Traceability of chemicals used by farmers should be ensured and quality control units of food companies working with these farmers should be established. At the certain time intervals should be inspected by the companies, especially after using systemic effective drugs, products should not be harvested until a certain day. Harvesting of crops before that date leads to chemical residue and is damaging to human health. This research focused on the damages caused by the use of pesticides and advised on measures to be taken against them.

**Keywords:** Agriculture, Environment, Pesticides, Health, Production

# Treatment of Confectionery Industry Wastewater: A Case Study

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Confectionery industry is an important branch of food industry and has a high potential of organic pollution. The industry produces a variety of products such as candies, bars etc. however, the raw materials that are used for all products are the same and limited in number. The main polluting parameters of wastewaters are BOD<sub>5</sub>, COD, TSS, and oil and grease. Though, the organic content is relatively readily biodegradable, its concentration is high being around 10000 mg/L as an average value. Since this level of concentration is too high for a single stage treatment, generally two-stage treatment is considered for the treatment of wastewaters originating from confectionery industries. Anaerobic treatment as the first step proved to be successful and efficient. Anaerobic second stage biological treatment generally follows to comply with discharge standards. However, amount of the wastewaters is quite low (generally lower than 10 m<sup>3</sup>/day) and variable in both character and daily amount.

This study attempts to find a more flexible and easy to operate treatment alternatives by employing coagulation-flocculation as a roughing and balancing treatment system. An aerobic biological treatment which was selected to be also a flexible system, a sequencing batch activated sludge was used as a complementary process. In this context, a typical confectionery plant was selected on which wastewater sources, process and pollution profile were determined. The use of combination of coagulation-flocculation and sequencing batch activated sludge (SBR) for treatment of the high strength wastewater originating from the selected plant was investigated. This combination proved to be quite efficient and reliable. Total COD of around 10000 mg/L influent COD was reduced 100 mg/L. Coagulation-flocculation provided 30-35% COD removal with a reasonable dosage of 250 – 300 mg/L alum, ferric chloride or ferrous sulfate with lime. This application resulted in an effluent almost free from suspended solids. SBR worked with a high performance and flexibility even at high organic loading of 1.69 g COD/gMLSS.day. In addition to the aforementioned flexibility of the system, batch-wise operation also made it possible to apply chemical treatment to SBR effluents for the extreme organic loadings ensuring to comply with discharge standards.

**Keywords:** confectionery industry wastewater, chemical treatment, sequencing batch activated sludge, pollution and process profile

## **Fouling composition from the ports (south-eastern Adriatic Sea-Montenegro)**

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Monitoring of fouling communities from ports in the south-eastern Adriatic Sea (Montenegro) shows the presence of high flora and fauna species. Research was performed at two yahts marinas. One is characterized by high traffic and long-term use while the other has been operational for one year. Among the species identified as very abundant was the alien species. During this study species *Paraleucilla magna*, *Styela plicata*, *Pinctada imbricata radiata* are for first time recorded for the Montenegro.

**Keywords:** fouling communities, alien species, south-eastern Adriatic Sea, Montenegro

## A research on the view of hotel managers in Istanbul on the environmental insurance

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During the commercial and industrial activities, environmental insurances are made for the purpose of compensating the damages that the businesses may cause to the environment and eliminating the pollution that occurs. In line with the development of environmental responsibility awareness, legal regulations on reducing and preventing environmental pollution lead businesses to take new measures. Under environmental legislation in Turkey "Coastal Facilities Sea Pollution Compulsory Liability Insurance, Compulsory Third Party Liability for Dangerous Materials and Hazardous Waste Insurance and Environmental Pollution Liability Insurance" three different insurance application to be available. Environmental Pollution Liability Insurance is optional. As in other commercial and industrial sectors, hotel businesses operating in the tourism sector can also harm the environment during their activities. Environmental insurances are made in order to reduce, eliminate and compensate the damages arising from the activities of hotel businesses operating on the coastline, which may cause marine, air and land pollution. In Turkey, for damage caused to the environment of the hotel business is not obliged to insurance. However, Environmental Pollution Financial Liability Insurance (EPFLI) is provided for the damages that the hotels may cause to the environment. Environmental Pollution Financial Liability Insurance is generally done in the "hotel package insurance" by providing tail policy. Environmental damages, which are limited to the environmental pollution risks that arise suddenly and unexpectedly during the operations of the hotel business, are covered within the limits specified in the insurance policy. The principle of "polluter pays" is common in environmental pollution. This principle brings with it the principle of responsibility. Compensation of environmental damages caused by hotels causing environmental pollution is a requirement of this principle. However, the magnitude of environmental damage caused may exceed the financial structure of hotels. Environmental insurance can be considered as a tool for both increasing the awareness of hotel managers on the environment and solving the large-scale compensation obligation that may be exposed due to environmental damage. In this study, the view of the managers of hotels operating in Istanbul to environmental insurance, their level of awareness about environmental insurance, the types of environmental insurance they purchase, their preferences and trends in environmental insurance are examined through empirical study. After determining the current status of the hotels operating in Istanbul against environmental insurance, suggestions are given in the result section.

**Keywords:** Hotel, hotel insurance, environmental pollution, environmental insurance.

## Distribution of phytoplankton species in marina Porto Novi (Boka Kotorska Bay)

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Small enclosed Boka Kotorska Bay located in the south-eastern part of the Adriatic Sea along Montenegrin coast presents important transitional areas of the Adriatic. It presents a boundary environment between land and sea, characterized with specific biological communities. "Porto Novi" is marina for luxury yachts which is situated in Herceg Novi Bay part of Boka Kotorska (Montenegro). Distribution of phytoplankton species were researched in marina Porto Novi during 2019. Samplings were performed at six positions, at three depths: surface, middle and bottom. The abundance of phytoplankton varied from  $10^4$  to  $10^5$  cells/l. The most dominant group is diatom which reached value to  $10^5$  cells/l. The highest abundance of diatom was in March 2019 ( $1.10 \times 10^5$  cells/l). Dinoflagellates reached maximal value in October 2019 ( $8.36 \times 10^3$  cells/l). Potentially toxic species from phytoplankton genus *Pseudo-nitzschia* reached value up to  $10^4$  cells/l. It was noticed 7 toxic and potentially toxic species which belongs to dinoflagellates from genus: *Dinophysis*, *Gonyaulax*, *Lingulodinium*, *Phalacroma*, *Prorocentrum*. Toxic dinoflagellate were: *Dinophysis acuminata*, *D. acuta*, *Gonyaulax spinifera*, *Lingulodinium polyedra*, *Phalacroma rotundatum*, *Prorocentrum cordatum*, *P. micans*. The aim of this study was to present phytoplankton distribution in marina Porto Novi.

**Keywords:** Phytoplankton, toxic and potentially toxic species, marina Porto Novi, Boka Kotorska Bay

# GIS-Based Monitoring of the Carbon Footprint Changes For Sustainable Campus Management; A Case Study of ITU Ayazaga Campus

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The sharp increase in the world population, industrialization, decreases in the green areas and energy demand which increase every day are some of the main environmental issues. Another important issue is significant increases in greenhouse gas emissions that cause the greenhouse effect in the atmosphere. Numerous studies have been reported that greenhouse gas emissions are the main reason for global warming, pollution, severe weather patterns, and species extinction. According to the Kyoto Protocol, there are six species of greenhouse gas used to assess the carbon footprint. These gases are; carbon dioxide (CO<sub>2</sub>) which is evaluated as the primary greenhouse gas emitted through human activities, methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluoric perfluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>). Many governments around the world have implemented lots of legislation to measure and decrease carbon emissions according to The Kyoto Protocol.

The concept of "footprint" developed to measure how much natural resources are used by humans. In this context, there are three footprints: Ecological Footprint, Carbon Footprint, and Water Footprint. Among them, the effects of human activities on nature are measured with the concept of Carbon Footprint which might be defined as "a carbon footprint is the total amount of CO<sub>2</sub> and other greenhouse gases, emitted over the full life cycle of a process or product". It can be pointed out that, accounting carbon footprint plays a vital role to monitor and determine carbon emissions emitting from their sources for countries.

In this study, parallel to the recent studies carried out in Turkey, reducing the carbon footprint of individuals from a sustainable perspective was aimed at the main campus of Istanbul Technical University (ITU). Within the study, the monitoring of the carbon footprint of the campus by means of Geographic Information System (GIS) was carried out. For this purpose, greenhouse gas emissions were determined with different approaches at a campus with the goal of sustainable campus management. Monitoring carbon footprint is also aimed at utilizing evaluations and calculations made in certain periods by means of a system which will be established to take necessary measures to reduce greenhouse gas emission by the university's relevant decision-support mechanisms.

In this context, several related parameters and data which are officially gathered from the University administration are used to calculate the greenhouse gas emission in the year 2019. Main parameters and data used are; greenhouse gas produced by sewage treatment processes, amount of sludge produced monthly or daily amount of wastewater, average number of vehicles, number of shuttle vehicles, number and frequency of ring services, monthly electricity amount on the basis of buildings (used for light, air conditioning, elevator etc.) in all buildings, water consumption in all buildings, the amount of fuel such

as natural gas used for heating and hot water usage on a building basis in all buildings, average monthly solid waste generated, the amount of paper consumed in all units, chemical consumption in all laboratories, total number of academic, administrative and students, number of people living in total dormitories and lodgings in campus. Values obtained at this stage of the study will be used as a reference dataset for subsequent studies. Along with the analysis to be made with the addition of the studies carried out in the following years to the GIS-based system, it will be possible to monitor the amount of emission per capita per year.

**Keywords:** Greenhouse Gas Emissions, Carbon Emissions, Carbon Footprint, Geographic Information System.



# Generating Road Data Set for Deep Learning Applications

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Deep learning is a specific part of machine learning and represents the number of layers that are used for modeling the data. Successful results in image classification and image segmentation studies have been obtained by using this technique. Although it has become the main approach of many new applications, it still contains problems that need to be overcome. One of them is semantic labeling which is the most important activity and widely used in object extraction from remotely sensed data by using deep learning techniques. The main problem of semantic labeling is the assignment of a class label to every pixel. Generally, much of the labeling is still time consuming, costly and slowly performed by human experts. Additionally, deep learning requires a lot of training data because of the big number of complex parameters needed to be tuned by a learning algorithm. For automatic labeling of objects from aerial or satellite imagery such as roads, should be developed. Moreover, in the current datasets, mostly contains systematically planned urban areas that are generally obtained roads have uniform shapes in deep learning applications. However, in Turkey, roads are not in a uniform shape, especially in rural areas. Thus, extracting these features is becoming more difficult. Using these data set as the training data may bring several learning problems for other countries as well. To overcome this situation, generalized data are generated for deep learning applications. During the data set preparation, each country should be evaluated separately considering their land use/cover characteristics. In this study, the road labeling dataset obtained from an aerial image covers a wide range of urban and suburban regions was generated. During this process, the availability of recently orthorectified imagery and open access data were considered. Deep learning-based convolutional neural network architecture was tested on a generated dataset. Additionally, using the availability of generated dataset were evaluated in wide range areas with different conditions.

**Keywords:** Deep learning, semantic labeling, image segmentation, remote sensing

# Evaluating the effectiveness of infrared techniques in quantifying disturbances of post harvested pine forest systems

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In forest ecosystems, anthropogenic pressures such as land-use change, overgrazing, increasing demand for timber and firewood as well as chronic harvesting of forest products are degradation factors that can potentially lead to changes in the availability of natural resources, diversifying forest areas and reducing their productivity and regeneration. In forest pine systems, resin harvesting disturbs trees as it causes structural damage to their trunks, while affecting their growth rate. After all, resin production is the trees' defensive response to wounds, as it prevents water loss as well as penetration of insects or other pathogens. In addition, it alters trees' sensitivity to climatic stress, making them less resilient to extreme weather events. Monitoring forest systems using infrared techniques contribute in identifying their disturbances, assessing their state and it can be a tool for precise estimation of their degradation at an individual and population level. In this respect, the state of forest systems after resin extraction was evaluated, using infrared techniques. For this purpose, in 20 pine forest stands in Vasilikon forest, Lesvos Island, Greece, with a cover of 900m<sup>2</sup> each, 335 resin extracted trees, were selected. Morphological features related to trees' architecture were recorded and light availability was calculated using hemispherical photography in order to calculate leaf area index and canopy openness. Moreover, thermal images of their resinous surfaces were collected and analyzed to detect potential changes of their state. The relationship between pines' architecture was investigated with respect to the temperature variation of the trunk's resin surface. In order to examine the effect of morphological features on the temperature range, multiple linear regression analysis was used, based on the degree of dependency between the observed correlations. Evaluation of the association of temperature range and morphological features showed that there were linear relationships between the variables, focusing on specific morphological characteristics of the trees. In addition, correlation analysis showed that both the canopy openness and the leaf area index exhibits a negative correlation with the temperature range at the surface of the pine trunks. The effectiveness of thermal imaging in combination with pine trees morphological characteristics has demonstrated the importance both in accurately assessing disturbances as well as developing beneficial management plans to protect and preserve them.

**Keywords:** Pine forests, resin extraction, ground thermal imaging, hemispherical imaging

# Geospatial analysis for tree hazard assessment using screening tools: implications for urban forest management

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Urban forests are complex dynamic ecosystems created by the interaction of anthropogenic and natural processes, and generate critical benefits both to humankind as well as urban wildlife. They provide a wide range of ecosystem services; (a) provisioning, i.e. production of wood, fuel and water supply, (b) regulating, i.e. recycling of nutrients, air quality regulation, controlling local microclimate, (c) supporting, i.e. circulation of elements, primary production, soil formation, habitat function, hydrological cycle, and (d) cultural, i.e. recreational activities and ecotourism. Moreover, as they age, they provide increasingly diverse wildlife habitats and microhabitats as a result of developing features, such as cavities and decaying wood. However, tree-related microhabitats, structural defects, and tree aging are crucial factors that may jeopardize their mechanical integrity and stability, with consequences both for wildlife and public safety. Therefore, tree health assessment, to support decision making, regarding trees' possible failure issues, is an essential task, for tree arborists, in order to develop an effective management plan for their protection and conservation. In this context, several (a) tools, classified according to their measurement speed, resolution and accuracy, and (b) methodologies characterized as destructive and non-destructive, are presented in the international scientific literature. In parallel, identifying hazardous trees hotspots and evaluating their risk probability, are fundamental requirements for urban forest management. In this research, 334 trees, in four urban forests in the city of Mytilene, Greece, were assessed using a non-destructive screening tool. To evaluate trees' mechanical integrity, structural defects were examined via infrared thermography and strength loss equations for each tree, were applied. The Getis-Ord  $G_i^*$  spatial autocorrelation method was used for the recognition of hazardous trees hotspots in the study area and kriging geostatistical procedure, as an interpolation technique, was applied for mapping the spatial extension of hotspots. The results showed that screening tools can provide precise information on hazardous trees and can sufficiently explain the presence of cavities or decaying wood. Furthermore, identifying hazardous trees hotspots as well as tree risk zones across the urban forests, may offer significant data for more focused conservation strategies regarding arboreal vegetation management.

**Keywords:** Infrared thermography, tree risk assessment, hotspot analysis

## Hot spots, cluster detection, and spatial outlier analysis for estimating trees' structural defects

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Infrared thermography is a fast-growing, non-contact, and non-invasive technique for monitoring, among others, plant species' health state, as it can estimate accurately vegetation disturbances that may compromise their resilience. In woody vegetation species, the homogeneous temperature distribution, on stems and branches, is considered a hallmark of their health state as deterioration, voids, decay, and structural defects in general, that may occur within their trunks, interrupt the energy flow and cause temperature abnormalities on their surface. In this research, a methodological framework for assessing trees' structural defects was developed, by combining a set of field measurements, thermal indices, and geospatial statistical methods. For this purpose, thirty black locust trees were selected and photographed under similar environmental conditions. To develop thermal indices, trees' temperature data were analyzed using ArcGIS software and several spatial statistical tools were implemented in order to examine their spatial clustering. In particular, to assess temperatures' spatial dependence, the overall degree of spatial autocorrelation across the trees' bark texture, was estimated using Moran's I index. To identify statistically significant spatial clusters of high and low values, two local indicators of the spatial association were used, the Getis-Ord  $G_i^*$  and the Anselin Local Moran's I. Based on the extracted thermal indices, the Getis-Ord  $G_i^*$  statistic was used to detect spots of structural defects on trees' surface, while the Anselin Local Moran's I to verify and complement the hot spot analysis. The Global Moran's I and its corresponding z-score suggested that there was significant spatial autocorrelation ( $p < 0.05$ ) for the trees' temperature data. Moreover, significant clusters with high (hot spots) and low (cold spots) temperatures, as calculated by the Getis-Ord  $G_i^*$  tool, were observed. Finally, the cluster and outlier analysis confirmed, for each tree, the areas where temperature anomalies occurred. The proposed methodological framework has provided promising results on detecting structural defects on trees' trunk surface and could be used as a monitoring tool for tree health assessment.

**Keywords:** Thermal imaging, black locust, spatial statistics

# Multidimensional indicators for evaluating impacts of climate change and air pollution on human health at local scale: a test case in Southern Italy

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Climate change has become one of the major environmental factor to affect human health in the recent years. The extreme weather events (heat and cold waves, floods and droughts, changes in the distribution of vector-borne) represent a considerable risk factor for public health. Extreme heat events have been found to be associated with cardiovascular, respiratory and cerebrovascular disease. Moreover these extreme weather events, increased in frequency and in intensity, can be relevant for surface air quality, which have been extensively demonstrated to affect mortality and morbidity. Recent literature has been devoted to study of the relationship between climate change, air pollution and related risk for human health but only few studies have been focused on combined effects on these factors. In order to improve the knowledge of the severe impact of climate change on public health, a fundamental step is understanding both the relationship between the air pollution events and climate change and their synergetic impact on human health at local scale.

The present study investigates the joint effects of weather parameters and atmospheric pollutants on daily hospital admissions in the City of Bari (Southern Italy). In particular, the data of daily hospital admissions for specific diseases, representative daily meteorological parameters (minimum and maximum temperature, minimum and maximum relative humidity, wind velocity, atmospheric pressure and precipitation) and daily series of atmospheric pollutants (ozone and PM10) have been analyzed over a reference period of three years (2013-2015). A multivariate statistical procedure, based on factorial analysis (PCA and MCA) and synthetic indices, were used to identify the correlation structure among weather conditions, air quality and hospital admissions.

Future research on health impacts of the joint extreme weather and air pollution events should focus both on the more accurate quantification of the current impacts and the modelling of future impacts dynamic in order to ensure suitable public health prevention plans.

This research was carried out in the framework of the project 'OT4CLIMA' which was funded by the Italian Ministry of Education, University and Research (D.D. 2261 del 6.9.2018, PON R&I 2014-2020 and FSC).

## References

[1] Analitis A., De'Donato F, Scortichini M, Lanki T, Basagana X, Ballester F, Astrom C, Paldy A, Pascal M, Gasparrini A, Michelozzi P, Katsouyanni K. 2018. Synergistic effects of ambient temperature and air pollution on health in Europe: results from the PHASE project. *International journal of environmental research and public health*.15(9): 1856-1867.

[2] De Marco A, Amoatey P, Khaniabadi Y O, Sicard P, Hopke PK. 2018. Mortality and morbidity for cardiopulmonary diseases attributed to PM<sub>2.5</sub> exposure in the metropolis of Rome, Italy. *European journal of internal medicine*. 57: 49-57.

[3] Giorgio GA, Ragosta M, Telesca V. 2017. Application of a multivariate statistical index on series of weather measurements at local scale. *Measurement*. 112: 61–66.

[4] Ragosta M, Giorgio GA, D'Emilio M, Salimbene O, Riccio P. 2019. Application of MCA for studying as the lifestyle and the air quality can affect forms of sleep disordered breathing. *Fresenius Environmental Bulletin*. 28 (2): 836-841.

[5] Salmond J, Sabel CE, Vardoulakij S. 2018. Towards the Integrated Study of Urban Climate, Air Pollution, and Public Health. *Climate*. 6: 14-18

[6] Telesca V, Lay-Ekuakille A, Ragosta M, Giorgio GA, Lumpungu B. 2018. Effects on public health of heat waves to improve the urban quality of life. *Sustainability*. 10(4):1082-1098.

**Keywords:** Meteorological parameters, Pollutants concentrations, Hospital admissions, Factorial analysis

# **Estimation of Surface Energy Balance Components over Canola Canopy by Using Chaotic Approach**

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Determination of the energy balance components over a canopy surface is essential to better understand the water requirement of crops and the other hydrological processes as evapotranspiration. However, measurements of these components are not wide. Thus, in this study, it was aimed to estimate these components when the measurements are absent or not sufficient. Within this frame, eddy covariance measurements taking from the experimental area of Atatürk Soil Water and Agricultural Meteorology Research Institute in Kırklareli, Turkey over canola covered area during 2015-2016 growing season were used to achieve energy balance components. According to the nonlinear dynamic system approach, it is possible that temporal evolution of a system can be represented by its trajectories in phase space. The coordinates of phase space consist of the state variables that are necessary to determine the temporal evolution of a system. In order to predict energy balance components, time lag of each component was calculated by using autocorrelation function and mutual information as a first step. Then, embedding dimension was determined for each variable with False Nearest Neighbor (FNN) Algorithm. Finally, the phase space was reconstructed to predict the components of the energy balance. Chaotic approach presented satisfactory results that will be useful for agricultural purposes.

**Keywords:** Prediction, phase space, chaos theory, evapotranspiration, Turkey

# Ecosystem health assessment: an integrated approach in a tropical rainforest

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Ecological conditions of ecosystems reflect the health status of natural and human communities. Healthy ecosystems indeed ensure benefits to the people providing goods and services. As such, emerging fields in the health assessment, e.g. integrated approaches involving One Health and EcoHealth, have been raising the awareness of sustainable use and management of natural resources. The ecosystem health assessment must take into account multiple indicators, including the evaluation of relationships between human pressures on living organisms and their physical environment. Hence follows the need of applying approaches aiming to protect the global environment and improve the life quality of everyone, as stressed by the United Nations Sustainable Agenda. This framework is fundamental for primary prevention and implementing measures aimed to decrease pressures on the ecosystems, especially in the least developing countries. Rural areas and primary forests often arise in tropical regions of such countries, where climate change effects amplify the impacts of human activities on the ecosystems. Tropical rainforests in Madagascar host a huge number of species, most of them endemic. Such important biodiversity hotspots face the challenges of climate change and anthropogenic disturbance. Moreover, the lack of financial resources and well-established monitoring strategies make it hard to implement sustainable conservation programmes, and an overall health assessment is missing. Therefore, the direct and indirect impacts of the biodiversity loss and the environmental degradation on local communities are partially unknown. This study aims to provide information on the health status of a tropical Malagasy rainforest and its surroundings. Areas of limited and medium anthropogenic pressure will be considered. The ecosystem health will be assessed by using targeted indexes and methods focused on different environmental components, including animals and humans. The study will promote sustainable development in the implementation area by helping in the effect detection of anthropogenic disturbance on the ecosystem and transferring the outcomes to the local communities.

**Keywords:** EcoHealth, ecosystems, climate change, anthropogenic disturbance, health assessment, biodiversity loss



# Correlation analysis between air pollutants levels and extreme temperature events in summer time

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In recent years climate change has led to the increase in the number and strength of extreme temperature events that are closely related to air quality patterns; their synergic effect represents one of the most important environmental factor affecting human health. Meteorological conditions can influence the emissions, transport, formation, and deposition of air pollutants both directly and indirectly. Recently, many studies focus on the relationships between weather processes and air pollutants by means of bioclimatic indices, that combine air temperature, relative humidity and wind speed; these indices may be very useful to determine the human thermal comfort. For an enhanced assessment of the health impacts of exposures to heat waves, the understanding of the complex links between air pollution events and extreme weather events plays a key role.

This study investigates the relationships between daily series of atmospheric pollutants levels (PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>x</sub> and O<sub>3</sub> concentrations) and daily series of maximum temperatures measured in 14 monitoring sites of Emilia Romagna region, Northern Italy, during the summer time (June-August) from 2015 to 2017.

For the evaluation of the spatial and temporal correlation structure between the pollutants, different statistical techniques including cluster analysis (CA), and principal component analysis (PCA) were applied. Extreme temperature occurrences, the Hot Days (HDs), and their relative persistence, the Heat Waves (HWs), were identified respect to the daily average values of meteorological elements for a 30-year period 1971–2000 (Climatological Normals, CLINOs). Moreover, the analysis of the interaction between air quality and temperature has been performed to evaluate whether Heat Wave episodes may be assumed as potential modifiers of the air pollutants patterns. Further studies should be carried out to implement proper forecast models for air quality extreme events based on temperatures so that the policy makers and the stakeholders may identify appropriate strategies and policies, including surveillance and programs evaluation, related to public health.

This research was carried out in the framework of the project 'OT4CLIMA' which was funded by the Italian Ministry of Education, University and Research (D.D. 2261 del 6.9.2018, PON R&I 2014-2020 and FSC).

## References

[1] Coluzzi R, D'Emilio M, Imbrenda V, Giorgio GA, Lanfredi M, Macchiato M, Ragosta M, Simoniello T, Telesca V. 2019. Investigating climate variability and long-term vegetation activity across heterogeneous Basilicata agroecosystems. *Geomatics, Natural Hazards and Risk*. 10(1):168-180.

[2] Telesca V, Lay-Ekuakille A, Ragosta M, Giorgio GA, Lumpungu B. 2018. Effects on public health of heat waves to improve the urban quality of life. *Sustainability*. 10(4):1082.

[3] Kalisa E, Fadlallah S, Amani M, Nahayo L, Habiyaremye G. 2018. Temperature and air pollution relationship during heatwaves in Birmingham, UK. *Sustainable cities and society*. 43: 111-120.

[4]Giorgio GA, Ragosta M, Telesca V. 2017. Application of a multivariate statistical index on series of weather measurements at local scale. *Measurement*. 112:61–66.

[5]Giorgio GA, Ragosta M, Telesca V. 2017. Climate variability and suburban-rural heat environment in a Mediterranean area. *Sustainability*. 9:775-785.

[6] Zhang H, Wang Y, Park TW, Deng Y. 2017. Quantifying the relationship between extreme air pollution events and extreme weather events. *Atmospheric Research*. 188:64-79.

**Keywords:** Heat Waves, Hot Days, Air pollution, Maximum Temperature, Extreme events

## **An overview of the accomplishments of the ICSC program**

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The International Chemical Safety Cards (ICSCs) is a concise and easy to handle peer-reviewed tool for essential safety and health information on chemicals. The International Chemical Safety Cards (ICSC) project is a joint program between World Health Organization (WHO) and the International Labour Office (ILO) with the cooperation of the European Commission. It aims to contribute to the improvement of safely handling of chemicals resulting in good health of workers and general public all over the world. In its ca 30 (1988-2020) years of existence, the ICSC program has prepared cards on YY chemicals with information on the chemical and physical properties and, the chemical and physical dangers that might exist and how to handle the chemical in order to avoid them. In addition information on the health and environmental effects as well as national and international regulatory information is provided. In the following I will pinpoint the major steps of the procedure of preparing the cards, and give some statistical data on the accomplishments of the ICSCs.

**Keywords:** ICSC, chemical hazards, chemical safety

## The PRO.S.IT. project for the improvement of viticulture sustainability in Basilicata Region (Southern Italy)

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The PRO.S.IT. (PROductivity and Sustainability in vITiculture) project, funded by the Rural Development Program (RDP) 2014-2020 of Basilicata Region (Southern Italy), is mainly focused on the achievement of substantial cost reduction for grapewine production by increasing sustainability levels in wine-sector products. In this framework, the activities of the IMAA-CNR (Institute of Methodologies for Environmental Analysis - National Council of Research) have been devoted to the mapping of vineyards located in Basilicata, to the analysis of vegetation health by satellite data and to the creation of a customizable and user-specific WebGIS.

Firstly, we analyzed various sources of data (cadastral maps, orthophotos, Google Earth images, etc.) to ascertain the correct presence of vineyards within cadastral units. The right spatial arrangement of vineyards represents a crucial information for public administrations and farmers' cooperatives and strongly influences the proper development of subsequent project actions. Secondly, satellite data techniques are able to trace spatio-temporal variability of pivotal vineyard parameters. They can increase knowledge on the productive performances of grapewine in different agricultural environments by adopting suitable vegetation indexes linked to photosynthetic activity, water canopy content, foliar pigments, carbon content, etc.. These indexes offer the possibility to follow the diachronic evolution of vegetation yield changes and to identify homogeneous areas in a given field or wine-growing area for carrying out possible precision farming applications (type of cropping system, timing and quantity of fertilization, antiparasitic treatments, etc.).

Finally, all the collected data will be inserted in an appositely devised geo-platform dedicated to the viticulture of Basilicata. This platform will report georeferenced data of each single vineyard (based on a single piece of land reported in the real estate registry). The WebGIS will use open source softwares and mature technologies already implemented for the vineyard management in a bottom-up flow chart. Each user (single farmer or consortium technician) will feed-up and update the WebGIS using specific smartphone and/or tablet applications and can control outputs of the geoplatform for your own vineyards (e. g.: phenological stage, ripening process, water consumption, leaf area index, etc.). This way it is possible to incorporate a high technological added value that should support a more sustainable management of vineyards also in the perspective to face the challenge of climate change on grape and wine production.

**Keywords:** WebGIS, vineyards, precision farming, Rural Development Program (RDP)

## Multivariate data analysis procedure for characterizing correlation structure of air contaminants in operating rooms

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Multidimensional data analysis approach allow to investigate the intrinsic correlation structure of a dataset. Also for small samples, factorial analysis and clustering procedure are able to highlight relationships among descriptors (quantitative and qualitative) and sampling sites. In this study, data concerning air quality in operating rooms (ORs), collected under different conditions, were analyzed. In 18 ORs of general surgery (with approximately 30 m<sup>2</sup> of floor space and 100 m<sup>3</sup> of volume), concentrations of particles with aerodynamic diameter higher than 5µm and 10µm (P5 and P10 respectively, expressed as number of particles N/m<sup>3</sup>), microbial charge (MC in CFU/m<sup>3</sup>), air changes numbers and differential pressure were measured. The data were collected in four different condition (Condition A: OR empty, without operators, closed door; Condition B: same conditions as previous case, 30 min after opening door; Condition C: At presence of operators wearing surgical mask, 30 min from their entry, closed door; Condition D: At presence of the operators, 30 min after they removing the mask, closed door) and in the corridor out of the OR. These different cases were used for quantifying the influence of the surgical environment on the surgical site infections (SSIs) and, consequently, for minimizing the risk. SSIs represent 20% of all healthcare-associated infections (HAIs) in hospitalized patients; at now they are among the most common and costly HAIs.

Particularly comparing the different cases, it is possible to note that in Condition A and in Condition C the correlation pattern puts in evidence a strong link among particles and microbial charges (the three original descriptors can be substituted with an only new variable taking into account about 45% of data variance). On the contrary in condition B and in condition D, particles and microbial charge are separated on two factors. These results suggest that the mask remotion and the door opening introduce the same variation in the correlation pattern. Also the clustering define different subgroups that may be interpreted as different typologies of OR in which physical characteristics (air changes numbers and differential pressure) play a crucial role. In conclusion we may suggest to use a multivariate approach for identifying the role of each parameter in the correlation structure and for evaluating its modifications changing the condition of the surgical environment.

**Keywords:** Indoor air quality, Surgical environment, Particulate, Microbial charge, Factorial analysis

# Using One-Soil for an easy and fast monitoring of the vineyard phenology

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Studies of vegetation phenology increasingly benefit from freely available satellite imagery acquired with high temporal frequency at fine spatial resolution. Sentinel 2 satellite that provides high-resolution multispectral data with a spatial resolution of 10m on a global scale, every five days, with no-cost since its launch in 2015, represents a breakthrough for the monitoring and the analyses of the Earth's surface. In particular, this sensor represents the major shift in the use of satellite data in precision farming and in the exploitation of natural resources. Thanks to its visible and infrared bands, Sentinel 2 data help to monitor fields by using various spectral vegetation indices providing useful and cost-effective solutions to better characterize in-field variability.

In viticulture, Sentinel 2 data may be helpfully adopted to analyze vineyard phenology and to obtain detailed spatial and temporal information regarding vine development. In order to track vineyard phenology, we adopted One-Soil (<https://onesoil.ai/en/>), an understandable, affordable, and easy-to-use application that provides freely Sentinel 2- NDVI maps with high temporal frequency at fine spatial resolution.

The study was carried out in 2018 and 2019 for three different production vineyards located in Basilicata Region, Southern Italy. NDVI time series were analyzed and the NDVI spatial variability observed. First results show the potential of Sentinel 2-NDVI maps to characterize vineyards vigor and to monitor vinegrowers' practices at local scale and suggest that they allow to obtain fast information on vegetation spatial and temporal variability useful for vineyard management in order to reduce costs (water consumption, agrochemicals, etc.) and increase production efficiency.

**Keywords:** Sentinel 2, precision agriculture, phenology, vegetation index

# Environmental Effect Of The Activity Of The Boat/Yacht On Marine Water Quality And Marine Vegetation In Phaselis (Antalya, Turkey) And Ecological Status Assessment

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Boats, yachts and daily tours can damage marine habitat with their hulls and anchors. In last decades, research on the environmental effect of boats and yachts marine engine has tended to concentrate on potential effects of oil spill, sewage, turbidity, noisy, antifouling paints and disturbance to wildlife. In Turkey, Beydağları Coastal National Park that is one of the rare protected areas, hosting both marine and terrestrial ecosystems, having unique natural and cultural resources and values and allowing a wide variety of recreational activities. This paper presents assessment the effect boat and yacht activities on marine flora and marine ecological quality of touristic tour destination in Phaselis bay. The study compared the changes in water quality and vegetation between 2008 and 2015. Compared to the past, it was determined that in sediment more damage occurred due to the anchoring of dense yachts and daily tours. Anchor movements caused the loss of sea grass and traces left around it and an unhealthy appearance of the seabed. Cover value decreased to 1% in seaweed. After the increase in the number of visitors in the seven-year period, a 9-16-fold increase in nutrient elements and oil-gress concentrations detected. The ecological quality status is in good quality in regions where visitors and yachts have low impact. In areas with high yacht and visitor pressures, the ecological status is bad.

**Keywords:** Recreational boating, Ecological water quality, Ecological status, Seagrass, Anchoring, Phaselis

# Home air purifiers in dwellings: health impacts on adult populations

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## Introduction

Individuals in the UK spend up to 90% of the day in indoor environments such as homes, offices and schools where airborne pollutant concentrations can be up to higher than outdoors, indicating the potential for greater health impacts than may occur with outdoor air exposures. Air purifiers are one device developed attempting to clean indoor air of harmful pollutants. There are a wide range of air purifiers that use different technologies for air cleaning; reducing the indoor concentrations of pollutants, these devices would be expected to be beneficial for health, but conversely some have been shown to have adverse health impacts. The most common equipment currently available for in-home use are home air purifiers (HAPs), which aim to reduce particulate matter (PM) concentrations, some of which are harmful to health. This work updates current research evidence regarding HAPs using filtration technology, their impact on particulate matter (PM<sub>2.5</sub>) concentrations and associated health outcomes on adult populations in homes.

## Methods

A systematic literature review investigating HAPs was conducted and key data and outcomes extracted. 17 studies were included for analysis, which were trials conducted in dwellings with the use of HAPs.

## Results

Analysed studies all showed reductions in PM<sub>2.5</sub> concentrations of between 29% - 92% with the use of HAPs. Associations with health impacts included for blood pressure, respiratory parameters and pregnancy outcomes. Changes in clinical biochemical markers were also identified. However, evidence for such associations was limited and inconsistent. Health benefits from a reduction in PM<sub>2.5</sub> would be expected as the cumulative body of scientific evidence from various cohort studies shows positive impacts of long- term reduction in indoor PM<sub>2.5</sub> concentrations.

## Conclusion

From the literature review, home air purifiers are seen to reduce indoor PM<sub>2.5</sub> concentrations which has the potential to offer health benefits, especially for those with pre-existing conditions. Further research is required to determine the impact on health improvement.

## Acknowledgements

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**Keywords:** home air purifiers, PM, health impacts



## **Spontaneous tail movement in zebrafish embryo as indicator of neurotoxic substances in the environment**

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Thousands toxic substances daily reach aquatic environment, mainly deriving from industrial, urban and agricultural activity. Many of them exhibit neuroactive properties and they are considered an emerging issue for both human and environment health. The real impact of the exposure of neurotoxic contaminants on ecosystem is not yet much known but there are evidences that they can cause important changes in organism behaviour, furthermore also humans can be indirectly exposed to neurotoxicants through ingestion of fishery products and drinking waters. An improvement to bridge the gap of knowledge in this sector is needed and new standardized methods are required. The aim of this study is to verify the feasibility and applicability of the coiling activity test with zebrafish embryo applied on environmental samples. Spontaneous movements of the tail in embryo occurred earlier at 17 h post-fertilization originate from a single neural circuit and they are influenced by contaminant exposure. The count of bursts and their intensity are important parameters of neurotoxic effect and specific software allows the rapid measurement of them. We applied the coiling activity test on different environmental samples in 24 well plates at different laboratory conditions in order to suggest a rapid operating protocol as a screening identification and cost effective test in the ecotoxicological assessment. In parallel we utilized the 96 hours Fish Embryo toxicity acute test (OECD, 236) to add more information on the samples and to verify the sensibility between two tests. The spontaneous tail movement in zebrafish is demonstrated to be a very powerful tool in eco-neurotoxicological studies as it provides in few hours important screening information on the presence of dangerous substances in ecosystem. This test could give also a valid contribute to increase the regulatory guidelines to identify neurotoxic risks in ecosystem.

**Keywords:** zebrafish embryo, coiling activity, neurotoxicity, sublethal endpoint

## **Genotoxicity indicators of transplanted mussels *Mytilus galloprovincialis* reveal early signs of marine pollution in the Boka Kotorska Bay, Montenegro**

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Montenegrin coast is under high anthropogenic pressure from developed cruise and yachting tourism during the summer season, especially in a narrow channel of the Boka Kotorska Bay. To evaluate the possible effects of pollution and determine the level of genotoxicity in marine organisms within the Bay, we carried a field study which included transplantation of the Mediterranean mussels *Mytilus galloprovincialis* from their natural habitat (Orahovac) to more impacted sites (Tivat and Dobrota), situated in vicinity of the main ports. The mussels were sampled in Orahovac (42°29'6.61''N 18°44'43.40''E). Two groups of specimens were placed in tubular mussel nets and deployed at 1,5 - 2 m depth within the port of Tivat (42°25'59.79''N 18°41'19.51''E) and on the site Dobrota (42°26'13.50''N 18°45'48.26''E) near the port of Kotor. After two weeks of exposure, mussels hemolymph (taken by syringe and needle) from impacted sites (Tivat and Dobrota) was compared to the mussels hemolymph from their natural habitat (Orahovac). The cytotoxicity was measured by following the viability of haemocytes which was determined by trypan blue staining while genotoxicity was measured by DNA damage induction based on comet (single cell gel electrophoresis) assay parameter – Tail intensity (TI%). The experiments were performed 2 or 3 times. According to our results there was no significant difference in cell viability among the tested mussel groups. Mean value of TI% obtained from mussels at the sampling site Orahovac was  $5.57 \pm 0.53$ , while TI% values for transplanted mussels on the sites Dobrota and port of Tivat were  $3.57 \pm 0.85$  and  $15.57 \pm 0.94$ , respectively. Statistically significant differences ( $p < 0,05$ ) of TI% were observed between all three sites. The group of mussels from port of Tivat showed the highest TI% (higher level of DNA damage), most probably caused by marine pollution. Samples from other two sites showed much lower TI%, indicating more suitable environmental conditions. Since transplanted mussels showed a significant response in a relatively short exposure period, our data is in compliance with the fact that comet assay can reveal early signs of DNA damage and pollution pressure. The combination of this two factors can serve as an early warning system and help local authorities take action on time and prevent larger scale marine pollution accidents.

**Keywords:** Genotoxicity, *Mytilus galloprovincialis*, marine pollution, Boka Kotorska Bay

## Health and climate change: the charter as a tool to promote actions

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Climate change is already a large scale global killer and will increasingly affect the health of all and particularly Globally, people at greatest risk of adverse health effects associated with climate change include children, the elderly and of other vulnerable population groups. The scientific community is united in declaring that climate change effects on health, whether direct or indirect, are the most urgent public health problem which needs to be faced now. The next 10 years will prove crucial for the health of both humans and planet. Climate changes affect social and environmental health determinants such as clean air, ecosystems health, safe drinking water and safe sufficient food. Temperature-related death and illness, extreme events, polluted or stressed ecosystems represent relevant issues raising concern for both health and economic consequences. The aim of the Symposium “Health and Climate Change” was to promote an inter-sectoral and multidisciplinary approach to estimate, and to prevent, climate change-related events as well as to call the authorities to put in place measures to reduce adverse health effects. Approximately 500 researchers from 27 countries gathered in the H&CC Symposium to discuss the far ranging impacts climate changes have and will increasingly have on human health and reach a consensus on a set of key actions required to face the risks and threats.

At the end of the Symposium the Rome International Charter on Health and Climate Change was presented. It includes a series of actions and recommendations, discussed and shared by all the participants, intended to inform policy makers and all the stakeholders involved in the management of climate changes. It is interesting to note that one of the key focuses, cross-sectoral among the sessions, concerned information, education and empowerment of citizens as an effective means to contribute to the mitigation of the effects of climate change on health and at the same time enable adaptation by fostering resilience of the single and of communities. These key messages and measures (Key MM) need to be translated into action by decision makers and administrators. These need to be taken and must be considered in all policies if we want to protect the future of humankind and the planet.

**Keywords:** climate changes, human health, adaptation, innovative tools, management policy

## The accreditation process, as innovative approach to enhance the reliability of vibrio fischeri assay

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Ecotoxicological tests are fundamental in the assessment of chemical compounds effects in aquatic systems: one of the widely applied is the *Vibrio fischeri* bioluminescent inhibition assay: it is sensitive, cost-effective and easy to use. It is able to detect effect of organic and inorganic compounds and metals, furthermore has been long used for wastewater treatment efficiency evaluation, surface water and sediment quality monitoring. The Accreditation, according to ISO/IEC 17025, is the process to assess performance, reliability and efficiency of a laboratory test, improving the quality of results. Quality assurance is common, for chemical analysis, but it is not considered yet as an added value for ecotoxicological assay. Being accredited ISO/IEC 17025 allows laboratories a continuous improvement in their performance, we chose this process, as innovative approach to enhance the reliability of the *V. Fischeri* assay. We also included in this test also sampling and preservation of the sample, important factors in the environmental analysis. To assess performance, reliability and efficiency of our laboratory we have taken into account following aspects of ISO/IEC 17025: Instruments and reagents; Operator qualification; Repeatability and uncertainty of measurement estimation, Internal quality control. The luminometer Microtox ® Model 500 Toxicity Analyzer was the instrument used to performed assay, previously calibrated by an accredited calibration laboratory, as well as freeze-dried bacteria, reagents, reference materials were provided by certificated companies. The operating procedures were drafted according to the requirements of following international standards: ISO 5667:1, ISO 5667:3, ISO 5667:16 for sampling preservation of the sample and ISO 11348-3 for *V. fischeri* assay. Operators were trained both for sampling activities and for running experiment. Their competence on sampling was evaluated on following aspects: appropriate selection of equipment, choice of the point of sampling point, correct labelling and handling of the samples. While those related to test performing was evaluated comparing obtained data on toxic references with those reported in ISO 11348-3. The uncertainty related to inhibition effect was estimated using experimental data, analyzing three samples with different toxicity. The experiment was performed under the following repeatability conditions: same operator, same instruments and same toxic reference substance. The approach showed in this study to accredit *V. fischeri* inhibition assay, can be easy used for the others ecotoxicological assays to enhance their reliability in environmental monitoring.

**Keywords:** ecotoxicology, quality assurance, *Vibrio fischeri*

## Plants biodiversity in relation to medicine and human well-being

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The ecosystem, being a complex community of organisms and environment in which they live, has the ability to provide services, intended as the benefits that people obtain from the ecosystem itself. Such services, that include food, water, medicines and building materials, are more easily provided by unperturbed ecosystems in which a state of equilibrium is maintained. In this context, biodiversity is one the most important characteristic in an operating ecosystem. However, a rapid extinction has been happening for many years due to human activities and does not seem to slow down. It has been estimated that 50,000 of the ~390,000 species of plants known today are at risk of extinction, with deforestation that has led to the destruction of one third of the world's forests. Such loss implies several consequences on human health, among others the disappearance of potential new drugs and medicines. To the present day, in fact, only a small portion of all known plants has been systematically investigated for bioactive compounds. The loss of species, often not yet described, can consequently preclude the discovery of new molecules so much that around three potential new drugs are lost every year. This is why, despite the recent technological progress, it is not yet possible to artificially synthesize all the molecular structures. The plants ability to supply new drugs depends on the presence of a multitude metabolites, such as alkaloids, terpenes, steroids, flavonoids and tannins, which can present a variety of properties (antiallergic, antibacterial, anti-inflammatory, antiviral). Thanks to this, over the last few decades a large number of new products were placed on the market, with consequent benefits for millions of people. For example Taxol, a chemotherapy medicine largely used to treat a number of types of cancer, was isolated in 1971 from the Pacific yew (*Taxus brevifolia*). Also, the use of plants and medicinal herbs is a key element in the traditional medicine, such as the Chinese, the Arabic (*unani*) and the Indian (*ayurveda*) ones, in which natural components of plant origin are largely used. The herbal medicine is in fact widespread even today, and the World Health Organization (WHO) estimates that it is actually being used by about four billion people. Even in the western world, where it was almost completely replaced by the modern medical science, the traditional medicine has recently been rediscovered. These applications, as well as others related to ecosystem services and human well-being make the biodiversity conservation and the preservation of the ecosystems health a priority now and for the next decades.

**Keywords:** biodiversity, human health, extinction, medicine, ecosystem

## Efficient, user-friendly water monitoring strategies and systems based on innovative technologies Intcatch: project H2020

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The European Project Horizon 2020 INTCATCH (Development and application of Novel, Integrated Tools for monitoring and managing Catchments) is a EU Horizon 2020-funded project that aims to investigate a paradigm shift in the monitoring and management of river and lake water quality, by bringing together, validating and exploiting a range of innovative monitoring tools for river and lake water quality into a single efficient and replicable business model for water quality monitoring that engages the widest set of stakeholders and will be fit for European waters in the period 2020-2050. The project addressed how the technologies can be integrated with Citizen Science and what the implications are for the use of the environmental data produced by this approach. The project results will support green growth, increase resilience to climate change and will improve and implement the chemical and ecological monitoring programmers of the EU Water Framework Directive. INTCATCH developed efficient, user-friendly water monitoring strategies and systems based on innovative technologies that will provide real time data for important parameters. The INTCATCH project used demonstration activities to showcase eco-innovative autonomous and radio controlled boats, sensors, DNA test kits, smartphone apps and run-off treatment technologies INTCATCH will incentivize the engagement of stakeholders and embodying citizen science in improving the quality of aquatic environments. The concept of Citizen Science endorsed and promoted in the project through the active participation of volunteers in actions, such as the operation of the monitoring boats in the demonstration catchments, participation in monitoring programmers, sampling campaigns and dissemination activities

**Keywords:** novel technologies, climatic changes, stakeholders, citizen science, monitoring, aquatic ecosystems

## **A Decision Support System (DSS) for integrated climate forcing and air pollution reduction and in European Cities**

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Air quality is a very important factor that has a severe impact to the health of millions of people around the globe. Together with climate change, they play a most important role to the quality of life and the expectation of the population, with those residing in or close to urban environments being the most affected. There is growing recognition that a comprehensive and combined analysis of air pollution and climate change could reveal important synergies of emission control measures which could be of high policy relevance. Insight into the multiple benefits of control measures could make emission controls economically more viable, both in industrialized and developing countries. While scientific understanding on many individual aspects of air pollution and climate change has considerably increased in the last years, little attention has been paid to a holistic analysis of the interactions between both problems. In this context, the ICARUS Decision Support System (DSS) is mainly intended to assist policy makers of all levels of administration, NGOs and research institutes whose activities relate to air quality and climate forcing. Policy makers of municipal, regional and national level will be able to use the DSS in order to design and simulate the impact of potential measures. The ICARUS DSS provides policy and measures impact estimations at many levels, namely: emissions, pollutants concentration, population exposure, health impact, monetary evaluation and at three temporal levels, 2015, 2020 and 2030. To this end, the DSS implements the models developed in the ICARUS research project, taking into consideration the particularities of each region, including population activities and habits, based on their socioeconomic status. Special focus is given to the exploitation of data of several data types and formats, originating by numerous different sources, such as meteorological and concentration measurement stations, smartphone and wearable sensors. Particular attention has been paid to the analysis of the spatial and temporal relations between the data types involved. Datasets are provided in a standard format, compliant with the INSPIRE Directive.

The policy makers will be able to select a policy from a set of predefined scenarios and proceed to select or draw an area of interest, on which the different impacts will be calculated by the DSS. Apart from selecting among predefined policy scenarios, the policy makers will be also able to import their own data for their jurisdictions and to also define their own custom policies. An essential feature of the DSS is the ability to evaluate the policy impacts while it is being applied, by importing air quality data that they might be in possession of and comparing them to the estimates. Finally, NGOs and researchers may use the DSS to retrieve data and facilitate their research.

Great emphasis has been put into the usability, security, interoperability and scalability of the DSS, which is accessible through an open-source WebGIS infrastructure, integrating all project information, enabling

users to manage and process spatial data and to effectively visualize the results of spatially resolved models. This will enable access from any computer through a browser, without requiring installation. The project methodology was applied in nine European cities of variable size starting from relatively small (Basel, Brno, Ljubljana, Roskilde) to mid-size (Stuttgart, Thessaloniki) to large cities (Athens, Milan and Madrid). They were selected carefully to represent the mix of urban settings around Europe and cover the whole spectrum of “green urban management”.

ICARUS aims at the improvement of life quality and public health, as well as environmental risk reduction. It proposes an innovative system to assess and monitor AQ and adverse health effects of exposure to poor AQ in an integrated, cost-effective and dependable way, using to the maximum current and near-future capabilities of the environmental monitoring and telematics infrastructure. The ICARUS DSS deployment and application in several cities across Europe is expected to have a positive impact on local society and the economy contributing to lower the health costs associated to environmental burden. In this regard, one of the expected key results is the identification of strategies to improve air quality, cope with climate change and lower health costs.

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**Keywords:** Air quality, Climate change, Emissions, Health impact, Decision Support System



## Application of BlueHealth International Survey in Appia Antica Park (Italy)

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The objective of the H2020 BlueHealth EU Project (<https://bluehealth2020.eu>) has been to increase the knowledge of the effects of blue space on human health and well-being through a large-scale systematic programme of interdisciplinary international research. This part of the project took place in the Appia Antica Park in Rome. The park's area is ca. 3500 ha, with an important archeological and cultural heritage. Natural and artificial aquatic ecosystems, including streams, springs and wetlands, represent a biological corridor for wildlife. In the last few decades this urban park has been studied, valued and protected as an urban reservoir of biodiversity. The BlueHealth International Survey (BIS) developed during the Project, was administered to park goers in Appia Antica Park in Rome using the shorter site-specific, the BlueHealth Community Level Survey (BCLS). BCLS comprises 40 questions on physical and mental wellbeing and the type of activities performed in the proximity of blue spaces as well as their frequencies, personal feelings about the benefit and protection of blue areas. The face-to-face interviews were performed in two areas, in the proximity of the blue spaces Parco della Caffarella and Parco degli Acquadotti, with 807 people. Data analyses was performed excluding occasional visitors, like tourists, focusing on the people who made visits to the park in the last 4 weeks. This smaller dataset of 568 park goers (54% males and 46% females) was mainly composed of adults aged between 35-64 years old (54.4% of interviewees). Data were analyzed using univariate and multivariate predictive models. The results showed, not surprisingly, that people living closely to the park are more likely to visit the park than those living further away. In addition, dog owners are more likely to go to the park more frequently compared to those who do not own one. Most park visitors stayed, on average, for over an hour (81% of interviewees) and described walking (with or without dog, respectively 12,5 % and 39,6% of interviewees) as their main activity on the site. In relation to the effect on human well-being, 84 % of park visitors were satisfied with the visit and felt happy; furthermore 70% of them said they felt as part of nature and 65 % said they were able to rest and recovery their emotional and cognitive capacities during the visit. The results of this study improve the data set of BlueHealth International Survey and underlined positive perception of blue space effects mental and physical health of park users.

**Keywords:** blue spaces, well-being, Appia Antica Park (Rome)

## Real time personal exposure assessment using low-cost sensors

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A comprehensive personal exposure study was conducted in seven European cities, in frame of ICARUS Horizon2020 project. The investigation assessed the exposure of volunteers in different microenvironments, including both wearable sensors to track personal exposure to environmental stressors and activity levels and static sensors to monitor Indoor Air Quality (IAQ) inside their residences. This study aims to develop a high spatial and temporal resolution population exposure estimation methodology, based on static/portable, low-cost, advanced technologies. Concerning the Athens campaign, 100 individuals (34 households) living across the Attica region were participated. Volunteers coming from a wide range of age and socio-demographic status were recruited. The sampling period for each household was seven days, including a weekend, while the measurements in each residence took place both in summer and winter, in order for seasonal variation to be examined. Personal monitoring included: a physical activity sensor tracking steps, floors climbed, intensity minutes and heart rate on continuous basis and a custom-made monitoring device measuring PM concentrations. In order to assess IAQ in participants’ households, an additional sensor was placed in their living rooms to measure temperature, relative humidity, carbon dioxide (CO<sub>2</sub>), PM<sub>2.5</sub>, nitrogen dioxide (NO<sub>2</sub>), ozone (O<sub>3</sub>) and total volatile organic compounds (TVOCs). Participants were asked to fill out a questionnaire to gather information about the characteristics of their household. They were also asked to fill in a time activity diary during the campaign, giving information about the kind of activities they carried out and the places they visited. Preliminary results show a significant range of the measured pollutants among the studied households. In particular, PM<sub>2.5</sub> average concentration inside the residences ranged between 6.7- 63.5 µg/m<sup>3</sup> during the winter and 6.8-139 µg/m<sup>3</sup> during the summer period. As for the personal exposure monitoring, the highest PM values were observed in public means of transport and inside crowded environments, such as restaurants and cafes. TVOC concentrations were highly variable both between the houses and within individual residences, while higher concentrations were recorded during the summer period with respect to the winter. As for the CO<sub>2</sub> concentrations, exceeded the ASHRAE 62.1-2016 recommendation of 1000 ppm in several houses, especially during the summer campaign.

Research results and methodology of the present study not only provide a reference for future personal exposure studies, but also can be used by policy makers to design control policies.

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**Keywords:** personal exposure, PM, IAQ, sensors

## Are children and adolescents from rural area of Slovenia exposed to glyphosate?

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The use of the non-selective herbicidal products containing glyphosate (GLY) as an active compound is globally increasing, leading into higher concern for possible adverse effect in humans. General population is exposed to Gly and its major metabolite aminomethylphosphonic acid (AMPA) through contaminated food and water, dermal contact or inhalation during or after GBH application and through the dust. Regardless numerous experimental, in vitro and epidemiological studies on health effects of Gly, the current data is contradictory and, in many cases, uncertain. One of the major drawbacks in the assessment of Gly health effects is the lack of the data on human exposure levels.

Present study aimed to assess the exposure in children and adolescents from rural areas of Slovenia to Gly and AMPA and to identify possible sources of the exposure. 149 children (aged 7-10 years, 55% girls) and 97 adolescents (aged 12-15 years; 44% girls) were recruited in 2018 from three different rural areas of Eastern Slovenia: i) area with dispersed farms, vineyards and orchards on low hills; ii) flat area with the intensive agriculture; and iii) area rich with vineyards. To test for the effect of the seasonal application of Gly on the exposure, we followed urine levels of Gly and AMPA in winter and summer time of the year. Questionnaire data on dietary habits, living environment and use of pesticides were obtained for all the participants.

In winter time 27% and 50% of the urine samples had detectable levels of Gly and AMPA respectively; in the summer the percentages were similar with 22% and 56%, respectively. Geometric means of both analytes were below limit of detection (0.1 µg/L) in both sampling periods; levels of the 95 percentiles were 0.19 µg/L for Gly, regardless of the sampling period, and 0.29 and 0.33 µg/L for AMPA in winter and summer period, respectively. None of the participants exceeded the currently available reference value of 0.8 µg/L set for Gly, and only one participant with 0.76 µg/L in the summer time exceeded the reference value of 0.5 µg/L set for AMPA. Such levels are much lower than those existing in the literature (means 0.4 – 2.5 µg/L) and are indicating very low exposure to Gly in the studied population. In general, we did not observe any significant influence of sampling season (winter vs. summer), age, gender, sampling area, vicinity of agriculture, vineyards, orchards, gardens, sport courts or cemetery, on the levels of Gly or AMPA. Moreover, individuals that reported use of herbicides (type not specified, n = 41) or glyphosate-based herbicide (e.g. Boom Efekt, Touchdown; n = 15) in general did not express higher levels of either Gly or AMPA. However, the above-mentioned individual with the highest level of AMPA in the summer period, did report the use of glyphosate in time between both sampling periods and lives in close vicinity of agriculture, orchards and gardens (all closer than 50 m). We suppose that the studied population was mainly exposed through the contaminated food and/or water, although based on our dietary data we could not identify a specific type of food as a source of exposure. Exposure from direct Gly use in the vicinity of child's home is less likely, except for few individuals. Anyhow, interesting was that the percentage of summer samples with detectable levels of Gly and AMPA was

higher among individuals using public or private supply of drinking water than among individuals using only bottled drinking water, although the difference was not significant. At such low exposure levels, we would need more precise, Gly oriented, dietary questionnaire and larger sample size to appropriately assess possible exposure to Gly via food.

**Keywords:** glyphosate, AMPA, urine, children, adolescents, rural Slovenia

## Comparison of ecological status in two lakes in Albania based on diatoms algae

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The best way to evaluate ecological status of waters is the simultaneous use of chemical and biological analysis. The use of diatoms algae are the best indicators in water quality assessment. The main objective of this study was to assess ecological status of waters in two lakes in Albania, Ohrid lake in southeast and Viroi lake in south. The samples in two lakes were collected in littoral zone during 2011. Quantitative analysis showed that in Ohrid lake were dominant species as *Cyclotella ocellata*, *Achnanthes minutissima* and *A. biasolettiana*, *Fragilaria capucina*, *Gomphonema pumilum*, *G. olivaceum*, etc. Also 40 species were endemic of Ohrid lake. In Viroi lake were determined about 41 species and the most dominants were *Achnanthes minutissima*, *Cocconeis placentula*, *Nitzschia palea var palea* etc. By analyzing trophic index (TIDIA), saprobic index (SI) and Specific Pollution Sensitivity Index (IPS) the ecological status of lakes was evaluated, which indicates that the water quality in Ohrid lake is good and in Viroi lake is moderate.

**Keywords:** Diatom algae, ecological status, trophic index, saprobic index, specific pollution sensitivity index.

# Synergy of mass and night cooling in reducing mechanical-ventilation energy demand. The case of an earthen structure

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Any structure using earth or soil as its base material is considered to be adobe, often designated as earthen buildings. The defining property of adobe materials lies in the preservation of cool night temperatures into the next day and the preservation of warm afternoon temperatures into the following evening. They may thus be regarded as thermal regulators. In this vein, an earthen building was monitored, under different ventilation and shading conditions, in the summer of 2019 in Istanbul Technical University (ITU), Ayazaga campus (41°6'2''N 29°1'16''E). The experimental building (see Figure 1) was made of alker; a building material formed by adding water to soil at a consistency of 20% - 24% (depending to the amount of moisture within the soil used as base) and 10% gypsum (usually enriched with 2.5% - 5% slaked lime).

In order to make full use of the high thermal mass of the building a “mixing mode” cooling system was employed. Night ventilation was achieved by the use of a fan - installed in the North-East window of the building (inlet). The fan operated in two speed modes, resulting in 3.1 and 2.3 air changes per hour respectively. For a 23°C temperature set point, the air conditioning unit, operated from 08:00 am up to 17:00 pm on a daily basis. As the main interest in this study was the effectiveness of mass and night ventilation in providing for a low-cost way to cool structures, the main criterion chosen for evaluating the performance of the experiment was the decrease of mechanical cooling energy. Night ventilation was undeniably impactful, reducing the expected mechanical energy expenditure up to 26%. Furthermore, the earthen-building proved to be extremely effective on moderating extremes of temperature under no-ventilation regime. During a rather hot day, with an outdoor maximum temperature of 35°C, the indoor maximum temperature of the high-mass building was only 24.5°C, namely within thermal comfort levels.

**Keywords:** Earthen Materials, Load Demand, Night Cooling



Figure 1. Recent view of earthen-house

## **Benzene measurements in the main metropolitan and industrial areas across Spain (2014-2017)**

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Benzene presents a high health risk as a carcinogenic substance [e.g. Wang et al., 2019]. The European Union defined an annual threshold of  $5 \mu\text{g m}^{-3}$  to avoid benzene exposure and protect human health [Directive, 2008]. However, as a carcinogenic substance to humans, no safe level of exposure is recommended by the WHO (exposures must be as minimal as possible).

We report in this work atmospheric benzene measurements in the main metropolitan and industrial areas across Spain, using hourly benzene levels measured at air-quality stations, from 2014-2017 period. Annual mean levels ranged between  $0.3$  and  $2.4 \mu\text{g m}^{-3}$  with an hourly maximum value of  $112 \mu\text{g m}^{-3}$ ; Industrial stations can reach concentrations of one order of magnitude greater than urban sites. Monthly and daily evolution of benzene levels, are also analysed and discussed.

Several exceedance events were analysed in detail along with meteorological data from ERA5 (European Centre for Medium Range Weather Forecasts). These benzene events occurred under weather conditions governed by high pressure systems. In these cases, the accumulation of benzene in the lower atmosphere was favoured by both the lower wind speed and height of the ABL which would lead to minor horizontal and vertical dispersion.

### **References:**

Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe. n.d.

Wang, L., Dong, S., Liu, M., Tao, W., Xiao, B., Zhang, S., Zhang, P., Li, X. Polycyclic aromatic hydrocarbons in atmospheric PM<sub>2.5</sub> and PM<sub>10</sub> in the semi-arid city of Xi'an, Northwest China: Seasonal variations, sources, health risks, and relationships with meteorological factors. *Atmos. Res.* 229, 60-73, 2019.

**Keywords:** Benzene, ERA5, ECMWF, Air quality, Regional pollution, Local pollution



# Personal exposure to air pollution: the milan sensor campaign in ICARUS project

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## Summary

This study aims at presenting the results of collection of multi-sensor data for personal exposure monitoring carried out in Milan (Italy) in 2019. About 100 individuals from all ages and all sociodemographic groups, with a focus on vulnerable groups of population (e.g. children and elderly), have been recruited for the implementation of the study. The process includes both at home and personal monitoring for 7 days, in both summer and winter periods. The types of information collected are based on: exposure monitoring devices, physical activity tracker, questionnaires and time activity diaries. This work is part of a comprehensive study carried out in other 8 European cities in the framework of the ICARUS project.

## Introduction

ICARUS is a 4-year EU-H2020 project focusing on research areas related to the climate and the environment and their interactions with health and wellbeing. The ICARUS project's main objective is to develop integrated tools and strategies for urban impact assessment in support of air quality and climate change governance in EU Member States leading to the design and implementation of appropriate strategies to improve the air quality (AQ) and reduce the carbon footprint in European cities. The main objectives of the campaigns were to: collect data on external environmental exposure and exposure determinants by combining location, activity and air pollution data in different microenvironments; demonstrate feasibility of using new sensors and mobile technologies in collecting exposure data; analyse and compare exposure data in several different European cities; use data to parameterize and/or validate simulation models (Agent Based Models).

## Methodology and Results

The winter campaign was carried out from January 10th to January 30th 2019, with 89 participants from 39 households while the summer one from June 12th to July 2nd 2019, with 65 participants from 30 households, leading to a total of 42 different households and 97 participants. *Participant recruitment:* thanks to the collaboration of the key local stakeholders such as the Municipality of Milan we issued a volunteer search advertisement in July 2018 on Milan Municipality's website asking interested people to fill in an online survey to express their interest to participate in the campaigns and to provide some information on the age, gender, location of household and workplace so as to have an optimal distribution

of participants covering as much as possible the whole municipality territory as well as different age and gender combinations. *Sensors used:* (a) Physical activity wristband (Garmin Vivosmart 3) for steps, distance, floors climbed, type of activity, heart rate, sleep time; (b) Personal PM sensor for PM<sub>1</sub>, PM<sub>2.5</sub>, PM<sub>10</sub>, temperature, humidity, GPS; (c) uHoo static sensor (indoor) for CO, CO<sub>2</sub>, VOCs, PM<sub>2.5</sub>, O<sub>3</sub>, NO<sub>2</sub>, air pressure, temperature, humidity; (d) Silicone wristband for organic chemicals (passive sampler).

In addition to these devices, we also used 3 different questionnaires that allowed us to better understand the participants' habits and their personal and living conditions: a Time Activity Diary (TAD) to collect the activities carried out (both outdoor and indoor) and house conditions (open windows, candles, A/C on) on hourly basis; two surveys, the first focusing on household additional characteristics and the second for the participants to gather the daily habits (transport, sports, health status). Data from these questionnaires were used to derive socio-economic status (SES) of participants and to associate exposure to pollutants with this variable and other specific features. Results of measurements has been collated, analyzed and finally distributed to all participants in targeted reports for each participant. The latter included air quality levels (CO<sub>2</sub>, NO<sub>2</sub>, VOCs) in the household reported as heatmaps showing deviation in hourly averages from the overall averages, while individual measurements were reported with one minutes time resolution to emphasize variations in concentrations over time plotted against average daily limits as defined by WHO Air Quality Guideline; finally we reported values of exposure to PM for various microenvironments and different activities. The summary of the data for the whole campaign, and comparisons between households and participants data where possible, were reported as well: indoor air quality in each household along with the meteorological conditions measured; patterns of indoor pollution levels for different households in the same days; personal exposure to PM data correlation with SES variables and geographical position of households; exposure patterns for different participants in the same households. User experience and feedback as reported by participants has been collected as well.

## Conclusions

The next plan is to use the sensor campaign data to validate ABM for modelling exposure in the city, in order to create a useful tool for the Municipality, to better understand the indoor and outdoor exposure patterns for each "agent" representing a specific group in the population with different features and daily habits. The results of Milan sensor campaign, together with the other ICARUS cities involved within the framework of the project will contribute to inform and nurture environment-conscious citizens, to raise citizens and authorities awareness about health impact of air pollution and motivate citizens to adopt alternative behaviours, to develop visions of smart, green & healthy cities with minimum environmental and health impact and to propose win-win solutions for climate change mitigation and air pollution reduction.

## Acknowledgement

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**Keywords:** Air Pollution, Air Quality, Exposure, Smart Sensors

## Healthy ecosystems and healthy people?

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An ecosystem is composed of plant and animal communities and the physical environment in which they live. A healthy ecosystem can be described as a system in the state of equilibrium in terms of physical, chemical, and biological components and their interrelationships. This condition allows to fight different stressors that can occur as microbiological, chemical and physical contaminants and extreme weather events, flooding, water scarcity and heat waves due to climate change. A healthy ecosystem provides services that give benefits to the human population in terms of social and economic value, such as food, water, shelter, economic livelihood, recreation, and natural beauty. The alteration of ecosystem due to several stressors can affect not only the health of ecosystem but also it is strong linked to human and animal health. Studying the ecosystem means to collect scientific information and the tools and methods for reversing and fighting severe stressors in order to better understanding the relationships between human health and the health of ecosystem. In this framework, the main elements of analysis are the environmental changes, the evolution of society and the characterization of the biological and chemical risks to which the environment is affected. The study of the relationship between ecosystem and human health requires an analysis at local, regional and global scale. There are many human health aspects related to environmental causes and among these we can identify two categories: the first concerns the delay in development, understood as the inability to face natural risks or inaccessibility of essential environmental resources or services; the second is related to unsustainable development as a cause of ecosystem degradation. This approach offers not only an increase of existing health promotion and prevention activities, but provides the basis for a socio-ecological approach to public health that incorporates environmental sustainability and primary prevention

**Keywords:** health, climate change, ecosystem, public health, primary prevention

# Usability investigation of UAV based photogrammetry and lidar for forest inventories

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Due to the dynamic ecosystems of forests that often change as a result of continuous growth, expansion or some natural and unnatural external influences. Thus, an accurate and up-to-date inventory of forests is one of the most important features for establishing a forest management policy. Most appropriate methods should be chosen after a detailed investigation which used for eliminating the complexity of the ecosystem, developing forest management and shaping the environmental policy. In this study, photogrammetry and Light Detection and Ranging (LIDAR) data were evaluated both separately and together to obtain the most appropriate results related to forest inventories. Additionally, Digital Terrain Model (DTM), Digital Surface Model (DSM), Normalized Digital Surface Model (NDSM), Canopy Height Models (CHM), which are the well-known products were produced using point cloud data obtained separately from each technique. To evaluate the data, noise reduction which is a must important step was performed on the point clouds as the first step. Then, Digital Elevation Models was produced by means of the classification of point clouds by means of 4 different methods in the determined study region. In the first one, tree inventory was obtained by using only photogrammetric data. In the second, three points were obtained by combining ground points obtained from LIDAR data and photogrammetry data together. In the third one, gaps in ground points in the photogrammetric point cloud were filled by IDW interpolation to extract the tree inventory. In the fourth one, tree inventory was obtained by using only LIDAR data. Finally, although LIDAR data is more expensive and laborious than the photogrammetric method, it is the most successful method to produce tree inventory by producing more accurate results. The main reason one of the successes here was that the success in producing the Digital Terrain Model from the LIDAR data yielded better results than the photogrammetric method. Because of the LIDAR's effectiveness in modeling vegetation three-dimensional structure, return information and the arrangement of parts of the vegetation can be predicted by the usage of this data. In the first model, the full inventories of the forest couldn't have been realized. In the second method, better performance was realized than the first method, but worse results obtained than the 4th method. Unexpectedly a number of counted trees were obtained in the third method than the second one. The main reason for the differences obtained with different methods was evaluated as the 5 years' differences between obtaining LIDAR and photogrammetric data.

**Keywords:** Forest Inventory, LIDAR, UAV-Based photogrammetry

## Thermal comfort analysis of an education building in Istanbul

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Indoor Environmental Quality is one of the important public health issues. People always seek a higher comfort level in order to be healthy, more productive, have a better quality of life and experience fewer problems caused by buildings indoor air quality may negatively affect the people's health and ability to work and to learn. Environmental parameters such as temperature, humidity or illumination level define the ambient status of the indoor environment, but not the comfort level. The aim of this study was to measure physical, mechanical and environmental factors influencing indoor environmental quality (IEQ) and thermal comfort (TCom) in indoor and outdoor environment that are qualified differently in a university building; and to evaluate relationships among these parameters. For this aim, comprehensive sampling was conducted during two education periods, in spring and fall. In order to represent the building, total of 21 indoor and outdoor stations were selected as offices (4), classrooms (2), corridors (2), common indoor areas (5), personal indoor areas (2), sports areas (2), and outdoor areas (4). The mechanical calculations were computed for the area and volume of stations, and furniture and other interior building components were noted. Then, physical and biological parameters determining the thermal comfort was measured in-situ at indoor and outdoor stations. Calculations of these comfort parameters (temperature, relative humidity, noise, light), and culturable bioaerosols (bacteria and fungi concentration) were performed in university building, including special stations like swimming pool and fitness centre.

Thermal Comfort Survey has also been carried out in order to assess thermal comfort level based on the perceptions of people working in the University. In this study level of thermal comfort was also considered and evaluated together with factors affecting IEQ and TCom. As a result of the study, it was observed that the noise levels ranged from 42 to 115 dBA, with mean light values ranging from 120 to 420 lux. The temperature values were measured between 11°C (outside station) and 28.3°C (Classroom 1). At the same time, humidity values were recorded between 39-78%. As a result of the concentration of culturable airborne bacteria obtained from the stations, the highest value (1660 CFU/m<sup>3</sup>) was measured in a restroom and the lowest value (1 CFU/m<sup>3</sup>) was measured in swimming pool station where sanitation rules are effective. The results indicated that the measured environmental parameters were significantly correlated with each other. Additionally, working people's perceptions of the level of thermal discomfort supporting results of factors like air temperature, humidity and, air velocity.

The results, both of determined and calculated, have helped to identify and quantify the relative role of factors contributing to sick building syndrome depending on IEQ and TCom. The data collected in this

study may also be used to evaluate the effectiveness of current building operation practices, also to prioritize the allocation of resources for reduction of risk associated with IEQ and TCom complaints.

**Keywords:** Thermal Comfort Survey, thermal comfort, indoor environmental quality

## Dirty12 in Slovenia: An environmental legacy?

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Within the Stockholm Treaty of 2004, twelve persistent organic pollutants (POPs) have been listed as environmental hazard contaminants and threats to human health. Despite their strict regulation, these POPs are still ubiquitously present in the environment due to their persistence and lipophilicity. Through their ability to biomagnify and bioaccumulate, they are able to enter the human body where they can cause adverse health effects. Many POPs have been regulated since the 1970s and their concentrations in the environment are constantly decreasing. Despite these efforts, hotspot regions of former pollutions exist until today where concentrations of certain POPs exceed the recommended reference values. Examples of this include former waste incinerator sites or mines and factories. Among the regulated dirty 12, the most commonly monitored POPs include polychlorinated biphenyls (PCBs), polychlorinated dibenzodioxins and furans (PCDD/PCDF), hexachlorobenzene (HCB), polybrominated diphenyl ethers (PBDEs), and dichlorodiphenyltrichloroethane (DDT) and its metabolites. While DDT and HCB formerly found applications in the agricultural sector (insecticide and fungicide, respectively), PCBs and PBDEs were/are mainly used as flame retardants, and PCDD/PCDF are unintentionally formed byproducts of incomplete organic combustion. Their former ubiquitous application as well as their persistence have facilitated the transport of POPs even to remote places, making them a global environmental hazard.

Article 11 of the Stockholm convention states the responsibility of individual states to research and monitor POPs, their sources and releases and to monitor the levels in humans. Within a national human biomonitoring (HBM) study, 10 out of 12 contaminants listed in the treaty have been monitored in Slovenian men and women. Measurements were done in pooled samples of plasma (men) and maternal milk (first-time mothers). Samples were taken in 12 regions of Slovenia, including rural and urban sites, industrial sites and polluted sites between 2008 and 2014. The average age of participants was 29 for women and 31 for men (range 20 – 40 years for both). A total of 810 participants (408 women and 402 men) were included in the study with (on average) 45 men and 45 women per region. Samples were analyzed for Aldrin, Chlordane, Dieldrin, DDT, Endrin, Heptachlor, HCB, PCBs, and PCDD/Fs. After collection and preparation, samples were analyzed with high resolution gas chromatography / high resolution mass spectrometry (HRGC/HRMS). Limits of quantification for both matrices lay between 0.05 pg/g and 0.1 pg/g. In milk samples, all measured tetra to octa PCDD/F were detected in 12% - 100% of samples. PCBs were detected in 100% of samples with the exception of PCB 81, where 28% were below LOD. All analyzed PBDEs were detected in all samples, except BDE 183, where 12% were below LOD. The highest median concentrations of dioxins/furans, PCB, and PBDE were obtained for: 1,2,3,4,6,7,8,9 OCDD (24.5 pg/g), PCB 118 (2700 pg/g), and BDE 47 (505 pg/g). In plasma samples, detection rates of PCDD/F lay between 3 and 27%, of PCBs between 9 and 100%, and of PBDEs between 18 and 100%. The highest concentrations observed for each of the three groups were 0.1 pg/g (1,2,3,4,6,7,8,9 OCDD), 9.8 pg/g (PCB 118), and 1.4 pg/g (BDE 99). Other contaminants

were measured in individual samples, but were below the limit of detection with the exception of hexachlorobenzene and the DDT metabolite p,p DDE.

We observed differences between the sampling regions. Levels of dioxins/furans were higher in samples from Zasavje, an industrialized area with an incineration plant, and elevated concentrations of PCBs were observed in Bela Krajina, Kočevje, and Ljubljana. Among these, Bela Krajina (southwest) is a well-known area heavily contaminated with PCBs from improper waste disposal from a former transformer and capacitor factory. Kočevje is a rural area with no known sources of contamination. Ljubljana is the capital of Slovenia and as such an urbanized area. Urban environments are known for higher concentrations of PCBs due to their presence in older buildings in immediate vicinity to one another. Ventilation systems facilitate the transport of contaminants into outdoor air where meteorological conditions (urban heat island effect) limit air exchange with the surrounding areas leading to higher concentrations of pollutants. In the future, individual samples will be included in the statistical analysis and associations with questionnaire data will be attempted in order to identify potential sources of exposure.

**Keywords:** persistent organic pollutants, human biomonitoring, environmental pollution



# Seasonal Changes in Easterly and Westerly Phases of Quasi-Biennial Oscillation

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Quasibiennial oscillation (QBO) is a quasi-periodic oscillation of stratospheric equator. At the time of the oscillation, zonal winds changes phases from easterly to westerly at approximately every 28-29 months. QBO creates a number of durable influences that change through the seasons over the whole globe. It is well-known that there is a strong correlation between QBO westerlies and the strength of the boreal polar night jet (PNJ). Additionally it is also acclaimed that sudden stratospheric warmings occur mainly during the easterly phase of QBO. In this study the seasonal variability in the easterly and westerly phases of QBO is examined by using CMIP5 MPI-ESM-MR model RCP 4.5 scenario between the years 2006-2100. It is found that there is a significant change in the amplitude of the easterly and westerly wind regimes during the solstices which is not observable in the monthly mean dataset.

**Keywords:** Quasi-Biennial Oscillation, Stratosphere, QBO, CMIP5, Seasonal

## **The Inno\_Olivo&Olio and O.R.G.OLI.O LUCANO projects for the characterization and mapping of olive cultivation in Basilicata Region (Southern Italy)**

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The Inno\_Olivo&Olio and O.R.G.OLI.O LUCANO projects, funded by the Rural Development Program (RDP) 2014-2020 of Basilicata Region (Southern Italy), are mainly focused on the achievement of the optimization of olive oil production, within a wider and more sustainable agricultural vision. In this framework, the activities of the IMAA-CNR (Institute of Methodologies for Environmental Analysis - National Council of Research) have been devoted to the mapping of olive groves located in Basilicata and to the analysis of their vegetation status by using satellite data. Firstly, we analyzed various sources of data (cadastral maps, orthophotos, Google Earth images, etc.) to ascertain the correct presence of olive groves within cadastral units. The right spatial arrangement of olive groves represents a crucial information for public administrations and farmers' cooperatives and strongly influences the proper development of subsequent project actions. Then, we selected a set of parameters at local scale useful for defining the attitude of territories to different types of olive cultivation (intensive, super intensive, traditional). The evaluation of vulnerable areas in terms of productivity gaps (by using vegetation satellite indices as proxy variables) and local climate conditions (obtained by means of in situ data) allow the farmers to improve the olive oil production and quality. Moreover, in these projects, satellite data techniques are used to trace also temporal variability of olive production in the last 35 years. This way it is possible to increase knowledge on the productive performances in different agricultural environments by adopting suitable vegetation indexes linked to photosynthetic activity, water canopy content, foliar pigments, carbon content, etc.. The final goal of these projects is to introduce innovations in the olive oil production by increasing sustainability levels of production processes to obtain a high quality of final product.

**Keywords:** Satellite indexes, Olive groves, sustainable farming, Rural Development Program (RDP)

# Development of a web-based platform for the provision of open, linked and semantically enriched environmental data for e-health applications

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One of the major problems in both developed and developing countries, nowadays, is the high levels of air pollution particularly during the winter period. Air pollution comes mainly from anthropogenic sources and also can often be very toxic for human health. Prolonged human exposure, even at low levels, can cause adverse health effects such as cardiorespiratory diseases and cancers or increase mortality. In this study was developed a web-based platform that provides open, linked and semantically enriched environmental data for e-health applications. In particular, this platform provides the ability to derive environmental data from the European Centre for Medium-Range Weather Forecasts (ECMWF) organization and geo data from the Google Maps Geolocation service. Additionally, the derived data related to air pollution were used to characterize air quality using Environmental Protection Agency Air Quality Index (EPA-AQI) and Common Air Quality Index (CAQI). The Semantic Air Quality Index Service (SAQIS) was developed using the appropriate programming languages providing user interface and allowing data processing, semantically enrichment of data, SAQIS connectivity with APIs as well as the development and management of the SAQIS database. SAQIS was used to analyze real air pollution data and assess exposure. The air quality of the period from 24/12/2015 to 29/12/2015 for the two biggest towns of Greece, Athens and Thessaloniki was examined because during this period increased levels of air pollution were observed. The results of the analysis showed that the data provided by SAQIS were in consistency with the reported levels of the Greek authorities. In addition, the results of the indicators highlight the problem of air pollution and remark that indicators are easily understandable to the public. Last but not least, the data derived from ECWFMF was semantically enriched, open and linked. The developed platform could be used as a decision support tool in the field of e-health preventing periods of emergencies as well as for scientific purposes or public information.

**Keywords:** e-health application, linked data, Semantic web, e-health application, exposure assessment

# **Growth and acetylcholinesterase levels in non-target fish *Gambusia affinis* in the Annaba-El Tarf region: Relationship with pollution**

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The objective of this study is to evaluate the impact of pollution on the growth and response of a neurotoxicity biomarker, acetylcholinesterase (AChE), in the head of a non-target organism *Gambusia affinis* (Cyprinodontiforme: Poeciliidae) collected during the reproduction period at three different sites by their level of exposure to polluting sources. Sidi Brahim (urban) and El Karma (agricultural) compared to Oued Messida (El Kala) which is considered as a reference site. The biometric study of *Gambusia affinis* reveals that the weight and linear growth of individuals from Oued Messida and El Karma are greater than that of individuals from Sidi Brahim, the results also show an inhibition of AChE activity observed in individuals from Sidi Brahim ( $p < 0.0001$ ) compared to that of El Karma and Oued Messida. This inhibition is more marked in males compared to females of Sidi Brahim during the reproduction period. Analysis of variance with two classification criteria indicates a site effect ( $F = 200.4$ ;  $p < 0.0001$ ) and a sex/site interaction ( $F = 65.36$ ;  $p < 0.001$ ). In conclusion, the site of Sidi Brahim is affected by significant pollution compared to those of El Karma and Oued Messida. In addition, males represent a greater sensitivity to environmental stress than adult females at 3 sites.

**Keywords:** Pollution, *Gambusia affinis*, Weight and linear growth, Acetylcholinesterase, Reproduction

# Characterization of shrimp *Palaemon adspersus* in Eastern Algeria: biometric parameters, reproductive potential and biomarkers activities

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The present study was aimed to assess the potential hazards of two commercial formulations of pesticides such as Actara® (Thiamethoxam ) and Herbasate (Glyphosate) on the non-target organisms shrimps *Palaemon adspersus* (Rathke, 1837) (Decapoda, Palaemonidae). Actara® (25 g in 100 g of thiamethoxam insecticide) belongs to neonicotinoids, which is the most widely used insecticide class for controlling various insect pests in the world and Herbasate (360 g/L of glyphosate) is a no selective, systemic herbicide, ranked among the most extensively used agricultural chemicals worldwide. In this context, the sublethal (LC10, LC25) and the lethal (LC50, LC90) concentrations against shrimp *P. adspersus*, were estimated. Then the sublethal effects of the both compounds were investigated in laboratory conditions on the activity of glutathione-S-transferase (GST) and acetylcholinesterase (AChE), biomarkers of oxidative stress and neurotoxicity, respectively. The compounds were added farmed sea water adult *P. adspersus* at different concentrations and mortality was recorded after 96 hours of exposure. Measuring the enzymatic activity (mM/ min / mg protein) of GST and AChE was performed in the control and treated with Actara® and Hebasate after for 96 hours of exposure. The data obtained reveal a significant increase in the activity of GST and a significant decrease in specific AChE activity. The both compounds at the sublethal concentrations showed an acute toxicity with a dose effect; also induction of GST and inhibition of AChE on this non-target species.

**Keywords:** {*Palaemon adspersus*}, Biometry, Sex ratio, fertility, Glutathione S-transferase (GST), Acetylcholinesterase (AChE).

## **Lethal effects of a biopesticide Azadirachtin on development of the Mediterranean flour moth, *Ephestia kuehniella* Zeller**

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Insect pests, considered as one of the major problems in agriculture, can also be vectors of pathogens and pose a threat to animals, including humans. Thus, in the context of sustainable development, non-polluting pesticides have been marketed by pharmaceutical and phytosanitary firms. Among these molecules, biodegradable and low environmental impact azadirachtin. Therefore, the purpose of this study is to evaluate the lethal effects (DI50) of a commercial formulation of azadirachtin, Neem oil, in a lepidopteran pest of stored *Ephestia kuehniella*, on embryonic development. Azadirachtin was administered in vivo to newly emerged female pupae of *E. Kuehniella*, by topical application at the dose 1.37  $\mu\text{g}$ ; For inhibition of 50 (ID50). This insecticide was diluted in acetone and 2 $\mu\text{l}$  was deposited on the ventral surface of the abdomen of the pupae. The aim of our study was to evaluate the action of this molecule on pupal development by examining its effect on: (i) the duration of pupal development, (ii) the induced different morphological types, and (iii) weight changes of chrysalis in a major pest of stored products: *Ephestia kuehniella* Zeller (Lepidoptera:Pyralidae). The results showed that azadirachtin had no effect on the duration of nymphal development, showed a high level of morphological types by comparison with the controls and significantly reduced the weight of the pupae at different days compared to the controls.

**Keywords:** Biopesticide, toxicity, *Ephestia kuehniella*, development

## **Characterization and remediation of an industrial contaminated site: a case study in the North-Italy**

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This research aims to retrace the entire design process of a remediation intervention on a contaminated site as defined by the Italian legislation in force. It is considered a site of national interest in Northern Italy, including a disused industrial plant, where, after the uncontrolled disposal of toxic - noxious waste in liquid and solid state, soil and groundwater contamination was generated throughout the area surrounding the production plant. Survey campaigns were carried out in the period 2004-2006, in 2007 and in 2011 in order to elaborate the geological, geotechnical and hydrogeological model of the site. The environmental health risk analysis procedure was developed, reporting the characterization plan for the study site and the considerations on the contaminated environmental components based on the analyzes carried out. In addition, the possible reclamation and safety techniques that can be used in order to achieve the goals described in Legislative Decree 152/06 "Consolidated Environmental Act" are described. For the environmental characterization of the site, the results of three survey campaigns that took place in the period 2004-2006, in the year 2007 and in the year 2011 were investigated, as well as the collection of existing data, in order to sample and carry out chemical analyzes of the soils and groundwater, determining the state of contamination of environmental components. A widespread state of contamination emerged from the result of the investigation campaigns. For the soil and subsoil matrix, both superficial and deeper contamination by hydrocarbons, especially heavy ones, emerged, the presence of which is due to the industrial activities previously carried out on the site; also emerged industrial-type organic contaminants of non-petroleum origin such as halogen aliphatic derivatives and metals such as hexavalent Cr, Hg and Pb or As and Zn, whose origin has not been well defined. For the water environment, understood as surface and groundwater came out a higher concentration of metals (Al, Pb, Ni, Mn) than the limits imposed by the Italian legislation (organic contaminants such as trichloroethene, tetra-chloroethene and vinyl chloride). From the characterization it emerged the need to carry out an environmental remediation and / or site safety intervention. Therefore, two distinct areas have been identified (Zone 1 and Zone 2) for which different interventions have been planned both in terms of aims and execution methods. For Zone 1, a permanent safety intervention was chosen by means of waterproof belts with a composite plastic diaphragm in order to reduce the transport of contaminants downstream of the plant area. The aim of this intervention is to decrease the flow into landfill areas and therefore the migration of contaminated products towards sensitive targets. In the Zone 2, an environmental remediation and restoration intervention is presented consisting in the removal of contaminated soil up to a depth to which the water table is placed and next reclamation intervention with injection of the HRC reagent that is capable of accelerating natural bio-degradative processes for the contaminated substances. Therefore, widespread state of contamination relating to several environmental components, has led to the choice of the intervention consisting of a double environmental remediation operation, both of the subsoil matrix and of the water environment.

**Keywords:** soil reclamation, aquifer reclamation, North-Italy, industrial waste.



# Prevalence of allergic rhinitis related to long-term exposure to indoor air pollution

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**INTRODUCTION:** There are limited epidemiological studies performed on the correlation of indoor (long-term exposures) air pollution and rhinitis.

**AIMS:** This cross-sectional study investigates the association of exposure to indoor air pollution sources (particulate matter from domestic combustion and pet allergens) with allergic rhinitis in a sample of 100 people (50 women and 50 men, aged from 35 to 61 years) that spend over than 80% of their time at home. All patients enrolled in this research live in a small rural village in the south Italy.

**METHODS:** For each patient were carried out clinical tests, social analysis and environmental survey, accordingly to the results of these investigations, four study groups were organized (H1: using open fireplace; H2: using closed fireplace, P1: living with pets; P2: living without pet).

**RESULTS & CONCLUSION:** It results that P1 group is more prone to rhinitis and presents higher values of Atopy and IgEtot than patients of P2 group. Seasonal rhinitis is higher in people using open fireplace compared to closed fireplace (13% vs 8%), but the use uncertified wood and pellet stoves could cause the same dispersion of PM in the home and it seems to affect rhinitis phenomena at the level of the upper airways. Eosinophils %, IgEtot and Absolute Eosinophils are lower in H1 group. Rhinitis Severity Index (RSI) shows that cases of severe rhinitis (intermittent/persistent) are indistinctly present in all groups, with a little positive percentage in P1 and H1 groups. All results are summarized in the table 1.

**Keywords:** Indoor air pollution, Rhinitis, Long-term exposure

Classification criteria and clinical results

<b>Classification Criteria</b>			
<b>Indoor Exposition</b>	<b>Group Code</b>	<b>Sources of PM<sub>10</sub>-PM<sub>2.5</sub>/Allergens</b>	<b>%</b>
<b>H (Home Heating)</b>	H1	Open fireplace-Wood Stove	63
	H2	Closed fireplace-Pellet Stove	37
<b>P (Pet allergens)</b>	P1	Pet	68
	P2	No Pet	32
<b>Results</b>			
<b>Group Code</b>	<b>Eosinophils (%)</b>	<b>IgE<sub>tot</sub> (UI/mL)</b>	<b>Absolute Eosinophils/l</b>
<b>H1</b>	3.4	238	0.26·10 <sup>9</sup> /l
<b>H2</b>	4.3	262	0.48·10 <sup>9</sup> /l
<b>Group</b>	<b>Rhinitis (%)</b>	<b>IgE<sub>tot</sub> (UI/mL)</b>	<b>Atopy (%)</b>
<b>P1</b>	72	304	60
<b>P2</b>	57	231	55
<b>RSI</b>	<b>H1-P1 &gt; H2-P2</b>		

## Global environmental change and women

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Recent and rapid global environmental change represents an issue of considerable interest and urgency. The health consequences of global environmental change profoundly affect women, who play a key role in building mitigation, adaptation and resilience. The global climate crisis threatens most people and their human rights. The adverse consequences of climate change will worsen. Addressing climate change is a health and human rights priority, and action cannot be delayed. Mitigation and adaptation measures must be equitable, protecting and promoting human rights. To highlight the need of innovative and collective strategies, we included a gender perspective as a significant dimension in sustainability and development of environmental policies. The consequences of GEC can result into extreme natural events, catastrophes and climate change. Long periods of drought, floods, excessive heat and cold waves are at the root of the socio-economic changes of a large part of the world's population and ecosystems. A quarter of the earth's surface is at risk of desertification. Excessive rainfall and intense heat put crops at risk, causing famine and malnutrition. GEC poses new and in some cases unprecedented threats to human security.

Gender equality is a fundamental human right as well as a cornerstone of a prosperous, modern economy that generates sustainable inclusive growth. Defense of human rights and gender equality are an emerging and recently considered issue when associated with environmental policies. Women have higher rates of death than men from extreme weather events, such as hurricanes and other storms. Pregnant women are especially susceptible to vector-borne disease, such as malaria, and waterborne disease. Because of longstanding bias and discrimination, in many countries women have fewer resources to deal with damage and loss from extreme weather events.

Women are also increasingly proactive in negotiating and adopting individual and collective innovative strategies for dealing with and adapting to global environmental change. In 2015 the United Nations launched the Sustainable Development Goals (SDGs), common goals that concern and involve all countries and all individuals: "leaving no one behind". The 2030 Agenda for Sustainable Development includes 17 goals that are interconnected, the success in one affects success for others. SDGs represent a unique and greatest chance we have to improve life for future generations, and in particular for women and girls. The problems related to the availability of resources, the impact of their use, natural risks and climate-environmental changes, have imposed on the recent scientific and political debate the need to approach the problem from a gender perspective (SDG5). The ability to mitigate and adapt is also mediated by social, economic, cultural, institutional and biological factors; the inclusion of gender issues must ensure adaptation and mitigation programs where women must be seen as the protagonists of sustainable life choices due to the role they play in the family and in society. Environmental justice is not possible without effective gender equality and the elimination of inequalities is not in contradiction with the fight against environmental change. The fight against global environmental changes are closely interlinked with sustainable development. The intertwining of the components of the socio-ecological system and the ways in which women try to respond, both individually and collectively, represents one of the fundamental steps in the policies to contain global environmental changes.

Women are responsible for subsistence agricultural work and in the conservation and redistribution of water, often without being paid back. Development can be considered truly sustainable only if the most effective and fair decision-making actions include a gender perspective. Community and ecosystem intervention should be based on the best available science integrated with traditional and indigenous knowledge, by gender-sensitive approaches into relevant social, economic and environmental policies.

**Keywords:** global environmental change, women, adaptation, mitigation, policies

# Investigation of BTEX pollutants in indoor air with INTERA platform in Southeastern Bulgaria

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Air quality in the rooms is part of the internal environment, which includes physical factors and psychological aspects. The quality of air in a rooms can be exacerbated by volatile organic compounds generated inside the room. The group of volatile organic pollutants consists of Benzene, Toluene, Ethylbenzene, Xylenes (BTEX) and Formaldehyde, Acetaldehyde emissions. The aim of this study was to assess the negative impact on human health of various chemical contaminants in schools and kindergartens. Studies covering southeast Bulgaria, affecting the most vulnerable groups of residents 5 years and 5-15 years. Evaluation was based on grid computing space INTERA. From the data the impact on boys is most pronounced for the inhabitants of the site in the village Karamantsi, followed by secondary schools in Haskovo and Kardzhali, which achieved doses reach 8.1 – 17.0  $\mu\text{g}/\text{m}^3$ . When acetaldehyde achieved dose is high for a site in the village Shiroko Pole - 8.4  $\mu\text{g}/\text{m}^3$ . All calculated by the platform rate targets show that relatively high values of the studied indicators refer to sites where they carried out repair and renovation works, during which was not sufficiently careful selection of materials and techniques or in other words the potential health risk from the issue of chemical contaminants has been consistently underestimated. For both genders other pollutants such as aliphatic hydrocarbons are much less significant impact on the majority of the tested indicators are the limits of detection of these contaminants. Obviously, and the expected level of creating health risks they may deem negligible. Comparisons were made with the results of the monitoring of background loads. The experience of comparing the values obtained for chemical contaminants in the surveyed objects shows that there is a relationship both with background stresses and with the new introduced new materials and techniques in specific sites.

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**Keywords:** BTEX, indoor air pollution, exposure assessment, health risk, building materials

# Investigations of thermal stability on different fuels and bio-wastes

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Fuels supply and their quality is considered as the main topic for coming innovations and industrial sustainable development. There are a number of studies how to make the use of fuels mor efficient. The main subject of this paper is to study the content of some treated fuels mixture and to assess their heat capacity under different conditions on the way to be recommended better use in the practice. Thermo-gravimetric (TG) and differential scan calorimetry analysis (DSC) was used on the way to assess their heat capacity for sustainable use of Carbon, Hydrogen and Sulfur from fuel mixtures of coal, oil and water under different gas media. Mass changes and residue obtained were also determined. The content of Carbon, Hydrogen, Sulfur and Nitrogen were determined using automated Eurol A 3000 analyzer. Two samples NV-RQ-1 and NV-RQ-2 mixtures of coal and oil were used during studies. It was found that the content of Carbon in sample NV-RQ-1 is 82.92%wt, when in the sample NV-RQ-2 – it is 88.24%wt; the content of Hydrogen is respectively 10.07 and 10.15%wt; Sulfur is 0.1%wt and Nitrogen – 0.85 and 1.07%wt. TG-DTA curves confirm that the main mass loses are generated in Nitrogen media up to 493°C are 88.-89%wt, when in the air-medium the main loses are up to 406oC and they are 84.8%wt. At final temperatures (about 139°C the mass losses are 89-91.6%wt. The main differences are in the thermal stability - in Nitrogen atmosphere the residue is in liquid form and it is between 8.4-9.3%wt. In the air-medium the resedue mass is about 12.5%wt and is in a solid form. The enthalpy is much higher for the sample NV-RQ-1 in Nitrogen atmosphere – 32.5 MJ/kg, when for the second sample it only 12.5 MJ/kg. On the base the pretreatment applied for sample NV-RQ-1 is recommended.

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**Keywords:** fuels, bio-carbon, TG-DSC studies, enthalpy and thermal stability

## Endocrine disrupting chemicals in indoor dust and the implications for human exposure: preliminary findings

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Personal care products, including cosmetics and pharmaceuticals, are major sources of endocrine disrupting chemicals (EDC), such as parabens and triclosan (TCS) (Mitro et al. 2016). The use of these compounds has resulted in extensive environmental occurrence and human exposure. So far, levels of these chemicals in residences has not yet been fully explored, particularly in indoor dust (Chen et al. 2018; Geens et al. 2009).

The objectives of the study were to determine the concentrations of four parabens and TCS in house dust samples and to estimate human exposure doses to these compounds through ingestion in different life stages (infants, toddlers, children, teenagers and adults). Between May 2018 and February 2019, dust samples from 31 residential homes were collected. The quantification of parabens and TCS was performed by liquid chromatography-tandem mass spectrometry (LC-MS/MS) after solid phase extraction using OASIS MAX Cartridge (Waters). The dust samples analysed correspond to the 63 µm fraction. Estimated daily intake (EDI, ng/kg) through dust ingestion was calculated using the following equation:

$$EDI = (C_i \times IR) / BW \quad (1)$$

where  $C_i$  is the measured concentration of a specific analyte (ng/g) in dust, IR is the daily dust ingestion rate (g/d) and BW is average body weight (kg). Based on the USEPA exposure factors handbook (USEPA 2011), daily dust ingestion rate for infants, toddlers, children, teenagers and adults were 30, 60, 60, 60, and 30 mg, respectively, with average BW for each group at 7.5, 12.6, 25.2, 64.2 and 80 kg, respectively.

All target compounds were detected in all samples, indicating a widespread occurrence of these chemicals in home environments. Concentrations of individual compounds (median) are listed in decreasing order: methyl paraben (MePB) > TCS > propyl paraben (PrPB) > ethyl paraben (EtPB) > butyl paraben (BuPB) (Table 1). The sum of four parabens ( $\Sigma$ PB) ranged from 0.7 to 2770 ng/g, with a median at 82 ng/g.

The large range of observed levels may be associated with the different sources found indoors. Consistent with other studies, MePB and PrPB were the most abundant parabens found in indoor dust (Chen et al. 2018); although different sampling methods, sieved fractions, sample preparation techniques and analytical methods might influence the differences found among studies. Individual parabens concentrations were positively correlated, particularly for MePB and PrPB (Spearman's  $\rho=0.710$ ;

$p < 0.001$ ), indicating similar sources. Table 2 summarize the maximum, median and mean EDI of  $\Sigma$ parabens and TCS.

Median EDI varied from 0.33 (adults) to 3.50 (toddlers) and 0.05 (adults) to 0.61 (toddlers) for total parabens and TCS, respectively. In general, infants and toddlers had about 10 times higher EDI of parabens and TCS than the ones for adults. It is possible that toddlers use fewer products containing parabens and TCS than adults; therefore, dust ingestion may contribute more to total intake for infants and toddlers than for children and adults.

The present study investigated the levels of important environmental contaminants: MePB, EtPB, PrPB, BuPB and TCS in indoor dust samples. Assessing the occurrence of these chemicals can lead to a better understanding of their environmental distribution.

Median concentrations in 31 domestic dust samples were 550, 56, 110, 9.8 and 130 ng/g for MePB, EtPB, PrPB, BuPB and TCS, respectively. In general, toddlers and infants had higher EDI of parabens and TCS thus may be more affected by exposure through dust.

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### References

Chen J., Hartmann E. M., Kline J., Wymelenberg K. V. D., Halden R. U. 2018. Assessment of human exposure to triclocarban, triclosan and five parabens in U.S. indoor dust using dispersive solid phase extraction followed by liquid chromatography tandem mass spectrometry. *J. Hazard Mater.* 360: 623-630.

Geens T., Roosens L., Neels H., Covaci A. 2009. Assessment of human exposure to Bisphenol-A, Triclosan and Tetrabromobisphenol-A through indoor dust intake in Belgium. *Chemosphere.* 76: 755-760.

Mitro S. D., Dodson R. E., Singla V., Adamkiewicz G., Elmi A. F., Tilly M. K., Zota A. R. 2016. Consumer product chemicals in indoor dust: a quantitative meta-analysis of U.S. Studies. *Environ. Sci. Technol.* 50: 10661-10672.

US-EPA. 2011. Exposure Factors Handbook 2011. (Edition (final)) (2011). Washington, DC.

**Keywords:** parabens, triclosan, indoor dust, daily intake

Table 1. Individual parabens and TCS concentrations (ng/g) found in 31 indoor dust samples

	MePB	EtPB	PrPB	BuPB	TCS
Median	550	56	110	9.8	130
P25	200	28	71	4.8	767



P75	1300	91	210	16	250
Mean	830	69	190	14	203
Min	71	7.8	18	0.68	24
Max	2800	210	1200	100	1230

MePB: Methyparaben; EtPB: Ethylparaben; PrPB: Propylparaben; BuPB: Butylparaben; TCS: Triclosan; Min: Minimum; Max: Maximum

Table 2. Estimated daily intake of  $\Sigma$ Parabens and TCS via dust ingestion for different age groups

	$\Sigma$ Parabens			TCS		
EDI, ng/kgBW/d	Max	Median	Mean	Max	Median	Mean
Infants	12.45	3.50	4.41	5.00	0.52	0.89
Toddlers	14.82	4.16	5.25	5.95	0.61	1.06
Children	7.41	2.08	2.62	2.97	0.31	0.53
Teenagers	2.91	0.82	1.03	1.17	0.12	0.21
Adults	1.17	0.33	0.41	0.47	0.05	0.08

Max: Maximum; TCS: Triclosan

## Changes in metabolic profile of lettuce plants fertilized with olive oil mills sludge

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Climate change is one of the most important themes of the 2030 Agenda. The sustainable resource use, in particular of agro-industrial processing waste, represents a possible solution in a management system based on circular economy models, in which wastes replace non-renewable conventional raw materials. In this perspective, it is possible to preserve or restore soil fertility by the agricultural use of waste biomass, and also improve the crops productivity due to their organic matter and nutritional elements contents. However, it is necessary to consider the possible environmental risk due to the residual substances accumulation in the soil, and their subsequent uptake by crops against the agronomic and economic advantages.

In Italy, olive growing is one of the most widespread, ancient and characteristic agricultural activities of the typical landscape of many regions. A large olives quantity is destined to milling for the oil production. By these processes are accumulated as by-products a large quantity of solid residue (pomace) and liquid waste (mills wastewater).

Studies carried out on oil mill waste have shown that processing residues, characterized by a high content of inorganic salts and organic matter, even if they not meet the definition of waste, cannot be directly spilled into water bodies or onto soil.

The olive oil mill sludge chemical-physical composition is variable as it depends on the extraction technology (pressing or centrifugation), the degree of olives ripeness, and their storage conditions. Basically free of pathogens and heavy metals, they contain numerous organic compounds including sugars, polyphenols, lipids, nitrogenous substances, mineral elements such as potassium, phosphorus, calcium, etc., organic acids, such as chicoric, tartaric, and chlorogenic acid, which give the wastewater an acidic pH.

Mills wastewater can be used in others activity but, to the high organic load and low biodegradability due to the presence of polyphenols, whose antimicrobial action is able to slow down the transformation and biodegradation processes, can also be pollutant.

The Italian current legislation (Ministerial Decree 6 July 2005 and Law 11 November 1996, n. 574) provides to the oil mill sludge use in agriculture needs to meet rationality criteria in relation to the quantities, times, methods of spreading, and above all to the particular receiving site conditions. In particular, the Law 11 November 1996, n. 574 allows the administration of mills wastewater effluents on cultivated fields as long as they are "controlled", that is, in compliance with indispensable agronomic and environmental compatibility conditions.

In this work, olive oil mill sludge were used to restore and/or improve the agricultural soils functional qualities, simultaneously carrying out their characterization, their usefulness verification as fertilizers, and studying use methods and techniques to avoid any negative effects on soil, crops, groundwater and humans.

The first phase of the experimentation was carried out in open chambers, closed-cycle for mass balances (mesocosms), in order to carry out an agronomic, environmental and toxicological evaluation of the sludge effects on the soil, and on lettuce used as a witness organism. Lettuce cultivations were carried out on both, sandy and loamy-clay, soil types.

The analyzed parameters include the chemical-physical characteristics of the investigated soils, and the content of some elements in the plants edible portions, determined with ICP-OES. Moreover, the biometric characteristics with optical methods and nuclear magnetic resonance spectroscopy (NMRS) were detected to define any changes of the vegetables metabolic profile. These parameters represent significant agro-environmental indicators in evaluating the effectiveness of the waste biomass use in the cultivation of fruit and vegetable crops. In both soils used, an increase in the organic matter content, available P, and total Cu was observed. From the first genotoxicity tests conducted in laboratory on the experimentation soil samples, it would seem that the repeated over time sludge use can cause toxicity. As regards the nutrient contents of in plants, treatment with olive oil mills sludge showed a variation only in Na and Cu contents. NMR analysis showed the major differences in the region of the phenolic compounds respect to the control one, especially in the lettuce samples cultivated in the sandy soil. The results of the plants' biometric examination submitted to the treatments showed an increase in the ratio between leaf area and primary root length in mesocosms treated with olive oil mills sludge in comparison to the control, especially in the clayey-loamy soil. Further experimental tests will be carried out to confirm the obtained data of this first phase research and to define a method of treatment of mill wastewater in order to eliminate or reduce its toxicity.

**Keywords:** olive oil mills sludge, fertilization, lettuce, phenolic content, toxicity

## Evaluation of bioindicators parameters of male rats Wistar exposed to fungicide chlorothalonil

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The aim of the present investigation was to evaluate the possible adverse effects of the fungicide Chlorothalonil on the haematology and serum parameters of male Wistar. The doses 60mg/kg and 180 mg/kg b.wt /day were given to the male rats in the diet for 8 weeks. At end of treatment period, all animals were scarified, the blood was collected and the organs were removed. The obtained results showed an increase in the weight of the liver and kidney associated by changes in the biochemical parameters related to the liver and renal functions, manifested by an increase in the serum transaminase concentration (ASAT, ALAT). The level of glucose and urea serum concentrations and Protein content was increased significantly when exposed to the used fungicide. A decrease in the albumin, creatinine concentrations, and protein, triglycerides were observed in the treated groups as compared to control rats. Concerning, the haematological parameters, a decrease in total erythrocyte count, haemoglobin content, haematocrit and platelets value were observed, associated with an increase in the total leukocyte count was recorded also in the treated groups as compared to the control.

**Keywords:** Chlorothalonil, toxicity, biochemical and haematological parameters, rats

Table 1. Variation of hematological parameters in different groups after 4 weeks of treatment 04 (m ± sd, n = 7).

Biochemical parameters	Control: G1	G2:Treated group 60mg/kg BW	G3: Treated group 180mg/kg BW
ASAT(U/l)	286, 67 ± 39,02	301,83 ± 59,2 ns	336,28 ± 53,27 ns
ALAT (U/l)	14,54 ± 7,08	28,92 ± 7,8 *** 5	54,23 ± 7,1 ***
Total Protein (g/l)	123,69 ± 10,502	114,67 ± 9,82 ns	106,6 ± 3,6 ns
Albumine (g/l)	32,89 ± 3,36	31,85 ± 4,73 ns	30,14 ± 3,38 ns
Triglycerides (g/l)	0,95 ± 0,3	0,62 ± 0,34 ns	0,55 ± 0,15 *
Glucose (g/l)	1,17 ± 0,07	1,21 ± 0,15 ns	1,21 ± 0,2 ns

Table 2. Variation of hematological parameters in different groups after 4 weeks of treatment 04 ( $m \pm$  sd,  $n = 7$ ).

Biochemical parameters	Control: G1	G2:Treated group 60mg/kg BW	G3: Treated group 180mg/kg BW
ASAT(U/l)	286, 67 $\pm$ 39,02	301,83 $\pm$ 59,2 ns	336,28 $\pm$ 53,27 ns
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# **Sustainability of compact, high magnetic field fusion reactors: the impact on environment, society and economy**

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Fusion energy is commonly considered a sustainable energy source, bringing the potential of limitless fuel. However, sustainability does not refer to resources' availability only, but encompasses the environment, society and economy. When considering the whole life-cycle of the reactor, from resource extraction for fuel and components to the waste management, sustainability may be challenged. Deuterium is largely abundant in seawater, but tritium is not present in nature and must be bred from lithium, whose reserves are finite. Beryllium and rare earths, which are exploited in the neutron multiplier and in the superconducting coils, are even more critical resources. Resource scarcity may damage fusion energy economy, and the uneven distribution of these resources may be an obstacle to energy equity. Even more common materials, such as concrete or steel, should be accounted when considering sustainability, due to the carbon footprint associated to their production. Furthermore, fusion reactor components are subject to neutrons activation, becoming nuclear wastes at the end of life. Finally, the whole cycle may not be economically feasible. The present work investigates the sustainability (from the environmental, social and economic viewpoint) of a high magnetic field tokamak, taking ARC as representative of this reactors' class. Material requirements for construction, components and maintenance are estimated and compared to current reserves. Materials activation at the end-of-life is assessed for the vessel components, and the wastes are classified and quantified. Special attention is paid to the impact of the new technologies implemented in ARC, such as the FLiBe liquid blanket or the REBCO superconductors.

**Keywords:** Sustainability, Natural resources, Wastes, Fusion energy, Affordable Robust Compact (ARC), Tokamak

# **Infertility: knowledge and attitudes of Moroccan young people. Gender approach**

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**BACKGROUND:** The knowledge and the beliefs of people could affect the fertility of women and men all over the society. According to gender, the aim of this study was to describe knowledge level and attitude of Moroccan young people about infertility.

**MATERIALS-METHODS:** We conducted this descriptive study in Marrakesh-Safi region in Morocco. We selected 355 Moroccan young people by a simple random sampling method, during 2019 and using a previously validate questionnaire.

**RESULTS:** Both of female and male had a low level knowledge about the meaning, causes and treatment of infertility (20,8% of female versus 25,6% of male who had infertility information ( $p = 0,041$ )). Even, the most of the participants thought that infertility is a god's will (92% of female versus 84, 5% of male), The result shows that the majority had agreed that the first resort is consulting a medical advice (82,3% of women versus 79,1% of men). If the infertility treatment fails, the percentage of male who had proposed the polygamy as solution was higher than female (22,5% versus 6, 6%). The adoption was the second solution proposed and accepted by both male and female. Beside, the minority had accepted divorce as alternative (3,5% of female versus 3,1% of male).

**CONCLUSION:** The result of our study reflects the fact that it's important to investigate on education and a public awareness about fertility in order to upgrade the level of knowledge and attitudes of Moroccan young people (the future parents).

**Keywords:** Infertility, knowledge, Attitude, Gender approach, Moroccan young people.

# Cadmium Bioaccumulation and Translocation in *Brassica napus* L. at Flowering and Maturation: a Case Study

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The processes of urbanization and industrialization have caused a global increase of agricultural soils contaminated by heavy metals. The attention on the wide dispersion of cadmium in the environment and in food has increased. Phosphorus fertilizers contain cadmium (Cd) as a contaminant and they therefore represent a major source of Cd input in agricultural systems. With regard to the effects of cadmium on human health, the major route of exposure to Cd for non-smokers is via food. It is only tolerated at extremely low concentrations and excesses are associated with many adverse health effects. Plants will accumulate Cd from the soil with the amount of uptake depending on a wide range of factors including soil Cd total and potentially bioavailable concentrations, the soil's chemical, physical and biological characteristics, agricultural management practices and crop genetics. The bioavailable heavy metal fraction, which is potentially assimilated by biota, is of great interest in soil contamination studies because it is the environmentally most mobile. The cultivation of *Brassica napus* is widespread all over the world and can accumulate relatively high amounts of toxic metals. The aim of this work was to verify the existence of a threshold effect in the capacity of *Brassica napus* to bioaccumulate cadmium from the soil and to translocate it to the shoots attributable to the phenological state of the crop and/or to the soil pollution level. The cadmium effects on the *Brassica napus* biomass production, on the cadmium uptake and on the morphological parameters were also investigated and the bioconcentration factor (BCF) and the translocation factor (TF) were also processed. Pot experiment was carried out in controlled conditions. The soil was contaminated with two concentrations of cadmium (50 and 100 mg kg<sup>-1</sup> soil) administered to soil as cadmium sulphate. Plants were collected at flowering and maturation time. The cadmium concentration of the plant and soil was determined after acid digestion by Inductively Coupled Plasma (ICP). Cadmium uptake was calculated for each growth stage. The results showed that the *B. napus* tolerate and bioaccumulate cadmium during the entire life cycle but the behaviour of cadmium in plants was different in flowering and maturation. The higher heavy metal removal by shoots was found at flowering while, at maturation, the oilseed rape seems to be more active in bioaccumulating cadmium in roots. Positive linear correlation coefficient was found between cadmium in soil and shoots removals both for contamination levels and for phenological stages. It has been highlighted that the BCF elaborated using the bioavailable cadmium concentration in soil showed values more close to 1 both at flowering and maturation respect to BCF elaborated using total cadmium concentration in soil. This result highlighted that the fraction bioavailable of heavy metals in soil should be considered in assessing the applicability of phytoremediation strategies on contaminated soils. These features could make this crop capable of being used on soils with high levels of cadmium in innovative and eco-sustainable techniques for controlling contaminants in the soil-plant system as, for example, the development of phytoextractor-crop rotation systems.

**Keywords:** soil cadmium contamination, cadmium bioavailability, phytoextraction, {*Brassica napus*}, rape.



# Effects of air pollution on daily hospital admissions for cardiovascular diseases in Castilla-La Mancha, Spain

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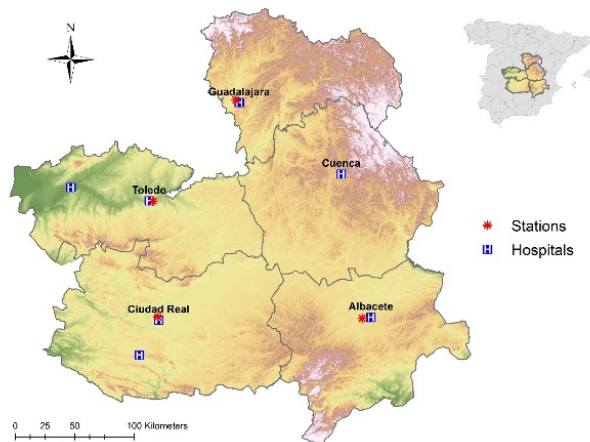
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Although several health effects of air pollutants studies have been conducted in Spain few have been conducted in Castilla-La Mancha (CLM) (Gabriel et al., 2008; Nájera et al., 2009; Amor et al., 2015; Santurtun et al., 2017). The autonomous community of CLM is located in the middle-southeast of Spain (Figure 1). The region of CLM covers an area of 79,463 km<sup>2</sup>, which in 2015 was home to 2,048.900 inhabitants. It is the most sparsely populated autonomous community of Spain (representing approximately 4.4% of the country's population) (Eurostat, 2018).

Health and environmental data over a period of 10 years (2006-20015) were collected in order to evaluate the relationship between the risk of hospital admission for cardiovascular disease (CVD) and exposure to daily air pollution concentration (PM<sub>2.5</sub>, PM<sub>10</sub> and NO<sub>2</sub>), temperature and relative humidity in CLM. Possible exposure misclassification while using pollution data from one central monitoring station were checked by sensitivity analysis by restricting the CVD hospital admission to the nearest hospital to air quality monitoring station (Toledo).

A time-series analysis with generalized linear model was used to examine the effects of air pollution on hospital admissions by controlling for long-term trend and potential confounders. The effect modification by gender and age (15–64; ≥65 years) was examined. Lagging exposure concept was used to analyze a possible latency period in cumulative exposure-pollution analyses (Table 1).

Finally, we found that the elderly (≥65 years) were the most susceptible group to the effect of air pollution, whereas the effect estimate for sex was significantly different depending on the age group.



**Figure 1.** Map of the study area and locations of air quality monitoring stations and hospital

**Table 1.** RR and 95% confidence intervals for significant associations between air pollutants and daily cardiovascular hospital admission due to lag effects in the cities studied.

City	Pollutant	lag	Relative Risk	CI	City	Pollutant	lag	Relative Risk	CI		
TOLEDO	PM <sub>2.5</sub>	0	1.028	<b>1.009-1.048</b>	ALBACETE	PM <sub>2.5</sub>	0	1.013	0.997-1.028		
		1	1.002	0.982-1.023			1	0.998	0.982-1.014		
		2	0.986	0.966-1.007			2	0.999	0.983-1.016		
		3	0.996	0.975-1.016			3	0.993	0.977-1.010		
		4	1.011	0.990-1.031			4	1.008	0.991-1.025		
		5	1.013	0.993-1.034			5	1.008	0.992-1.025		
		6	1.006	0.986-1.027			6	1.007	0.991-1.024		
			7	0.999	0.980-1.018			7	0.999	0.983-1.014	
		PM <sub>2.5</sub> Only Toledo*	0	1.048	<b>1.015-1.081</b>		PM <sub>10</sub>	0	1.013	<b>1.008-1.018</b>	
			1	1.005	0.971-1.040			1	0.997	0.992-1.002	
			2	0.982	0.948-1.016			2	0.993	<b>0.987-0.998</b>	
			3	1.017	0.983-1.052			3	0.998	0.993-1.003	
			4	0.997	0.963-1.031			4	0.999	0.994-1.004	
			5	1.006	0.972-1.041			5	0.998	0.993-1.003	
			6	1.016	0.982-1.051			6	1.006	<b>1.001-1.011</b>	
			7	1.009	0.977-1.042			7	1.006	<b>1.001-1.011</b>	
		PM <sub>10</sub>	0	1.025	<b>1.019-1.030</b>		NO <sub>2</sub>	0	1.042	<b>1.036-1.050</b>	
			1	0.997	0.991-1.003			1	1.000	0.993-1.008	
			2	0.993	0.987-1.000			2	0.991	<b>0.983-0.998</b>	
			3	1.001	0.994-1.007			3	0.991	<b>0.984-0.998</b>	
			4	0.994	0.987-1.000			4	0.998	0.991-1.005	
			5	1.000	0.993-1.006			5	0.996	0.989-1.004	
			6	1.003	0.996-1.009			6	1.001	0.994-1.008	
			7	1.009	<b>1.003-1.015</b>			7	1.022	<b>1.015-1.029</b>	
		PM <sub>10</sub> Only Toledo*	0	1.035	<b>1.025-1.045</b>	CIUDAD REAL	PM <sub>10</sub>	0	1.015	<b>1.010-1.020</b>	
			1	0.991	0.980-1.002				1	0.998	0.993-1.004
			2	0.992	0.981-1.003				2	0.999	0.994-1.005
			3	1.010	0.999-1.021				3	0.994	<b>0.989-0.999</b>
	4		0.988	0.977-0.999				4	0.998	0.993-1.004	
	5		1.003	0.992-1.014				5	0.997	0.992-1.003	
	6		1.001	0.990-1.011				6	1.006	1.000-1.011	
		7	1.007	0.997-1.017			7	1.005	1.000-1.009		
	NO <sub>2</sub>	0	1.011	<b>1.007-1.015</b>		NO <sub>2</sub>	0	1.035	<b>1.027-1.043</b>		
		1	1.005	1.000-1.009			1	1.1020	1.002-1018		
		2	0.995	<b>0.995-0.999</b>			2	0.990	<b>0.982-0.998</b>		
		3	0.999	0.995-1.004			3	0.997	0.989-1.015		
		4	1.005	1.001-1.010			4	1.007	0.999-1.015		
		5	0.997	0.993-1.001			5	0.988	<b>0.980-0.996</b>		
		6	0.999	0.995-1.004			6	1.001	0.993-1.009		
		7	1.005	<b>1.001-1.010</b>			7	1.013	<b>1.006-1.021</b>		
	NO <sub>2</sub> Only Toledo*	0	1.014	<b>1.004-1.024</b>	GUADALAJARA	PM <sub>10</sub>	0	1.026	<b>1.021-1.031</b>		
		1	1.007	0.997-1.017				1	0.999	0.993-1.004	
		2	0.998	0.987-1.008				2	0.984	<b>0.979-0.990</b>	
		3	0.996	0.986-1.007				3	1.001	0.995-1.006	
		4	1.005	0.995-1.015				4	0.994	<b>0.988-0.999</b>	
		5	0.999	0.989-1.009				5	0.997	0.992-1.003	
		6	0.997	0.986-1.007				6	1.006	1.000-1.011	
		7	0.998	0.988-1.008			7	1.012	<b>1.007-1.017</b>		
						NO <sub>2</sub>	0	1.014	<b>1.010-1.018</b>		
							1	1.003	0.999-1.007		
							2	0.993	<b>0.989-0.997</b>		
							3	0.995	<b>0.991-0.999</b>		
							4	1.000	0.996-1.004		
							5	0.997	0.993-1.001		
							6	0.997	0.993-1.001		
						7	1.011	<b>1.007-1.015</b>			

\*Only in Toledo: Exclusively admissions from Toledo Hospital, the closest location to the measuring station.

## References

Amor, A.J., Masana, L., Soriguer, F., Goday, A., Calle-Pascual, A., Gaztambide, S., Rojo-Martínez, G.,

Valdés S., Gomis, R., Ortega, E., 2015. Estimating Cardiovascular Risk in Spain by the European Guidelines on Cardiovascular Disease Prevention in Clinical Practice. *Rev. Esp. Cardiol.* 68, 417-425. <http://dx.doi.org/10.1016/j.rec.2014.05.023>

EUROSTAT, 2018. Internal Market, Industry, Entrepreneurship and SMEs: Regional Innovation Monitor Plus. ES42: Castilla la Mancha URL: <https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/base-profile/castilla-la-mancha> (accessed June 08, 2020)

Gabriel, R., Alonso, M., Segura, A., Tormo, M.J., Artigao, L.M., Banegas, J.R., Brotons, C., Elosua, R., Fernández-Cruz, A., Muñoz, J., Reviriego, B., Rigo, F., 2008. Prevalence, Geographic Distribution, and Geographic Variability of Major Cardiovascular Risk Factors in Spain. Pooled Analysis of Data from Population-Based Epidemiological Studies: The ERICE Study. *Rev Esp Cardiol.* 61, 1030–40. [https://doi.org/10.1016/S1885-5857\(09\)60006-2](https://doi.org/10.1016/S1885-5857(09)60006-2)

Nájera, A., Arribas, E., De Pablo, F., Tomás, C., 2009. Aspectos climáticos de la ciudad de Albacete (1961-2005). Editorial Capitán Swing Libros, España. ISBN: 978-84-613-2211-4

Santurtun, A., Ruiz, P. B., Lopez-Delgado, L. Sánchez-Lorenzo, A., Riacho, J., Zarrabeitia, M. T., 2017. Stroke: Temporal Trend and Association with Atmospheric Variables and Air Pollutants in Northern Spain. *Cardiovasc. Toxicol.* 17, 360-367. <https://doi.org/10.1007/s12012-016-9395-6>

**Keywords:** Cardiovascular Diseases, Air Pollution, Hospital Admissions, Time-Series, Castilla-La Mancha, Spain.

## The bactericidal effect of green algae *Cladophora* sp. against humans' pathogenic bacteria

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Recently, there has been a growing interest in researching and developing new antimicrobial agents from various sources to combat microbial resistance. Algae contains antimicrobial substances, which have inhibitory effects on pathogenic microbes. A filamentous macroalgae *Cladophora* sp. was collected from Algerian fountainhead and its crude hydrohalcolique extract (methanol-water) was tested against three standard Gram negative bacteria: *Escherichia coli* (ATCC25922), *Pseudomonas aeruginosa* (ATCC 27853), *Klebsiella pneumoniae* (ATCC 700603) and two standard Gram positive bacteria strains: *Staphylococcus aureus* (ATCC 25923), *Enterococcus faecalis* (ATCC 29212). The antibacterial effect of *Cladophora* sp. crude hydrohalcolique extract was investigated by using the well diffusion method to evaluate the inhibition zones. The MIC values were determined by the dilution method and non-growth tubes were recorded, and then proceed with MBC test. The results indicate that the crude hydrohalcolique extract of *Cladophora* sp, is more powerful against Gram plus bacteria, with a major effect on *Staphylococcus aureus* (ATCC 25923) on which we recorded an inhibition zone of 35mm at 80 mg/l. As for the Gram-negative strains, the ones who are more sensitive were *Escherichia coli* (ATCC25922) with a 46 mm, followed by *Pseudomonas aeruginosa* (ATCC 27853) with 28 mm. These inhibition zones were recorded with a concentration of 100mg/l. The MIC activity of the extract of *Cladophora* sp. was resulted at a concentration of 50 mg/ml for *Staphylococcus aureus* (ATCC 25923), and *Enterococcus faecalis* ATCC (29212), 100 mg/ml for *Escherichia coli* (ATCC25922) and *Pseudomonas aeruginosa* (ATCC 27853). The lowest MBC activity is noted on *Enterococcus faecalis* ATCC (29212) with a concentration of 100 mg/ml. however, the highest bactericidal activity for *Staphylococcus aureus* (ATCC 25923) is 200 mg/ml. The *Cladophora* sp. macroalgae represents a potential source of bioactive compounds which can be used for therapeutic purposes in order to strengthen the antibiotic therapy.

**Keywords:** Antibacterial activity, *Cladophora*, Gram-negative bacteria, Gram-positive bacteria, MIC, MBC.

## The effect of titanium dioxide nanomaterials against cyanobacterial organisms

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Nanomaterials such as metallic nanoparticles are widely used in the different manufacturies due to their inherent properties, for exemple titanium dioxide (NP-TiO<sub>2</sub>) who present ahigh interest as an excellent antibacterial agent against pathogenic microorganisms to human and to the environment. Whereas the massive proliferation of potentially toxic cyanobacteria in water bodies intended to drinking water production threatens public and environmental health because of the toxicity risks related to the bloom forming genera « Microcystis ». For this, we tested in the laboratory three concentrations of NP-TiO<sub>2</sub> (150 mg/l, 300 mg/l and 600 mg/l) on two strains of Microcystis (S1, S2) over a period of eight days. In parallel three biotic variables were measured: Cyanobacterial cells density (cell/ml), Chlorophyll (a) (µg/l) and Phycocyanin (µg/l) contents each 48 hours all along the experimental period. The obtained results showed a decrease in cell densities from 77490 to 39091 cells/ml for the strain (S1) and from 2801 to 0 cells/ml for the strain (S2) with the concentration 600 mg/l. Also the contents of chlorophyll (a) fell from 45 to 8 µg/l for the S1 and from 34 to 0 µg/l for the S2. Similarly, treatment with TiO<sub>2</sub> nanoparticules caused the degradation of phycocyanin from 200 to 65 µg/l for the strain (S1) and from 200 to 0 µg/l for the strain (S2) with the highest concentration of this NPs (600 mg/l). In conclusion, the results of this study reveal that titanium dioxide NPs exhibits a very important antibacterial effect against Microcystis. So NP-TiO<sub>2</sub> can be used in the future to reduce the high biomasses of cyanobacteria during the process of tap water production (pretreatment).

**Keywords:** Cyanobacteria, Microcystis, Titanium dioxide nanoparticles (NP-TiO<sub>2</sub>), Environmental risk, Antibacterial effect.

# Radiation damage investigation on ARC Reactor magnet components

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ARC reactor has been designed with the aim to build a commercial fusion reactor using the best technologies industrially available so far. The design foresees the adoption of innovative high-temperature superconducting materials, allowing a significant size reduction if compared to other reactor designs under constructions, raising though, questions about the shielding and protection from radiation damage of the novel magnet materials and components. One of the key aspects of ARC is the implementation of the REBCO, high temperature superconductors (HTS), in the design of the TF coils. These superconductors are made of multiple layers with specific characteristics. As shown in some recent experimental campaigns, magnets do not only experience mechanical stress induced degradation, but material degradation caused by neutron irradiation as well. Because of that, a new Monte Carlo ad-hoc neutron model has been set up by means of the Open MC code, coupled with the FISPACT-II code. This model has returned results that match with the literature in terms of neutron fluxes, when computed in the vessel and in the back plate for the reference version with Inconel 718 as structural material. However, its aim is to investigate on the radiation damage experienced in the magnets zone as a result of the change of structural material. Results of the neutron model are presented and discussed: it has been observed that the total neutron flux leaving the blanket is  $\sim 10\%$  when V-4Cr-4Ti is used instead of Inconel-718 as a vessel material, with spectral effects (modification of the energy distribution) too. Because of the singular energy spectrum of the neutron flux on the TF coils, results from experimental irradiation studies could only partially be applied to such components. So, a more accurate analysis of the radiation damage dynamics in magnets has been set up by means of SRIM-TRIM package, to investigate on other potential issues. It turns out that the reduction of the uncertainties in radiation damage estimates for the REBCO is the essential point, either they come from the neutronic model or from the material response to neutron irradiation. Some results from the model are presented and discussed.

**Keywords:** HTS, Radiation Damage, ARC

## Formaldehyde, acrolein and other carbonyls in dwellings of university students. Levels and source characterization

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Fifteen carbonyl compounds were investigated in the living rooms and bedrooms of 25 university student flats in the urban area of Ciudad Real (Central Southern Spain) in wintertime. Carbonyls were sampled using Radiello® passive samplers refilled in the laboratory according to the method described in ISO 16000-3 Standard. The most abundant carbonyls at living rooms and bedrooms were formaldehyde, acetone, acetaldehyde, hexaldehyde and butyraldehyde. The median concentration levels in the living rooms and bedrooms were: 28.6 and 34.2  $\mu\text{g m}^{-3}$  for formaldehyde, 18.3 and 23.1  $\mu\text{g m}^{-3}$  for acetone, 14.3 and 15.8  $\mu\text{g m}^{-3}$  for acetaldehyde, 11.4 and 14.1  $\mu\text{g m}^{-3}$  for hexaldehyde and 10.8 and 12.4  $\mu\text{g m}^{-3}$  for butyraldehyde. The median concentration of formaldehyde, benzaldehyde, valeraldehyde and hexaldehyde was significantly higher in the bedrooms than in the living rooms. Indoor concentrations were significantly higher than outdoor concentrations for all carbonyl measured, indicating that sources in the indoor environment are prevailing in all flats. Principal component analysis, multiple linear regressions and Spearman correlation coefficients were used to investigate the origin, the indoor pollutants determinant, to establish common sources between carbonyls or the possible influence of different factors such as floor characteristics, type of heating or smoking. Formaldehyde, acetaldehyde, acrolein, acetone, propionaldehyde and benzaldehyde concentrations were compared with relevant international guidelines, being their concentrations below recommended values except acrolein, where all measured flats exceed the reference levels; it would be important to focus on the characterization of emissions sources of acrolein in indoor air in order to minimise the exposition and health risk.

**Keywords:** Indoor air, Formaldehyde, Carbonyls, passive samplers, PCA, source identification

## **Study on the hepatotoxicity of a fungicide widely used in Algerian agriculture in the wistar rat**

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The use of pesticides has shown its benefits in particular in increasing production yields by eliminating or reducing crop predators. However, behind these benefits lie insidious effects. They are now at the heart of both environmental issues, with contamination of the flora and fauna, and health. The importation of pesticides into Algeria has undergone remarkable development in recent years. From 2002 we note an exponential evolution of these imports, probably following the restriction of these products in Europe and their orientation towards the Algerian market at low prices. Algeria uses 6,000 to 10,000 tonnes / year of pesticides, or 15 to 20% of normative needs. Insecticides, fungicides and herbicides are the most widely used pesticides.

Our work is based on the study of the subacute toxicity of a pesticide widely used in agriculture, an antifungal "Copper Quinolate". The aim of this work is to elucidate the toxic effects of oral administration of three different doses of CuQ for 3 weeks on weight gain and liver function in male Wistar rats. For this purpose biochemical assays of the hepatic enzyme activity have been performed (ASAT; ALAT; PAL) Monitoring of body weight change during the treatment period showed a decrease in body weight in rats treated at high and medium dose compared to controls. Our results revealed an increase in absolute and relative liver weights, particularly in rats treated with CuQ at medium and high doses. The results of the biochemical assays revealed a significant increase in the activity of the liver enzymes ASAT, ALAT, PAL, especially at high and medium. At the end of these results, it appears that the doses of copper quinolate tested, the high and medium doses, induce remarkable toxic effects on liver function.

**Keywords:** copper quinolate, hepatotoxicity, biochemical parameters, liver, rat



## **A survey of Microplastics contamination in a tributary of Tiber river: Almone river (Rome, Italy)**

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Microplastics (MPs) (microscopic pieces of plastic with dimension smaller than 5 mm) represent an emerging anthropogenic pollutant. The study of MPs in freshwaters has only arisen in the last few years. To evaluate the presence and the typology of MPs in a river flowing in an urban area, we selected Almone river, with the last stretch in the Regional Park of Appia Antica (Rome, Italy). In Two sampling campaigns, during summer and winter season, water and sediment samples were collected in three sampling sites from upstream to downstream. Ad-hoc protocols for water and sediment were setting up by adapting marine water and sand sampling protocols. Samples, transported in laboratory under controlled condition, were filtered, sieved and separated by NaCl density method in order to evaluate the number and the typology of MPs particles. A direct and stereoscope visual inspection was done in order to classify particles based on physical characteristics (type, dimension, color). The results showed that, in all sampling sites, a high number of MPs was present, with a different amount and typology from upstream to downstream and a higher presence in summer samples. These results are probably due to the higher degradation of plastic during summer season (UV, Temperature) and to a “dilution” of particles during winter season, when the river flow rate is significantly higher compared to summer season. The visual analysis showed different typologies of MPs in both sediment and water and from different sampling station, suggesting different source of MPs (i.e. illegal landfill, road dust, wastewater). The MPs category distribution changed based on sampling location, although all samples were dominated by MP fragments and film.

**Keywords:** microplastics, river, urban area, visual analysis

## Unravelling the indoor air mycobiome of residences in Athens

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Humans spend most of their day inside their residences. Nowadays, the advancement in technology in combination with life style changes have resulted in construction of air tight and energy efficient buildings. This in turn, has led to a decreased infiltration of outdoor air inside the houses, a fact that contributes to the deterioration of indoor air quality (IAQ). Contaminants of biological origin, such as fungi are very common in residential environments. Recently, exposure to fungal fragments has been of paramount importance, since they have been recognized as triggering factor for respiratory diseases and atopic dermatitis. A comprehensive study on IAQ was conducted in 6 dwellings across the Athens metropolitan area. The field campaigns covered two monitoring periods: February-March (winter) and May-June 2019 (summer). The investigation was carried out using a Burkard portable volumetric sampler for agar plates with PDA as a nutrient medium to identify the diversity and concentration of airborne on daily basis. In parallel, an additional device (uHoo sensor) was placed in the participants' living rooms to obtain information regarding the levels of several environmental factors (T, RH, TVOC, PM<sub>2.5</sub>, CO<sub>2</sub>, NO<sub>2</sub>, O<sub>3</sub>). The results indicated that airborne fungal community was classified into 24 genera and 4 groups, yeasts, Basidiomycota, Sphaeropsidales and NSF (Non Sporulating Fungi). The genera *Penicillium*, *Cladosporium*, *Aspergillus* and *Alternaria* and the yeasts constituted the dominant components. The mean daily total fungi concentration was 739 CFU/m<sup>3</sup> and 931 CFU/m<sup>3</sup> during the winter and the summer period, respectively, while in many cases unusually high values were observed. Several environmental parameters were statistically significantly related to the indoor mycobiome. Without a doubt, the combination of aerobiological with the monitoring of environmental parameters allows the identification of the conditions of potential biological risk.

**Keywords:** IAQ, fungi, residences

# Sensitivity of two procedures to estimate the impact of the ionic liquid 1,3-dimethylimidazolium dimethylphosphate [C1C1Im][DMP] on soil microbial activity

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Ionic liquids (IL) represent an alternative to organic solvents in processes of synthesis compounds and in separation technologies due their tuneable physicochemical properties as they can be synthesised by choosing from an enormous amount of cations and anions or even by changes in the alkyl chains of these ions. One of the key properties of these compounds is their negligible vapour pressure, due to which they are non-contaminant to the atmosphere and play an increasingly relevant role in green chemistry. Nevertheless, before their use can be generalised, toxicity studies must be performed as they could be toxic for terrestrial ecosystems. However, studies of the effects on soil and vegetation, media that can be reached by these liquids as a result of accidental spills, are scarce so far. The 1,3 dimethylimidazolium dimethylphosphate, [C1C1Im][DMP], is an imidazolium ionic liquid with potential use in several industrial applications, as for example increasing the rate of cellulose hydrolysis by cellulase enzyme in the bleaching process in paper and pulp industry. Thus, once its use will be widespread, the probability that reaches terrestrial ecosystems will be high and therefore estimating the toxicity of this compound to these systems is of priority. The main goals of this study were i) to estimate the toxicity of [C1C1Im][DMP] to the soil by analysing its effect on soil microbial activity, ii) to test the sensitivity of two procedures (microcalorimetry and the classical method of soil basal respiration determination) to estimate microbial activity in IL-polluted soils, and iii) to compare and combine the information provided by both procedures to obtain a more insightful picture of the impact of this compound on soil microbial activity.

The microcalorimetry technique is based on the analysis of the heat released by soil microbiota, activated with a solution of glucose, against time. The second methodology (soil basal respiration) is the classic measurement of the CO<sub>2</sub> emitted by the soil incubated under optimal laboratory conditions of moisture (60-80% of water holding capacity) and temperature (25-28 °C) during a given period of time (10-28 days). Since microcalorimetry was first applied for studying soil microbial activity it has been increasingly applied in soil studies. However, to our knowledge comparative analysis of the information provided by both techniques has not been performed.

Two acid soils with sandy-loam texture and different organic matter (OM) contents were selected: a forest soil with high OM (FOR) and a crop soil (CROP) with low OM. These soils were artificially contaminated with increasing doses of [C1C1Im][DMP] (0 to 123.48 g LI kg<sup>-1</sup> air-dried soil) and analysed for microbial activity by the two methods. The heat released by soil microbiota was determined against time and dose (only up to 92.61 g de IL kg<sup>-1</sup> soil) using an isothermal microcalorimeter (TAM III, TA Instrument). In addition, after three days of soil-IL contact time, all the polluted soil samples (0 to 123.48 g IL kg<sup>-1</sup> soil) were incubated at 25 °C and 80% of water holding capacity to measure soil

basal respiration. In our laboratory the soils are generally incubated for 10 days. However, with IL contaminated soil this period had to be increased until the CO<sub>2</sub> emitted by soil respiration in IL-polluted soils was stable or has reached the level of control soil (126 days).

The power-time curves resulting from microcalorimetry, showed important differences on the response of both soils to the IL addition: the FOR soil, with the highest OM content, an increase in heat released during the first hours of the experience followed by the death of the microorganism was observed for the lowest doses, in comparison with the control. Whereas the highest doses caused a delay in the growth phase of the activity. The CROP soil, with low OM content, showed an increasing delay on growth phase with the dose was observed.

As expected, soil basal respiration was more intense in the soil with high OM content (FOR) than in the soil with low OM. In both soils, the lowest amount of IL (1.92 g IL kg<sup>-1</sup>) did not affect soil respiration. However, all the other doses of IL increased very strongly the soil respiration and showed a peak in CO<sub>2</sub> emission. This peak was progressively increasing with the amount of IL, up to 61.74 g LI kg<sup>-1</sup>, and thereafter tended to decrease with respect to this maximum. In all cases, and similarly to what was observed by microcalorimetry, with increasing amounts of IL the moment of the peak was progressively delayed. The amount of CO<sub>2</sub> emitted during the 126-days of incubation (accumulated CO<sub>2</sub>) by the soil with the lowest dose of IL (1.92 g IL kg<sup>-1</sup>) was similar to that of the control both in FOR and CROP soils. However, highest amounts of IL strongly increased the amount of accumulated CO<sub>2</sub>, but this increase was not proportional to the dose. Both in FOR and in CROP soils the highest amount of accumulated CO<sub>2</sub> was obtained for the soil with an intermediate amount of IL (61.74 g LI kg<sup>-1</sup>), while the amount of CO<sub>2</sub> emitted decreased for the two highest doses of [C1C1Im][DMP], being this decrease especially important for the highest dose in the soil with the lowest OM.

In summary, both microcalorimetry and the classical method for measurement of soil basal respiration proved to be similarly sensitive to the presence and the amount of [C1C1Im][DMP], both in soils with high and low OM content. In addition, both methodologies showed a similar pattern of CO<sub>2</sub> emissions in the IL-amended soils with the amount of IL and with time (increasingly highest amount of CO<sub>2</sub> emitted with increasing doses of IL up to reach a maximum at intermediate doses; delayed peak of CO<sub>2</sub> emission; increasing delay in the peak appearance with increasing amount of IL), showing that both methods are sensitive to the temporal changes of microbial activity in soils amended with different amounts of [C1C1Im][DMP].

**Keywords:** 1,3 dimethylimidazolium dimethylphosphate, ionic liquids, soil microbial activity, microcalorimetry, soil basal respiration

## Effects on growth and biomass production of patè olive cake for agronomic application

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The cultivation of olive trees (*Olea europaea* L.) is very important worldwide and especially for the Mediterranean area. This crop is mainly used for the production of oil, but also of olives and precious wood. The chemical-physical characteristics of the by-products derived from the transformation of olives depend on the synergy between the soil and climatic conditions of the cultivation area, the variety, the state of ripeness of the olives and, above all, the processing system adopted. These wastes, in fact, due to their acidity, the presence of phenolic compounds, suspended substances and the high organic load, can be characterized by a high polluting and phytotoxic degree. These characteristics, combined with the seasonality of olive production, concentrated from October to March, and therefore the high concentration of potential pollutants in a short period of the year, are unable to guarantee cost-effectiveness of management in the transformation and disposal phase. The need arises for the recovery and recycling of oil waste for the production of compounds of commercial value to be reused in agriculture as an excellent combination between the enhancement of the by-product and waste management. This requires both the use of eco-sustainable separation and extraction technologies for the selective recovery of biological macromolecules of high added value, and the implementation of the agricultural use of the fractions with greater bio-stimulating potential. In this context is the study conducted within the ABASA project (Agricultural By-products into valuable Assets for Sustainable Agriculture), funded by Lazio Innova-Regione Lazio, CUP: B81G18000770002 "Green technologies for sustainable agriculture: protection from phytopathogens and fertilizers of agri-food crops using biomolecules obtained from oil waste". Object of this work is the evaluation of the effect on plant growth and biomass production of a new olive mill by-products named "Patè Olive Cake" (POC) generated by a multi-phase decanter (DMF) technology that combine an extraction technology without the addition of water. POC is an olive mill by-product consisting of olive pulp, olive skin and vegetative water. The aim of this research was to adopt protocols for the evaluation of different POC fractions through laboratory bioassays to highlight their nutritional, bio-stimulating, toxic and genotoxic properties. In the present work the first results obtained are reported and discussed. Tests in pots are being carried out in order to investigate the effects of different fractions on growth and biomass production tested on ryegrass (*Lolium perenne* L.) and on the chemical and microbiological characteristics on two different soils used for the experimental test.

**Keywords:** Olive tree, Patè Olive Cake, multi-phase decanter, sustainable agriculture, waste management

## The use of diatom from water quality assessment to forensics: a protocol to diagnose death by drowning

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Diatoms can represent an important tool in the diagnosis of drowning, thanks to their silica cell wall, acid resistant, that can be found in post mortem tissues also in highly decomposed bodies, and because they are not naturally present in human body in significant amounts. The principle of diatom test in drowning is based on the presence of these algae in waters where drowning took place, and their consequent penetration into bodies through inhaled waters, and their movement from the alveoli spaces of lungs to blood circulation, and deposition in brain, kidney, sternum, liver and bone marrow. This test can be useful when, typical post-mortem findings in case of highly putrefied and skeletonized bodies, are absent and it is the only reliable screening method of knowing whether the drowning is ante-mortem or post-mortem. In addition it can supply also information on the drowning site, comparing the diatoms found in organs to those found in the immersion waters. The diatom test has also some cons: it has been reported by some authors the occurrence of false positive and it requires labour-intensive effort in terms of times and expertise in identification. Many studies have been carried out on diatoms test in forensic context, highlighting its usefulness but nowadays are still not available guidelines or protocols. The reliability of diatom test in the ascertain of drowning should be improved through the standardization procedures, actually, there are not protocols for qualitative and quantitative diatoms analysis that make any comparison between different studies virtually impossible. Several factors may substantially influence the results, such as aliquot of tissue analyzed, and the extraction procedures. On the contrary the use of diatom in environmental monitoring, is well studied and analysis protocol have been developed and standardized. The aim of this work was to describe an easily to perform protocol for diatoms analysis to ascertain death by drowning based on international and national procedure for environmental monitoring. It was born from the collaboration between the researchers of Environment and Health unit of Istituto Superiore di Sanità and the Forensic Toxicology Laboratory of the Catholic University of the Sacred Heart. This protocol describes the operating modalities for environmental/tissue samples collection and treatment, diatom identification and quantitative analysis. It can represent the first step in the development of standard procedure of diatom test in forensic medicine in case of death related to drowning underlining the importance of collaboration between coroners and diatom experts in the improving the reliability of this test.

**Keywords:** diatoms, environmental and tissue analysis, species identification, drowning, protocol

## **Food: an ally against breast cancer**

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Cancer is a real public health problem. According to the latest WHO estimates, the number of cancer deaths is expected to continue to rise and exceed 11 million people by 2030. Breast cancer is one of the most complicated and poorly managed cancers (especially in developing countries). Recent work has shown that nutrition plays an important role in the etiology of this disease; indeed, the aim of this work is to highlight the impact of diet on the occurrence of breast cancer. A dose-response relationship has been demonstrated, indicating an inverse association between the consumption of dairy products and the risk of breast cancer. Some components of dairy products, notably calcium and vitamin D, appear to have anti-carcinogenic effects. In addition, a delayed progression of this pathology has been observed in populations regularly consuming fruits, vegetables and green tea. As for fish, the results show that high consumption is correlated with a low incidence of breast cancer. Unlike antioxidant foods, some foods can promote the formation of precancerous cells and are therefore among the risk factors to consider. This is the case with sugar, salt, bad fats, red meats and deli meats or alcohol. In conclusion, more research is needed to elucidate the precise mechanisms by which diet could reduce or increase the risk of this disease.

**Keywords:** breast cancer, nutrition, vitamin D, antioxidants.

## A New Host from Southern Anatolia: *Quercus robur* (English oak)

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*Monochaetia monochaeta* (Desm.) Allesch. is an endophytic fungus in deciduous trees, especially *Quercus* species on natural habitat. This pathogen produces dark brown spots on the leaves of the host plants and causing serious damage.

The species was recorded previously in Southern Anatolia, but it has not yet been found on *Quercus robur* L. (English oak). *Q. robur* infected by *M. monochaeta* is recorded as new host in the region. Morphological and microscopical features of this fungus are described, illustrated.

**Keywords:** new host, *Quercus robur*, Turkey



# Promotion of tomato growth and inhibition of tomato foot and root rot severity using dehydrated and anaerobically digested sewage sludge

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Management of biosolids, the stabilized organic solids produced by wastewater treatment plants, has become a major economic and environmental issue for municipal communities that need to be solved. Biosolids recycling to agricultural land can be a promising solution which both solves their disposal problem and provides nutrients to the plants similar to commonly used fertilizers. The objectives of the present study are to evaluate if biosolids can be applied as a fertilizer in order to enhance tomato growth and protect the plant from foot and root rot disease, caused by the pathogenic fungus *Fusarium oxysporum* f. sp. *radicis-lycopersici* (Forl). For this purpose, sandy and clay soil was mixed, individually, with anaerobically digested sludge, in three different concentrations of 0%, 2% and 4%, w/w (sludge to soil ratio) and placed in 3 liter pots in which tomato plants, previously grown from seeds in nurseries, were transplanted at the two-leaf stage. Eight pots-replications were used per concentration and soil type. Two plants were transplanted in each pot and Forl was applied by drenching, at transplantation, on half of the pots while the rest of the plants served as controls. Plants were grown in a screenhouse, for 5 and 7 weeks (one plant for each period for every pot), and then disease severity was scored and growth parameters such as plant weight, root weight, shoot length, number of leaves and number of flowers were recorded. The experiment was conducted twice in a different location each time and statistical analysis was performed by ANOVA. The results demonstrated that biosolids promoted plant growth and inhibited disease severity in both sandy and clay soil. Specifically, promotion of growth characteristics was accordingly enhanced by increased biosolid concentration rates. Moreover, the highest biosolid concentration caused the mildest disease symptoms while plants without biosolid enhancement presented the most severe symptoms.

**Keywords:** Biosolids, agriculture, treated sewage sludge, Forl

# Effects of long-term exposure to silver nanoparticles on *daphnia magna*

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Silver nanoparticles (AgNPs) have led to widespread application in various fields of human activity for its antibacterial properties. However, the increasing production and use of AgNPs raises concerns about the potential risk to non-target aquatic species. Experimental studies clarifying the potential chronic effects of AgNPs on representatives of invertebrate organisms are necessary to assess possible adverse effects on the aquatic ecosystem. In the current study, we focused on the chronic (21 days) toxicity of AgNPs to *Daphnia magna*. *Daphnia magna* is a zooplankton crustacean found in freshwater environment and is a standard model organism from the *Cladocera* order. Particle suspension used in toxicity testing was well characterized. The experiment was performed methodologically in accordance with the following standard OECD 211. The chronic toxicity (21d LC50) of AgNPs for *Daphnia magna* caused concentration  $<0.5 \mu\text{g}\cdot\text{L}^{-1}$  and hatching inhibition (21d EC50) caused concentration  $<0.4 \mu\text{g}\cdot\text{L}^{-1}$ . In the determination of chronic toxicity in the parental generation (F0) was beside the EC50 value also monitored the effect on the hatching rate and survival of the juveniles (F1). This study contributes to clarification of the potential risk of AgNPs for crustacean *Daphnia magna*. However, for better understanding of the impact of AgNPs on the entire aquatic ecosystem, it would be useful to extend the study to long-term effects on representatives of other trophic levels of aquatic biocenosis. (*Supported by the grant FVHE/Pikula/ITA2020.*)

**Keywords:** nano silver, Cladocerans, chronic toxicity

# **Determination of Urban Regeneration Areas in Turkey: Current Approach and Suggestions for Sustainable Development**

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Urban regeneration is an important city planning tool applied by local and central governments. They use urban regeneration projects to reduce the impacts of disasters and design livable environments for the citizens. It is important to expedite the process when it comes to the loss of lives and design livable public space; a large number of data have to be managed and institutions that are responsible for urban regeneration have to work coordinately. Urban regeneration projects are comprehensive projects involving many stakeholders and lots of properties. For this reason, a large number of spatial data must be processed together. This interoperability can be possible only with standards and have to be supported with a fit for purpose legislation.

Since 2012 hundreds of project areas were determined as urban regeneration area according to The Law on the Regeneration of Areas under Disaster Risk, commonly known as the Urban Regeneration Law (No.6306, May 2012). Though the process and requirements for the determination of urban regeneration areas are stated in the regulation, however, there may occur differences in practice. There exist insufficient information and a lack of data in the Regulation. There is a need for a more comprehensive regulation to set every point clear and transparent in order to develop cities sustainably. In this study, it is aimed to design a workflow diagram and determine the required data for the determination of urban regeneration areas according to the related legislation. After defining the current approach to urban regeneration, then suggestions are made to standardize the projects.

**Keywords:** Urban regeration, disaster, Istanbul

# Antimicrobial and Anti-biofilm Activities of Synthesized Hydroxyapatite Nanoparticles Against Drug-Resistance Bacteria

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The resistance of certain pathogenic bacteria causes a huge problem of public health. It leads to an increase in nosocomial infections and hospitalizations, an increase in medical expenses and an increase in mortality. The formation of biofilms by the adherence of bacteria to medical devices, implants and damaged tissues is the main origin of such infections. Nanotechnology is expected to open new avenues to fight and prevent disease using atomic scale tailoring of materials.

This work focuses on the antimicrobial and antibiofilm activities of synthesized hydroxyapatite nanoparticles (HAP NPs) against drug resistance Bacteria. The antimicrobial activity of HAP NPs was evaluated using the determination of minimum inhibitory concentration (MIC) by the dilution method on agar medium. The obtained results show a significant antimicrobial activity on the strains tested: *Pseudomonas aeruginosa* ATCC27853: 8µg/mL, *Staphylococcus aureus* ATCC 29213: 2µg/mL, *Escherichia coli* ATCC 25922: 2 µg/mL and *Candida albicans*: 1µg/mL. The antibiofilm activity of HAP was evaluated using a microplate biofilm test. The obtained results show a significant antibiofilm activity on the strain tested: *Staphylococcus aureus* which was significantly reduced by 88.05%, after contact with 100 µg/ml of HAP NPs. The HAP NPs appear to be attractive candidates of choice to be an effective alternative to antibiotics and pave the way for a promising new strategy antibacterial nanoscale as dental implant coating materials.

**Keywords:** Nanoparticles, Hydroxyapatite, Antimicrobial Activity, Antibiofilm Activity, Inhibition rate.