1ST MEETING OF COST ACTION CA20132

BOOK OF ABSTRACTS

SAFEGUARDING EUROPEAN URBAN TREES AND FORESTS THROUGH IMPROVED BIOSECURITY

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COST Action: CA20132 - Urban Tree Guard - Safeguarding European Urban Trees and Forests Through Improved Biosecurity

1st Meeting of COST Action CA20132

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LIST OF ABSTRACTS

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URBAN TREES OF SWITZERLAND AND A CALL FOR COLLABORATION ON A EUROPEAN URBAN TREE INVENTORY

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ABSTRACT

Scientists were recently able to calculate the number of trees on the earth: 3 trillion. While forest trees are well characterized by forest inventories on different scales in Central Europe and North America, urban trees represent a black box. However, urban trees are essential for different reasons: urban climate regulation, human health, urban biodiversity and biosecurity, amongst others. In Switzerland, urban tree inventories are mainly organized and maintained by individual municipalities, but not shared on a National level. As part of a project where we estimate the probability of establishment of priority quarantine forest pests, we collected and combined urban tree inventories from 30 municipalities, with a total of around 450'000 trees that are maintained by municipalities. Compared to surrounding forests, urban tree inventories show a very high diversity, with representatives of more than 130 genera and 1500 species. As a comparison, the Swiss National Forest Inventory samples 130 species. We found that tree community composition at the genus level in Swiss cities cannot be explained by spatial intercorrelation. However, it can be explained by which of the four National languages is spoken in the area. This suggests that tree community composition in Swiss cities is rather influenced by cultural aspects, then by geographical location.

Within UB3GUARD, we propose to expand the Swiss urban tree dataset over several European countries – a dataset like that would contain invaluable knowledge for policy makers and could be used to explore macroecological questions. Please contact me if you want to contribute with urban tree inventories in your country.

THE IMPACT OF THE COVID-19 PANDEMIC ON THE USE AND BEHAVIOURAL PATTERNS OF VISITORS TO PERI-URBAN FORESTS. CASE STUDY OF SARAJEVO CANTON

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ABSTRACT

Forests are an essential element of the environment that ensure positive effects on physical and mental health and human well-being [1]. In a time of societal health crises, such as the COVID-19 pandemic, these effects may be amplified. Moreover, government restrictions on social behaviour have fundamentally changed the interaction between people and forests in terms of use, attitudes and perceptions [2]. The aim of this paper is to investigate how people's behavioural patterns and attitudes towards peri-urban forests have changed due to the COVID-19 pandemic in Sarajevo Canton. The face-to-face survey was conducted in May-July 2021 on a sample of visitors (n=416) in six different locations in Sarajevo Canton. The survey asked the respondents about their use and behavioural patterns related to peri-urban forests during the period of restrictive measures imposed in response to the pandemic. The respondents were predominantly adults (aged from 35 to 55) and evenly distributed by gender. Most of the respondents live in Sarajevo Canton and reached the forests by car. 53% of the respondents visited the forests more frequently during the pandemic comparing to the period before. During the pandemic 45% of respondents visited forests more than 3 times a month, while 17% visited forests once a week. The need for changing or better managing of the daily routine when social restrictions were most severe, to meet other people, and to be engaged in outdoor physical activity were mentioned as the main reasons for visiting forests during the pandemic. The results of this paper emphasize the importance of multifunctional positive effects of forests ecosystem services on the society and point out on the imperative of considering these effects in the process of creating consistent forest policy.

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MONITORING OF PLATANUS USING LiDAR DEVICES

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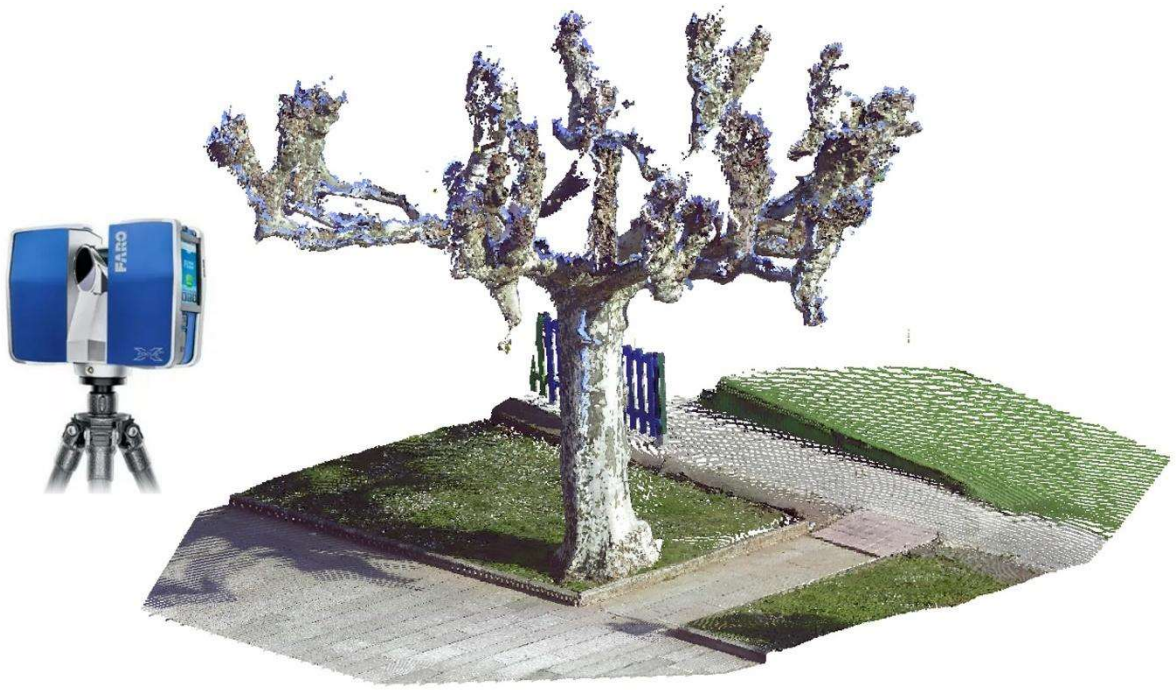

ABSTRACT

Platanus x hispanica Mill. Ex Münchh (sycamore, London plane, shadow plane, London plane tree, or hybrid plane), also known as *Platanus x acerifolia*, is a hybrid of *Platanus occidentalis L.* and *Platanus orientalis L.* common trees in European urban areas. Due to the rapid growth and ample shade, this species has been widely planted along avenues and boulevards. However, *platanus* trees are highly susceptible to the fungus *Ceratocystis platani*, which produces disruption of water movement, cankers and eventually death within 2-3 years [1]. This parasite has caused the death of high percentages of trees in those cities where the parasite has been detected. The effects of the *Ceratocystis platani* are not always visible on the tree trunk, but cankers are characterized by necrosis of inner bark and bluish-black to reddish-brown discoloration of sapwood [2].

LiDAR technology enables rapid 3D scanning of as-built environments. With the recent cheapening of laser scanning technology and its implementation in mobile devices, their use is becoming more and more popular in many sectors. In addition, most devices have photo sensors that allow color acquisition. Therefore, LiDAR devices allow to monitor tree areas and generate 3D models with centimeter precision [3] where color information is also integrated.

This work evaluates the use of an iPad pro in comparison with a Faro Focus X330 for the monitoring of *platanus* located in the *Paseo da Familia Álvarez-Blázquez* (Tui, Spain). The avenue and garden areas of high patrimonial and landscape have value date back to the 19th

and early 20th century. Although the iPad pro presents a range limitation of only 5 meters and a theoretical lower point density, the precision of 3 cm and high image quality are positive advantages for the generation of 3D color models at a very competitive cost comparing traditional Terrestrial Laser Scanners.

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IS THE REMEDY HIDDEN IN THE PROBLEM?

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ABSTRACT

Do we have to live in gray cities that have become concrete as we modernize? Or is it possible to color this colorlessness with the dominant color of nature, green? Trees, which are the last representatives of green and nature in cities, unfortunately, face the danger of not being able to continue their existence. These delicate giants are exposed to negativeness caused by anthropogenic and nature. Pest insects are only one of the factors that negatively affect trees. Research on microbial control techniques in managing harmful insects has gained momentum in recent years, and these studies have auspicious results [1]. Microbial control uses microorganisms that naturally make pest species sick and negatively affect their life cycle. In this context, especially Microsporidia taxa have attracted the attention of researchers with their potential for microbial control of forest pest insects.

Elm species (*Ulmus* spp.; Ulmaceae: Angiosperm) are widely used in the establishment of parks and gardens, especially in urban landscapes, in Turkey as well as all over the world [2]. Chemical control techniques to be applied to protect these tree species, which are intertwined with a human in urban life, carry great risks. In research conducted with this perspective, a microsporidium species (*Vairimorpha (Rugispora) istanbulensis* [3]) was detected in the elm leaf beetle (*Xanthogaleruca luteola* Muller, 1776), which is one of the most important pests of elm species, and the possibility of microbial control in the management of this pest was demonstrated. This example shows us that there is always an alternative method that does not affect nature and human health to protect urban trees from harmful insects instead of chemical control. In summary, the remedy is again within the problem.

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DETERMINATION OF WOOD DECAY IN URBAN TREES USING RESISTOGRAPH

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ABSTRACT

Although the term urban forestry is new, urban forestry practices have been going on for many years. Urban forests near or in urban areas, including parks, gardens and roadsides, all vegetation in the city covers the study area of urban forestry. It is known that urban trees have many important functions such as increasing the quality of life of people, improving the city visually, aesthetically and ecologically, storing carbon and saving energy. However, most of the time, abiotic and biotic stress factors cause the trees to lose their health, reducing the visual aesthetic values of these trees or posing a risk in terms of public safety. Sudden falling or breaking of trees in parks, gardens and roadsides, which are frequently used by the public, cause important and vital damages in terms of community security in the city. Wood decay is the most important biotic factor that causes branches and trunks of trees to break or fall from their roots. Accidents in which people, vehicles or buildings are damaged as a result of the breaking of branches or trunks of urban trees or the overthrowing of their roots are also frequent. It is not known whether wood rot fungi play an active role in breaking branches or stems of trees or toppling them from their roots in these accidents. Most of the time, it cannot be predicted how severe and dangerous the decay that occurs on the roots, trunk and branches of the trees is. An internal decay measurement is often required to accurately assess the hazard potential in urban trees. Such decays can be determined by visual inspection as well as non-destructive testing methods that do not harm the tree. Non-destructive inspection can provide the opportunity to detect decay caused by disease factors at an early stage and to carry out strategic interventions to trees without delay.

Resistograph is one of the non-destructive testing devices that has practical and widespread use in detecting internal rot in planted trees. In non-destructive examination with a resistograph, defects such as decay, voids, cracks and crevices that exist in the wood and cannot be detected from the outside can be detected thanks to the change in resistance. The resistograph detects changes in wood's mechanical resistance to measure the amount of decay present in the wood. During the decay process, the wood density decreases and accordingly the drilling resistance decreases. The aim of this study is to show that it is possible to determine whether there are structural or rotten defects in the trees by evaluating the measurements to be made without damaging the living trees by using the resistograph device. In the measurements to be made with the resistograph device, information can be obtained about the imperfections of the wood that cannot be detected from the outside by penetrating into the tree. With this non-destructive testing method, defects such as decay, voids, cracks and crevices in the wood can be detected thanks to the change in resistance. For this reason, the resistograph device is important in determining the health status and tipping hazards of urban trees. It is of great importance for public safety that institutions dealing with trees in areas frequently used by the public use these and similar devices and carry out regular measurements. It is necessary to use non-destructive testing methods and to improve urban tree care programs in order to reveal the damage extent of tree rot, which is a current problem that threatens the general health of urban trees and public

safety, with scientific data. In this context, it is recommended to analyze the general current health status of the urban trees in the parks, gardens and roadsides in the city centers, which are used extensively by the public, by resistograph measurements. Thus, important information can be obtained for the control of silvicultural methods that have been applied and currently being applied and for the development of appropriate care recommendations for the protection of trees, and it can be tried to prevent greater destructions that may occur in the future.

BIOCONTROL POTENTIAL OF SOME ENDOSPORE PRODUCING BACTERIA FROM ACTIVATED SLUDGE AGAINST THE DIPLODIA SAPINEA TIP BLIGHT DISEASE OF PINES

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ABSTRACT

Diplodia sapinea (Fr.) Fuckel (syn. *Diplodia pinea* (Desm.) Kickx., *Sphaeropsis sapinea* (Fr.: Fr./Dyko and Sutton) is a widely distributed pathogen of conifers causing Diplodia tip blight. The fungus causes several disease symptoms in conifers, including browning of needles, shoot blight, dieback, crown wilt and bark cankers of adult trees, collar rot, root disease and damping-off of seedlings, as well as wood blue stain of sapwood in timber. *D. sapinea* is also a well-known endophyte of Pinus spp. and an opportunistic agent that affects hosts subjected to predisposing stress factors such as hail, heatwaves, and especially drought in nurseries, plantations, and natural and urban forests. Changes in temperature and precipitation caused by climate change can influences host susceptibility and the presence of pathogens, which are effective in the emergence of this disease. It was recorded on several species in Turkey so far, such as *Pinus nigra* Arnold, *Pinus sylvestris* L., *Pinus brutia* Ten., *Pinus pinea* L., *Pinus halepensis* Mill., *Pinus radiata* D. Don., *Pinus pinaster* Aiton., *Cedrus libani* A. Rich. and *Pseudotsuga menziesii* (Mirb.) Franco. The fungus also causes very serious economic damages to edible seed production on *P. pinea* worldwide. Biological control based on the use of antagonistic organisms represents one of the most promising alternatives against Diplodia tip blight. Moreover, the Gram-positive family *Bacillaceae* has been known as a suitable biocontrol agent against fungal pathogens. In this study, potential antagonism between D. *sapinea* strain (DS85) isolated from the tips of symptomatic *P. halepensis* (İzmir-Urla, Turkey) and member of *Lysinibacillus* genus. *Lysinibacillus* strain BC9 (*Lysinibacillus* sp.) and BC12 (Lysinibacillus fusiformis) obtained from stock culture of Molecular Microbiology Laboratory, Department of Biology at Pamukkale University. Antagonistic relationship assays were performed as dual-culture and liquid fermentation medium. *Lysinibacillus* strains was growth in LB medium at 27°C for 24 h. For dual-culture assay, bacteria were transferred on PDA agar plates and plates were incubated at 27°C for 24 h for bacterial growth. After incubation, fungal hyphae sample was inoculated onto agar plate as across to growth bacterial cells. For fermentation medium assay, bacterial cells from LB medium were harvested by centrifugation at 6000 rpm for 5 min. Then, supernatant was discarded, and pellet were resuspended with PBS solution. Subsequently, bacterial cell number was adjusted to 0.5 MF using MacFarland standard. 2,5% bacterial suspension was inoculated in sterilized flask with 50 ml Potato Dextrose liquid medium. After that, fungal hyphae sample was inoculated. In order to make microbial mixture, flask was shaked at 250 rpm rotary shaker at 25°C for a while. Besides, a control flask was used just with fungal hyphae inoculation in PD medium with same conditions. Flasks were statically incubated at 25°C up to one week until hypheal growth in control flask. After that, incubations were extended to two weeks to see if any hypheal development in fermentation flask with *Lysinibacillus*. Incubation was ended two weeks later. Inoculated hyphae sample from the antagonistic flask were inoculated onto PDA and at 27°C for one week. Preliminary results suggest that two *Lysinibacillus* strains might be used as biocontrol agents against *D. sapinea*.

In future research, the mechanisms driving the observed antagonisms, specificity of strains (since endophytes could be potentially affected), optimal dose, and most suitable application method should be evaluated.

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STRONGER VIRULENCE FROM DIPLODIA TIP BLIGHT PATHOGEN DUE TO STRAINS ORIGINATING FROM NON-PINE HOSTS

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Scots pine stand with trees heavily infected by Diplodia Tip Blight close to Göttingen, Germany in 2019 (Foto: Kathrin Blumenstein).

ABSTRACT

Sphaeropsis sapinea (≡ *Diplodia sapinea*) is one of the most severe pathogens in Scots pine, which is the second most common conifer species in Germany. *Sphaeropsis sapinea* is usually a harmless endophyte but may become pathogenic causing Diplodia tip blight (conifer blight) under certain environmental conditions. Recently, the fungus has also been isolated from non-conifer hosts, indicating that the fungus has a broader host range than previously known [1]. To develop new disease management measures against this pathogen, we need to know the level of abiotic stress (such as drought) as a trigger for the endophyte to become pathogenic. The predicted climate change can alter this fungus to become a global threat to forest health, as the growth rate will be favoured by climate warming and the susceptibility of pines to *S. sapinea* is strongly enhanced by water stress [2]. For greater adaptability and mobility of this latent pathogen (compared to its hosts), we need to determine the specific virulence and pathogenicity of known subpopulations in different climates. We compared variable water availability impact to necrosis length caused by *S. sapinea* strains isolated as endophytes (eight strains isolated

from asymptomatic Scots pine) and pathogens (five strains isolated from symptomatic Scots pine) and five strains isolated from symptomatic non-pine hosts. For all strains the decreased water availability increased the necrosis length in Scots pine shoots [3]. The isolates from non-pine host caused the most severe reactions in the host under all water availabilities. The results indicate the likelihood that effects of climatic changes, such as drought, will drive *S. sapinea* damage in Scots pine dominated forests and increase mortality rates in these trees. Further, the higher necrosis in the Scots pines caused by strains that had performed a host switch are alerting in regard to future scenarios as such events may become more likely to happen increasing infection pressure to Scot pine.

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MOLECULAR CHARACTERIZATION OF *DIAPORTHE* SPP. ISOLATES DETECTED IN *FABACEAE* PLANTS

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Damages of *Fabaceae* plants (a – *Robinia pseudoacacia*; b,c,d – *Caragana arborescens*) caused by pathogenic fungi (e,f,g – *Diaporthe* spp.)

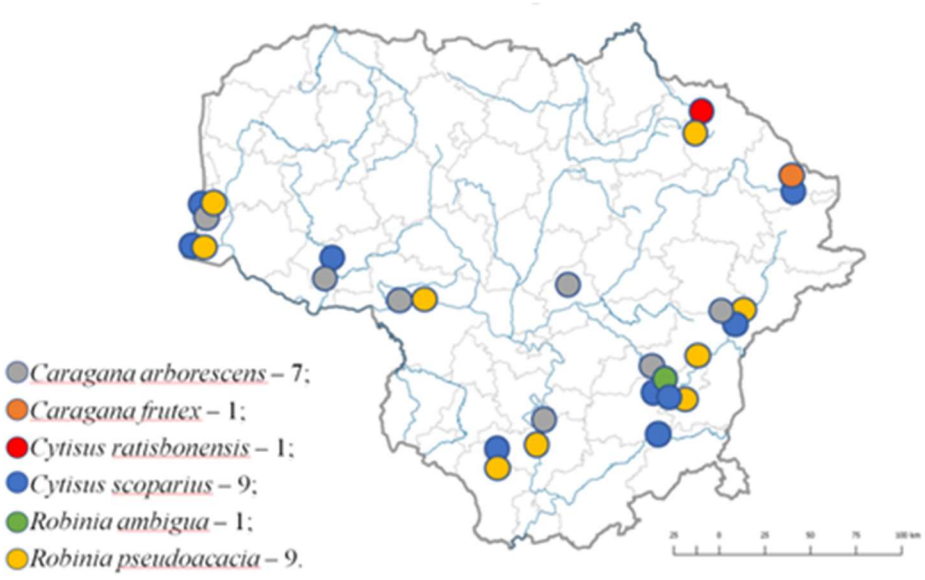

Fig. 2. Locations of studied *Fabaceae* plants in Lithuania.

ABSTRACT

Diaporthe spp. are widespread plant pathogens and have a broad range of hosts, including naturally growing trees. *Diaporthe* species may cause severe diebacks, cankers, leaf spots, decay, blights and wilts, which could lead to serious economic and ecological losses of many plants. However, there have been no detailed investigations about fungal diseases caused by *Diaporthe* in Lithuania so far.

The aim of this study was to identify and to characterize pathogenic fungi of the genus *Diaporthe* isolated from three different woody *Fabaceae* family plants, where they are widespread and dominant: *Caragana arborescens*, *Robinia pseudoacacia* and *Cytisus scoparius*. The last two of them are classified as invasive plants in Lithuania. A total of 144 plants were collected in 25 areas of the Lithuanian territory. 255 isolates of the *Diaporthe* genus were obtained from 82 plants.

Nucleic acid-based techniques were used for identification and characterization of *Diaporthe* species. In total, we examined five loci that were used for analysis: the internal transcribed spacer region (ITS) was amplified using primers ITS1 and ITS4 [1], primers EF1-728F and EF1-986R, ACT-512F and ACT-783R, CAL-228F and CAL737R [2] were used to amplify the part of translation elongation factor 1-α gene (TEF1), actin gene (ACT) and calmodulin (CAL), respectively, and primers Bt-2a and BT-2b for amplification of the beta-tubulin gene (TUB) [3] were used.

At the same time, taxonomic properties such as colony color, sporulation, growth rate in various media are investigated; a method suitable for pathogenicity studies to fully characterize and identify isolates up to *Diaporthe* species is currently being optimized.

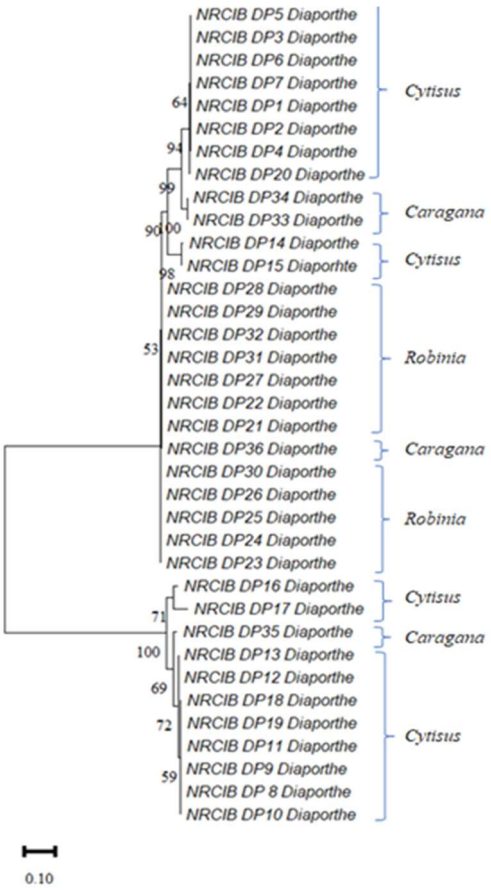

Fig. 3. Phylogenetic relationships generated from maximum likelihood analysis based on ITS sequence data from *Diaporthe* species.

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VEGETATION CONNECTIVITY IN GREEN BELT FOREST ECOSYSTEM FOR HEALTHY FOREST STAND

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ABSTRACT

Green Belt Forest Ecosystems are at the forefront of terrestrial ecosystems that provide important aesthetic and ecological functional contributions and are most affected by overpopulation. Today, these ecosystems are fields, vineyards, gardens and housing etc. Fragmentation affects soil properties depending on the characteristics of the habitat (slope, aspect, altitude, precipitation and temperature, etc.). For this reason, Kahramanmaras, which is a semi-arid region, Ahir Mountain green belt forest ecosystem and Trabzon Olympic Park in the humid region were examined as the study area. In this research, fragmented habitats of different sizes were identified and examined using Landsat8 satellite images. According to the research findings, fragmentation in green belt forest ecosystems varies between 0.5-80 ha and the distance between parts varies between 5 m-1000 m. Habitat size and distance from habitats affect habitat characteristics and therefore soil characteristics. According to the correlation analysis, as the habitat areas get smaller, the tendency to decrease in organic matter content, water holding capacity and increase in dispersion ratio has been determined statistically. The erosion susceptibility of the area has increased as the habitats have been separated into small pieces.

Insects, which are poikilothermal creatures [1], can only carry out their activities at the appropriate outdoor temperature. For this reason, insects are more common in open areas, forest roads and edges in the fragmented forest, which receives more light and is warmer. A similar feature applies to other wild animals, which is called the "edge effect" [2]. This factor is expressed as "diversity" in wildlife. Thus, there is an orientation from the center to the edges. However, this situation may not always be in favor of the ecosystem, for example, to Pine Pouch Beetles, it threatens plant health by spreading more in degraded areas, which are generally located on south-facing stony and eroded shallow soils near the stand [3].

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RECOVERING ELMS FOR THE CITIES: NEW DED-RESTISTANT ULMUS MINOR CULTIVARS SELECTED IN SPAIN

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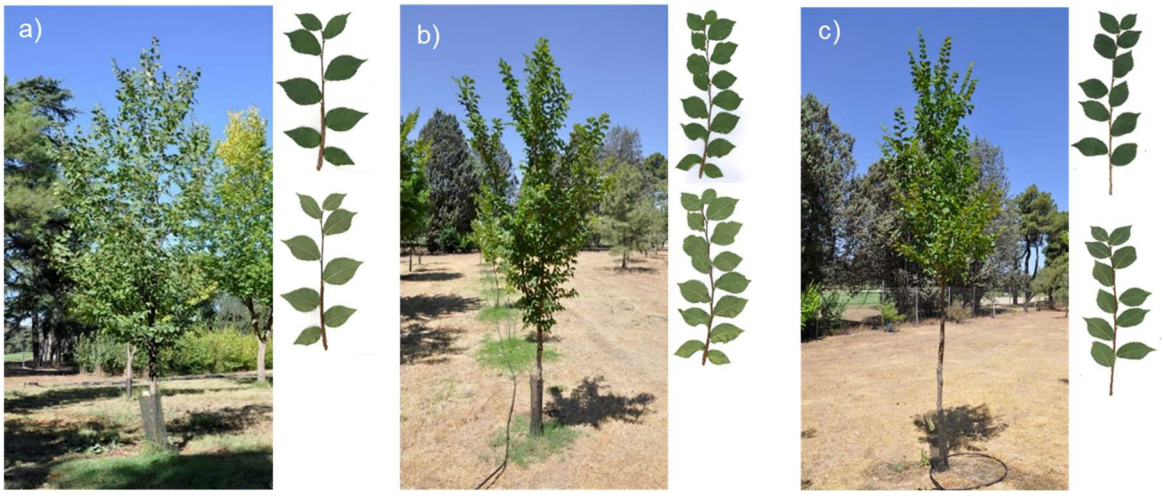

Growth habit of the three selected *Ulmus minor* clones grown in the clonal bank of Puerta de Hierro Forest Breeding Center (Madrid, Spain) and detail of their twigs. (a) R1×S 22, 11 years old (y.o.); (b) R2×S 32, 10 (y.o.); (c) R2×S 73, 9 (y.o.).

ABSTRACT

Ulmus minor is suitable as urban tree due to its high ornamental value and tolerance to soil compaction, root hypoxia, wind, poor soils and pollution [1]. This is evidenced by its widespread urban use before the arrival of the Dutch elm disease (DED) epidemics. Recovering the traditional use of elms in urban landscaping is an objective of the Spanish elm breeding program through the selection and breeding of genotypes resistant to DED. After three decades of activity, the Spanish elm breeding program registered seven elm resistant cultivars to DED in 2014 [2], five of which were pure *U. minor*. Increasing the genetic diversity of *U. minor* cultivars resistant to DED is a priority to reach reliable and stable resistance to DED and to broaden the environmental range for the species utilization. To this end, 121 new *U. minor* genotypes were obtained through controlled crosses between two moderately resistant parents (dams) and one susceptible parent (sire) [3]. After two consecutive years of DED inoculation under field experimental conditions, three genotypes stood out for their high resistance levels. The genetic fingerprint, leaf phenology and morphology, and ornamental traits of these three genotypes were characterized to facilitate their identification and use. Nuclear microsatellite profiling displayed unique barcodes for each genotype, ensuring traceability of the plant material. Morphological and phenological traits of the three genotypes are quite similar and fall

within the species standards. These cultivars will be proposed for registration as basic reproductive materials in Spain.

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THREAT OF ALIEN PATHOGENS IS INCREASING IN NORTHERN EUROPE

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Dead elms (*Ulmus glabra*) due to Dutch Elm Disease (*Ophiostoma novo-ulmi*) in Southern Estonia (Photo by Liina Jürisoo)

ABSTRACT

Climate change and international trade have affected strongly the spread and genetic diversity of pathogens in new areas. For example, European ash (*Fraxinus excelsior*) is continuously threatened by the invasive ascomycete *Hymenoscyphus fraxineus*. Thousands of *Ulmus* spp. individuals suffer for two subspecies and their hybrids of Dutch elm disease agent *Ophiostoma novo-ulmi*. *Pinus* species are affected by different pathogens, e.g. *Lecanosticta acicola* and this pathogen is expanding its area here.

Here we point out only some recently published results about the spread, monitoring and genetics of these pathogens and their effect to the mycobiomes of trees - to evaluate the impacts of alien pathogens to the indigenous microorganisms of trees. We have used PacBio sequencing of the fungal ITS1-5.8S-ITS2 rDNA region for exact detection of pathogens and their effect to the mycobiome of trees.

After that we investigated how *Hymenoscyphus fraxineus* affects mycobiome of European ash leaves. Surprisingly, the comparison of apparently healthy and symptomatic ash leaflets revealed no significant differences in relative abundance of this pathogen. However, the overall fungal richness on European ash leaves declined significantly along with an estimated increase of *H. fraxineus* biomass [1].

Which are vector beetles of the Dutch Elm Disease (agent *O. novo-ulmi*) in northeastern Europe? The beetles' DNA was analysed and the pathogen was found on six out of seven investigated beetle species: *Scolytus scolytus, S. triarmatus, S. multistriatus, S. laevis, Xyleborinus saxesenii* and *Xyleborus dispar*. The last two beetles were detected as new vectors for *O. novo-ulmi* [2]. It created even a new attention point to the pathogen.

Up-to-date global distribution data of the agent of the Brown spot needle blight *Lecanosticta acicola* were made available in the interactive map [3] and the analyses of the genetic structure of the worldwide population of this pathogen, focused to new areas is in progress.
All the obtained new data are essential for modelling of the potential threat of the appropriate pathogens in tree populations and for helping to attain control measures.

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MEASURES TO PROTECT THE URBAN ENVIRONEMNT AND NATURAL PHYSIOGNOMY. THE CASE OF VOULIAGMENI (IN GREECE)

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ABSTRACT

The degradation of the urban environment and, by extension, the degradation of standards of residents' live prompted them to look for new residential areas that offer remarkable natural resources. Thus, areas which present a healthy urban environment, its received pressure for building at the expense of natural resources. One such area is Vouliagmeni, which while it has remarkable natural ecosystem, is threatened by human activities and building. This paper refers to the protection of the urban environment in the area of Vouliagmeni Specifically it refers to the importance of urban natural element at the quality of life as well as to the protection of species of flora and fauna. Taking into account the directives of the European Union for the protection and enhancement of the urban environment, it assesses the current situation and proposed measures for its protection. To explore the data, a survey data of primary sources, geographical data, land use plans and a survey in site have been used. The survey showed that protecting the natural element, not only protected the life standard but the physiognomy of a place and the landscape. With the expansion of protected areas not only is the green area increased but also green pathways facilitating the movement of the animal species are created.

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A LEGISLATION ANALYSIS ON THE PROTECTION OF TREES IN TURKISH LAW

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ABSTRACT

When the legislation related to protection of trees and woodlands in Turkish law is examined, it is seen that there are special regulations for trees and woodlands within the forest boundary, and some different regulations for trees and trees and woodlands outside the forest boundary [1]. It is seen that the damage to trees and woodlands within the forest boundary is well known and well-established in terms of legislative implementations, however, regarding the damage to trees and woodlands outside the forest boundary and especially in urban areas, the awareness of the legislation is weaker, and the legislation is more detailed. Because the ownership of the land where the tree is located, the type of tree and its protection status are important for the protection of trees outside the forest boundary. These different distinctions require that trees be subject to different laws regarding the protection of trees. If the trees have a protection status, the Law on the Protection of Natural Assets is applied, if there is no protection status, the Turkish Penal Code is applied if someone other than the owner causes damage. On the other hand, for trees considered as forest trees, the forestry administration has the right to intervene even if the tree is outside the forest boundary [2, 3]. With this study, a detailed analysis of the legislation on the protection of trees will be carried out. The inadequacy of the legislation, especially regarding the intervention to trees in terms of disease, will be revealed; the awareness of the legislation will be analyzed; judicial decisions on the subject will be examined; and legal and administrative deficiencies in practice will be revealed, and some suggestions will be made.

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DEFENSE RESPONSES OF ALEPPO PINE TO THE INFESTATION BY THE GIANT PINE SCALE *MARCHALINA HELLENICA*

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ABSTRACT

The giant pine scale *Marchalina hellenica* (Gennadius) (Hemiptera, Margarodidae) is a univoltine sap-sucking insect native in Greece and Turkey, which infests pine trees. The scale's sweet, glutinous excretions are exploited by bees to produce pine honey, and in its native range it is considered an economically important insect for apiculture rather than a pest, since it rarely causes tree mortality there. Thus, it has been deliberately introduced in different areas for honey production. However, whenever *M. hellenica* infested novel areas, it became a pest, reaching high population densities, that ultimately contributed to tree health decline. More recently, the accidental invasion of *M. hellenica* in the area of Melbourne and Adelaide (Australia) caused significant damage to *P. radiata* in urban and peri-urban settings to such an extent that biological control agents are currently investigated in order to mitigate its impact [1]. As a consequence, the in-depth influence of insect's infestation on the physiological performance of its host trees has only recently received attention. Under moderate attack by the giant pine scale, the gas exchange of Aleppo pine (*Pinus halepensis*) is greatly affected [2]. In spring, at the peak of the insect's abundance, both assimilation rate and stomatal conductance were heavily reduced. The stable needle water status (relative water content, $\delta^{13}C$ natural abundance) indicated that this was not due to desiccation stress but because of metabolic disorders. Although Aleppo pine has developed a defense strategy through the regulation of gas exchange and the accumulation of sugars and phenolic compounds, the reduced assimilation rates in spring may impair the growth of the host pine on the long run.

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INVASIVE PESTS AND FUNGAL PATHOGENS THREATENING THE GREEN INFRASTRUCTURE OF URBAN ECOSYSTEMS IN BULGARIA

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ABSTRACT

Green infrastructure has the potential to decrease air pollution and improve human health and wellbeing in the cities. Currently, the urban green ecosystems in Bulgaria have been invaded by invasive pests and fungal pathogens, reducing species abundance and threatening diversity [1]. Damages are mainly caused by alien pests *Cameraria ohridella* on *Aesculus hippocastanum*, *Corythucha arcuata* on oak tree species, *Corythucha ciliata* on *Platanus* spp., *Cinara cedri* on *Cedrus* spp., *Cydalima perspectalis* on *Buxus sempervirens*, etc. In green urban areas, a sporadic occurrence of the pine processionary moth (*Thaumetopoea pityocampa*) was established on pine trees. The presence of the pest is undesirable in parks, schoolyards, and recreational forests, because of its potential to cause allergic reactions in humans and animals. Among the invasive pathogens, *Lecanosticta acicola*, *Dothistroma septosporum*, and *Diplodia sapinea* are of potential threat to natural pine species [2]. *Ophiostoma novo-ulmi* is widespread on elm trees in urban city parks, and *Cryphonectria parasitica* on chestnut natural forests. In recent years, newly-established pathogens *Botryosphaeria dothidea* and *Cryptostroma corticale* have caused significant damage to tree host species in the city parks. The identified biotic agents have violated the ecological role of urban ecosystems and their social functions. The application of measures to protect the green infrastructure against alien species is an important requirement for maintaining the city parks in good phytosanitary condition.

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APOCALYPSIS INSECTUM: URBAN AND FOREST TREE PEST INSECTS THAT ACCELERATE THE SOCIAL REACTION IN TURKEY

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ABSTRACT

In recent years, Turkish media has been generating terrifying terms for tree pest insects such as "vampire butterfly (vampir kelebek *Tr.*)" (10,400 Google hits) or "Dracula insect (Drakula böceği *Tr.*)" (4,100 hits). Whether or not these terms efficiently emphasize the biological nature of the insect in question, the need to create such terms stems from the alien species that cause public concern. Although they may seem exaggerated, these concerns are not in vain because of the rapid spread and/or outbreaks of these species. The citrus long-horned beetle, *Anoplophora chinensis*, native to Asia, was first reported from Europe in 1980 in the Netherlands, and in 2015 in Turkey. Currently, it occurs in almost all regions of the country. The box tree moth, *Cydalima perspectalis*, native to Asia, was first reported from Europe in 2007 in Germany, and since 2011, it reached to the southernmost and northernmost regions of Turkey. The Asian chestnut gall wasp, *Dryocosmus kuriphilus*, native to China, was first reported from Europe in 2002 in Italy, and in 2014 in Turkey, and it invaded almost all the chestnut growing regions of the country. The brown marmorated stink bug, *Halyomorpha halys*, native to Asia, was first reported from Europe in 2004 in Liechtenstein, and in 2017 in Turkey; it invaded almost all the Turkish Black Sea coast. Apart from the alien invasive species, local populations of native species can also occasionally reach to outbreak levels of public concern. The pale tussock moth, *Calliteara pudibunda*, made an outbreak in northwestern Turkey in 2018. A Google search with the term "beech caterpillar (kayın tırtılı *Tr.*)" yields only one hit for the period before 2018, whereas in a year, there were 1,330 hits because of the local panic in the outbreak region. Even more interestingly, natural periodic outbreaks of the pine processionary moths, *Thaumetopoea pityocampa* and *T. wilkinsoni*, end in hundreds to thousands of phone calls from citizens to the departments of forestry all around the country every four to five years. Although the pressure imposed on policy makers by such social reactions can lead to increased funding for control practices, the policy makers may be misled in the chaotic environment of social panic which, in turn, could end up with spreading the wrong control practices. Therefore, institutional strategies not only in pest management but also in "panic management" are highly needed.

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BIOECONOMY CONCEPT IN THE CONTEXT OF BIOSECURITY AND STRATEGIC PLANNING FOR TRANSITION TO BIOCITIES

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ABSTRACT

Biosecurity has been identified as one of the important topics of the rapidly developing bioeconomy concept after the 2000s. It is one of the environmental components of sustainable bioeconomy [1]. Sustainable bioeconomy policies should have the characteristics of dynamic system approach, transdisciplinary research, observable effects with a holistic view. At this point, the biocities approach represents the version of the bioeconomy perspective that took shape in cities, and nowadays it has entered the agenda of various bioeconomy actors like establishing biocity facilities [2]. The extent to which national bioeconomic policies affect urban forests, trees to rethink cities holistically to ensure their sustainability and resilience is a gap. With the effect of bioeconomy policies developed by international platforms such as the European Union and OECD, many countries in Europe have national bioeconomy strategies and implementation tools. The lack of published national bioeconomy strategies does not necessarily mean that countries do not focus on bioeconomy. For example, although Turkey does not have a direct bioeconomy strategy, it frequently emphasizes the fields of biotechnology, bioinnovations, especially in the agriculture and health sectors [3].

In order to investigate to what extent the city strategy plans contain the concept of bioeconomy, the Strategic Plan of the Istanbul Metropolitan Municipality (2020-2024) has been examined as an example. It has been determined that the issue of biosecurity is not included in the strategic plan and generally green economy and sustainability strategies are emphasized. The green economy includes sub-concepts such as bioeconomy, blue economy, clean industry, and circular economy, and the strategies to be implemented in line with these sub-concepts will be able to determine and monitor real sustainable green transition to biocities. Sub-areas like bioeconomy will clarify the stakeholder contribution in creation phase and increase the reliability of decision-making systems of strategic plans.

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HORSE CHESTNUT (*AESCULUS* SPP.) TREES' HEALTH STATUS IS LINKED TO VARIANCES IN THE ASSEMBLAGE OF ENDOPHYTIC FUNGI

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Horse Chestnut trees with symptoms of leaf blotch and leaf miner (Photos: Yasin Korkmaz, Göttingen 2020 and 2021)

ABSTRACT

Horse Chestnut (*Aesculus*) is a genus of common ornamental trees in western and central Europe, mainly found in urban areas. Horse Chestnut trees are aesthetically valuable and essential to cities because of their highly significant biodiversity. Due to increasing temperatures and the invasion of non-native pests and pathogens, early leaf dieback, abscission, and intense impact on tree death caused by, i.a., the leaf miner (*Cameraria ohridella*) and leaf blotch (*Guignardia aesculi*) [1]. In this study, 30 Horse Chestnut leaves with leaf blotch symptoms were collected from eight trees from different locations in Göttingen, Germany. Filamentous fungi were isolated from the infected tissues. A high fungal diversity of Ascomycetes could be identified with ITS4 and LR6 molecular markers. Common tree saprobionts and potential pathogens including *Biscogniauxia nummularia*, *Colletotrichum* spp., *Alternaria* spp., and *Fusarium* spp. were found. The most abundant fungal species belonged to the genus *Colletotrichum*, a typical tropical and subtropical pathogen. A potential synergy in causing the disease symptoms of the most abundant isolated pathogens and *G. aesculi* were further investigated by antagonism assays and comparing the nutrient profiles with Phenotypic MicroArrays. The results suggest that the fungi do not antagonize each other and even occupy individual metabolic niches; thus, a co-existence on the leaves is likely. The findings by Korkmaz [2] demonstrate that Horse Chestnut tree species are suffering from various fungal pathogens invasively infecting their host trees and may be responsible for the worsening constitution of their host since they probably cause disease symptoms in addition to the causal agent of leaf blotch. The situation may worsen with climate change favoring the establishment of an increasing number of alien species; however, this hypothesis needs to be tested. As the study was conducted in central Germany, the results suggest that those usually warm-loving

fungi spread to more temperate climate zones. Thus, more research is needed to investigate the distribution of those damage-causing pathogens and their possible correlation to the leaf miner infestations within Europe.

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INVASIVE ALIEN TREE PATHOGENS IN TURKEY

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Platanus sp. infected by *Ceratocystis platani* (Dolmabahçe Palace Garden, İstanbul); Symptoms of Dutch elm disease on *Ulmus minor* (Çankırı); *Cupressus sempervirens* infected by *Seiridium cardinale* (İzmir); Shoot dieback symptoms caused by *Diplodia sapinea* on *Cedrus libani* (Atatürk Arboretum, Istanbul), Severe infection symptoms on an endemic Anatolian black pine tree caused by *Lecanosticta acicola* (Atatürk Arboretum, Istanbul); Boxwoods killed by *Calonectria pseudonaviculata* in a forest (Rize) and in a public park (Gülhane Park, İstanbul). (Photos: Funda Oskay, Asko Lehtijärvi)

ABSTRACT

Invasive alien forest pests, including pathogens, are among the major threats to forest ecosystems. Invasive alien tree pathogens (IATP) that prompt enormous influence on urban and forest ecosystems as well as on management policies in Turkey include oak powdery mildew, chestnut blight, Dutch elm disease, cypress canker, canker stain of plane, boxwood blight, and brown spot needle blight of pines. Oak powdery mildew with an unknown introduction history, Dutch elm disease, first introduced into Turkey in the 1940s and Cyprus canker, first reported based on the symptom in the early 2000s are widespread diseases in the country — yet none of these diseases have been subjected to control measures, nor have the causal agents been investigated on a comprehensive scale. Since 2012, outbreak of boxwood blight caused by an invasive fungal pathogen (*Calonectria pseudonaviculata*) combined with the introduction of the invasive boxwood moth has resulted in destruction of the nearly entire populations of *Buxus sempervirens* in the country. The causal agent of canker stain of plane was reported already in the early 2010s, yet it was properly identified first in 2017 [1]. The presence of canker stain disease so far is only known from Istanbul, where the disease has affected and spread mainly

across alley trees of significant cultural value. This has had social impacts, either through creating public safety risk or through causing social pressure on management activities. Considering the inefficacy of legal measures and sound management strategies, it is likely that spread of the disease from urban areas in Istanbul to rural, forest and riparian ecosystems is only a matter of time. Brown spot needle blight caused by *Lecanosticta acicola* was detected in an arboretum in Istanbul, causing severe damage to especially native and endemic pines as well as to *Cedrus libani* in 2017 [2]. It is not known if the disease has spread to nearby pine plantations or to the forest nurseries.

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THE IMPACT OF CLIMATE CHANGE ON URBAN FORESTS IN THE REPUBLIC OF SERBIA

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ABSTRACT

The expected increase in aridity, which is manifested by an increase in the number of days with drought and a general decrease in the availability of groundwater in lowland areas, will cause a serious decrease in areas suitable for growth and vitality of forests in Serbia in the second half of 21 century. Conditions will be mostly worse in Vojvodina and the area of Belgrade, in Southern and Eastern Serbia, where large areas are under forests today, and especially in Kosovo. The least deterioration can be expected in Sumadija and Western Serbia [1]. Given the different forest species and indices, the models show the possibility of a significant reduction in habitat suitability, in the range of 13% (spruce habitats, RCP4.5, calculated according to the Ellenberg index for the period 2041 - 2070) to as much as 99% (fir habitats, RCP8.5 calculated according to the FAI index for the period 2071 - 2100). In the most widespread beech forests, the reduction will be somewhat smaller, although significant. Urban forests are being widely used as climate adaptation nature-based solutions and are generally considered important to mitigate several weather-related hazards – they keep the temperature down during heat waves, can stabilize soils, and help in preventing flooding. At the same time, urban forests themselves may be vulnerable to the same disturbances [2]. Serbia is facing a trend of uncontrolled urbanization and expansion of urban areas, with an extremely inefficient use of construction land and excessive conversion of agricultural and forest land. In the period from 2000 to 2013, 1.15% of the total land area was subject to some kind of conversion [3]. In such circumstances, the challenge remains to protect the existing, while promoting the introduction of new urban forest land in Serbia, which will be discussed in the presentation.

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AN OVERVIEW OF FUNGAL QUARANTINE PESTS FOR FORESTRY IN TURKEY

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ABSTRACT

Fungi and fungus like organisms of forestry concern listed as quarantine pests in the Turkish Plant Quarantine Regulation and EPPO (European and Mediterranean Plant Protection Organisation). were addressed More than half of the EPPO A1-listed harmful fungal organisms (which are not found in the EPPO region, including Turkey) either directly cause diseases on forest and fruit trees in orchards or pose a threat to wild hosts in forests. The Turkish quarantine pest list currently includes 60 fungi and fungus like organisms, 77 % being listed as to be absent in the country. However, some of the organisms listed in the EPPO A1 or A2 list have not been included in the Turkish Plant Quarantine Regulation such as the causal agent of thousand canker disease of walnut (*Geosmithia morbida*) or *Heterobasidion iregulare*. On the other hand, some important forest pathogens in the lists were accounted to absent even though present in the country. Moreover, some fungi were listed at different categories with their synonym names (i.e. as to be present and absent in the country at the same time). For example, *Dothistroma septosporum* was listed as a quarantine pathogen with limited distribution in the country while the same fungus with its synonym (*Scirrhia pini*) was listed among the quarantine fungi absent in the country. A more thorough evaluation of all quarantine pest lists (including insects, bacteria, nematodes, and so on) could provide a broader perspective on downsides and, as a result, requirements for enhancing quarantine measurements, particularly for those of forestry concern. Additionally, the existing regulations for mitigating potentially dangerous pests and pathogens in forestry in Turkey must be thoroughly addressed.

TREE DIVERSITY - IMPORTANT FACTOR IN SECURING HEALTHY URBAN FORESTS

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ABSTRACT

Tree diversity provides a basis for evaluating a city's ability to support a healthy urban forest. Diverse urban forests, both in terms of structure and species composition, ensure their resilience to the challenges of the urban environment. There is mounting evidence that species diversity in particular enhances ecosystem resistance to bio- and ecological disturbances. Urban forests with lower species richness face greater risks of mass mortality and canopy cover loss from the introduction of species- or genus-specific pests and disease—exemplified by the mass mortality events—of elm, ash, chestnut, and oak trees, by Dutch elm disease, emerald ash borer disease, chestnut blight fungus, and oak wilt fungus, respectively, which have collectively killed over 100 million urban trees across North America [1].

Tree diversity, on a species-, genus-, and family-level, is an important factor in securing healthy urban forests and providing ecosystem services. The 10/20/30 benchmark proposed by Frank Santamour [2] states that urban forests should comprise no more than 10% of any particular species, 20% of any genus or 30% of any single-family. Originally, Santamour presented his 10/20/30 benchmark in stem count. We obtained tree inventory data from Skopje municipality (Skopje Green Cadaster). After removing incomplete and erroneous data, relative abundance, calculated with stem counts, was used to score how well Skopje scored on the diversity benchmark 10/20/30. The top three most abundant species were *Tilia tomentosa* 7.3%, *Robinia pseudoacacia* 5.5% and *Acer pseudoplatanus* 4.5%, the top three most abundant genera were *Acer* 11.8%, *Tilia* 10.6% and *Fraxinus* 10.%, and families *Malvaceae* 10.6%, *Oleaceae* 10.1%, *Fabaceae* 8.3%. Therefore, it can be concluded that Skopje met the 10/20/30 benchmark.

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FACTORS AFFECTING PM10 RETENTION BY BLACK LOCUST RESTORATION PLANTATIONS

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ABSTRACT

Improving air quality is a major challenge worldwide. **N**ature-based solutions, such as tree plantations, are widely used to increase the retention of PM10 particles. In this study, we assessed the contribution of *Robinia pseudoacacia* L. restoration plantations, established at former open-cast mines of the Lignite Centre of Western Greece, in retaining PM10 particles. PM10 production data were collected for two consecutive years (2020 and 2021) from a network of 9 stations that measure air quality and climatic parameters. At the same time, leaf samples were collected to estimate their PM10 retention. During the first year, sampling was performed on a bimonthly basis at three plantations on former mines to assess site-specific differences. Sampling was conducted along two transects (25m long), each consisting of five trees, at different positions of the tree crown. We found that the effect of site and leaf orientation within the crown were negligible, while the effect of distance from the source was unclear. On the contrary, leaf position along the tree axis and season had significant effects. Based on these preliminary findings, we studied in more detail the impact of seasonality and distance from the source on PM10 retention during the second year. Samplings were performed more intensively (twice per month) at one site, where four transects each 50 m long, consisting of 5 trees, where established. Leaf samples were also collected from three positions within the tree canopy (high - middle - low). PM10 concentration was highest at the edge of the plantation, closer to the pollution source and decreased with increasing distance. Significant differences were also found in terms of seasonal variation and the position of the leaves within the tree canopy. Our results support that black locust plantations have the ability to retain dust in their foliage and contribute to the improvement of air quality in polluted areas, such as lignite mining centers. The rates of PM10 retention depend on the distance from the emitting source and are fluctuating seasonally, due to the prevailing weather conditions and to the intensity of PM10 release by the energy plant.

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RAPID IN-SITU DETECTION OF CERATOCYSTIS PLATANI

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ABSTRACT

Canker stain of plane tree (caused by the fungal lethal pathogen *Ceratocystis platani*), has an important economic impact as it causes mortality of one of most important tree species in the urban environment all over the world. To contain the spread of disease in the cities, a simple and rapid detection is strongly needed. We describe the applicability of a new detection protocol against Ceratocystis platani: LAMP assay applied to plane tree woody samples (*Platanus* × *acerifolia*). The setting up of a direct DNA extraction from fresh wood dust associated to a highly performant LAMP protocol [1] allows a specific and sensitive in-situ diagnosis, accelerating analysis time compared with traditional methods, including real-time PCR [2].

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CERATOCYSTIS IN EUROPE; AN ONGOING INVASION

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ABSTRACT

Ceratocystis is a fungal genus that keeps rising in number of species described and causing emerging new diseases worldwide with a severe impact in the tree host species affected. *Ceratocystis platani* is attacking plane trees, both in urban and rural environment. The pathogen is of American origin and has invaded Europe during WWII. In Greece, it affects the highly susceptible *Platanus orientalis* that is occurring naturally in abundance as main tree component of the riparian vegetation across the country. The disease is causing mass losses in these natural ecosystems as well as in urban plantations where besides *P. orientalis* the hybrid *P.* × *acerifolia* is affected [1]. Recently, *Ceratocystis ficicola* has been recorded in Greece, which is also invasive in Europe from Asia. This fungus attacks primarily *Ficus carica* in the field, but has also been pathogenic to *F. benjamina* in inoculation trials. For this second pathogen, there is high uncertainty on the potential hosts. In Greece, in fig orchards in two regions of the country that fig cultivation is an important agricultural sector, rapid decline is taking place [2]. In Greece, there is at least one geographic region that both pathogens are found, infecting their hosts, raising further concerns for the chance of hybridisation events. *Ceratocystis platani* and *C. ficicola* are soil persistent pathogens, dispersed mainly by human activities, both making a real challenge the management of infected fields in urban, agricultural and natural environments. Monitoring, strict quarantine, and eradication efforts should be applied. Early detection can be crucial in the efficacy of applied measures. Networking, and scientific collaboration across the continent and partners, rapid exchange of information at policy makers and stakeholders' level are essential components in a sustainable plant health strategy.

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INFLUENCE OF VACCINATION TREATMENT ON EPIPHYTES AND FUNGAL ENDOPHYTES IN ELMS

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ABSTRACT

Elms (*Ulmus* spp.) are ideal urban trees and support a rich biological diversity. Unfortunately, elm populations are severely affected by Dutch elm disease (DED), caused by *Ophiostoma novo-ulmi.* A biological control product Dutch Trig® has been successfully used against the DED [1]. The possible effects of vaccination on the associated biodiversity, such as the epiphytes or endophytic fungi, are not known. In March 2022, two studies were initiated to explore this aspect. In Stockholm, the epiphyte coverage was mapped on the bark of 17 *U. glabra* 'Camperdownii' trees vaccinated annually between 2018-2021 and on as many conspecific, unvaccinated trees. A net with 100 squares (2 x 2 cm) was placed over the bark of each tree at the height of 130 cm to allow standardized evaluation of the epiphyte coverage. The results indicate lower epiphyte coverage in vaccinated trees as compared with unvaccinated trees. In Gotland, bark samples containing were collected at 130 cm height from unvaccinated (n=15), continuously vaccinated (n=15) and previously vaccinated (n=15) elm trees using a cork borer. The samples were surface sterilized, cut into four pieces and placed on water agar (1.5%) where the mycelia were allowed to emerge for 14 days. The number of morphologically unique mycelia emerging from each piece was recorded, and small pieces of growing mycelia were transferred on malt extract agar. After 14-21 days, the colonies were classified into morphotypes based on colony texture, color and growth rate. Preliminary results show that at least one unique type of mycelium emerged from all samples, indicating high overall presence of endophytic infections. Over 50 morphological groups were separated, with a large proportion of singletons. Samples collected from elms that had been vaccinated earlier resulted in the highest frequency of morphologically unique endophytes. The quantitative results of the studies are currently being evaluated.

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