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Perception about urban forest and its influence on well-being in workplaces

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Abstract: Urban forests play an essential role in mitigating negative human actions over people's quality of life. Trees provide well-being to populations since they enable the provision of several environmental services. Human perception about nature is essential to keep balance in cities' development processes, according to which, natural environments are part of them. Thus, the aim of the current study is to analyze Technological Research Institute workers' perception about its urban forest to support its management process. Results have evidenced the positive and negative influence of urban forests on the daily activities of local community in its work environment, based on the application of an online questionnaire. Participants have contributed to help improving environmental management at the Institute Campus, by proposing actions.

Keywords: Urban forestry; well-being; health; workplace.

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Introduction

There has been a significant decrease in native forests and green areas in recent years due to large population growth and unrestrained economic development (FERREIRA, 2012). The number of environmental hazard cases, such as landslides, natural floods, inundations, overflow sites and powerful torrents associated with reduced natural vegetation in urban environments, has increased over the years (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA, 2019; INSTITUTO DE PESQUISAS ESPACIAIS, 2010; UNIVERSIDADE FEDERAL RURAL DO RIO DE JANEIRO, 2020; GESTÃO DE RISCOS DE DESASTRES, 2013), as well as the number of fatal victims resulting from these events (INSTITUTO DE PESQUISAS TECNOLÓGICAS DO ESTADO DE SÃO PAULO, 2017). Cities are the most populous life centers, as well as the place where most causes of environmental issues are concentrated in. Society's current lifestyle has taken a great leap due to technological advances; however, the human/nature relation has been neglected. Studies have shown that vegetation removal is one of the reasons for the increased number of so-called modern diseases, such as infections and respiratory conditions, heart issues, cancer, allergies and psychological diseases (MEDEIROS, 2003; SILVA *et al.,* 2016; MOREIRA, 2018). Nature provides the necessary resources to improve and maintain humans' quality of life, good body and mind conditions, as well as environmental quality. Among these resources, one finds cities' vegetation, which is capable of forming Urban Forests (NICODEMO; PRIMAVESI, 2009).

The international conceptualization and standardization of the urban forest terminology was first mentioned in the United States, back in 1894. It reemerged in the 1960s as a comprehensive and interdisciplinary approach to address specific challenges associated with the process of growing trees in urban environments. However, standardizing urban forestry terminology is a complex task, either because it requires the involvement of different disciplines or because of translation difficulties. Unlike the North American viewpoint, the direct translation of "urban forest" into several European languages, for example, is more often associated with forest ecosystems than with growing trees in road systems and parks. According to Randrup *et al.* (2005), the concept of urban forest includes three components. The first one lies on vegetation structure; this topic was addressed by Miller (1997), Paiva and Gonçalves (2002), Harris, Clark and Matheny (2004), Badiru, Pires and Rodriguez (2005), Konijnendijk *et al.* (2006) and Gresham (2011). The second component refers to vegetation location; this topic was addressed by Sampson, Moll and Kielbaso (1992), Konijnendijk (1999), National Urban Forestry Unit (1999), Konijnendijk *et al.* (2006), Gresham's (2011) and Melbourne (2014). The last component deals with benefits of vegetation, and this topic was addressed by Helms (1998) and Jorgensen (1986) (Chart 1).

Chart 1 - Concepts linked to the definition of urban forest

Vegetation structure	Sum of all woody vegetation surrounding and involving urban clusters, from small rural communities to large metropolitan regions (MILLER, 1997).
	Natural or planted vegetation (HARRIS; CLARK; MATHENY, 2004).
	Set or cluster of trees and shrubs grown and managed in urban spaces (BADIRU; PIRES; RODRIGUEZ, 2005).
	Urban forestry tree is the smallest analysis scale (KONIJNENDIJK *et al.,* 2006).
	Prevalence of arboreal vegetation (PAIVA; GONÇALVES, 2002; KONIJNENDIJK *et al.,* 2006; GRESHAM'S, 2011).
Vegetation location	Located in public and private properties (SAMPSON; MOLL; KIELBASO, 1992; NATIONAL URBAN FORESTRY UNIT, 1999; GRESHAM, 2011).
	All tree vegetation grown in places where decision-making processes are dominated by local urban actors (KONIJNENDIJK, 1999).
	If urban forests include forest areas where urban demands prevail, even areas (as far as 100 km from the city center) can be taken into consideration, for example, when they protect the drinking water resources of a given city (KONIJNENDIJK *et al.,* 2006).
	Urban forest comprises all trees, among other vegetation types - and the soil and water supporting it - in the municipality (MELBOURNE, 2014).
Benefits from vegetation	Contribution to urban society's physiological, sociological and economic well-being. These contributions comprise trees' overall improvement effect on their environment, as well as their general leisure and amenity value (JORGENSEN, 1986).
	Physiological, sociological, economic and aesthetic benefits provided by trees to society (HELMS, 1998).

Source: Elaborated by the authors.

Based on the analysis applied to the aforementioned studies, the urban forest concept best adapted to the composition of the forest vegetation found in IPT Campus was defined as follows: "Urban forest covers all vegetation - mainly tree-shrub, either natural or planted - both formed by native and exotic species located in the public or private domain, where decision-making processes are dominated by local urban actors; they help providing physiological, sociological, economic and aesthetic benefits to society".

It is of utmost importance developing a society able to use natural environments and to respect their limits.

Urban planning has neglected the relevant role played by vegetation in cities' advancement processes. This factor has been causing increasing environmental issues, such as climate change, worsened air pollution rates and tree falling, rather than preventing them from happening. In addition, it highlights authorities' unpreparedness and poor knowledge about the role played by natural environmental management as fundamental component for public management modernization processes. Electric power distribution infrastructure, for example, is one of the main conflicting issues associated with urban forest (VELASCO, 2003), although this issue was solved a long time ago in first-world countries, due to undergrounding cables. Irregular occupations, which often result from irregular deforestation, also worsen this scenario (COMPANS, 2007). We are all part of a natural system humans try to disassociate themselves from. Thus, society is experiencing a dangerous and harmful time.

One of the worst difficulties observed in Urban Forest Management processes lies on weak community involvement in them, since it does not understand the priceless value of environmental services provided by well-wooded regions. It is also logical to report that certain socio-cultural, economic and educational contexts do not favor people's discernment about this topic. In many cases, trees are seen as obstacles, as well as are associated with dirt, due to falling leaves; with damage to sidewalks; and with pests, such as termites and borers, among other insects (MONICO, 2001). Moreover, they are seen as elements capable of providing favorable environment for theft and drug use, among other criminal practices (ALVES, 2018; VALINHOS, 2020). They are also associated with accidents caused by falling trees and branches that, in their turn, can lead to material damage, or even to fatal victims. However, these issues involve planning, urban forest management and security-related public policies. Previous studies have pointed towards increase in the number of workers with mental disorders, who act in several segments - depression is the biggest problem among mental illnesses. These disorders rank the third position among the reasons for granting social security benefits to workers (BRASIL, 2017). Other studies have evidenced that physical environment (noise, lighting, temperature, intoxication, and physical-space layout) and relationships in work environment are factors capable of affecting workers' psychological health (TEIXEIRA, 2007). Accordingly, previous studies have shown that urban afforestation contributes to several public health aspects, besides providing cities with environmental quality (SILVA *et al.,* 2016).

It is extremely important associating these two aspects – i.e., work environment and urban forest -, since they are among factors capable of providing more efficient results to society, workers and entrepreneurs, because they influence employees' feeling of well-being and make them more productive (CASTRO, 2015; FUNCIONÁRIOS…, 2018). Natural environment and workplace are interdependent factors, since one requires resources from the other, be they natural or human. Moreover, both factors need management and control to enable people's safety and health. Natural environment and workspace are essential elements for society, since they are the places where people spend most of their lives in. Buckeridge (2015) has also mentioned that cities' development and urban forestry are essentially connected to each other. The aforementioned study has also emphasized the importance of being aware of this connection to enable natural environments' recovery

and revitalization processes in metropolises, of the economic benefits linked to health spending and, according to Lourenço *et al.* (2016), of both energy conservation and increased property values.

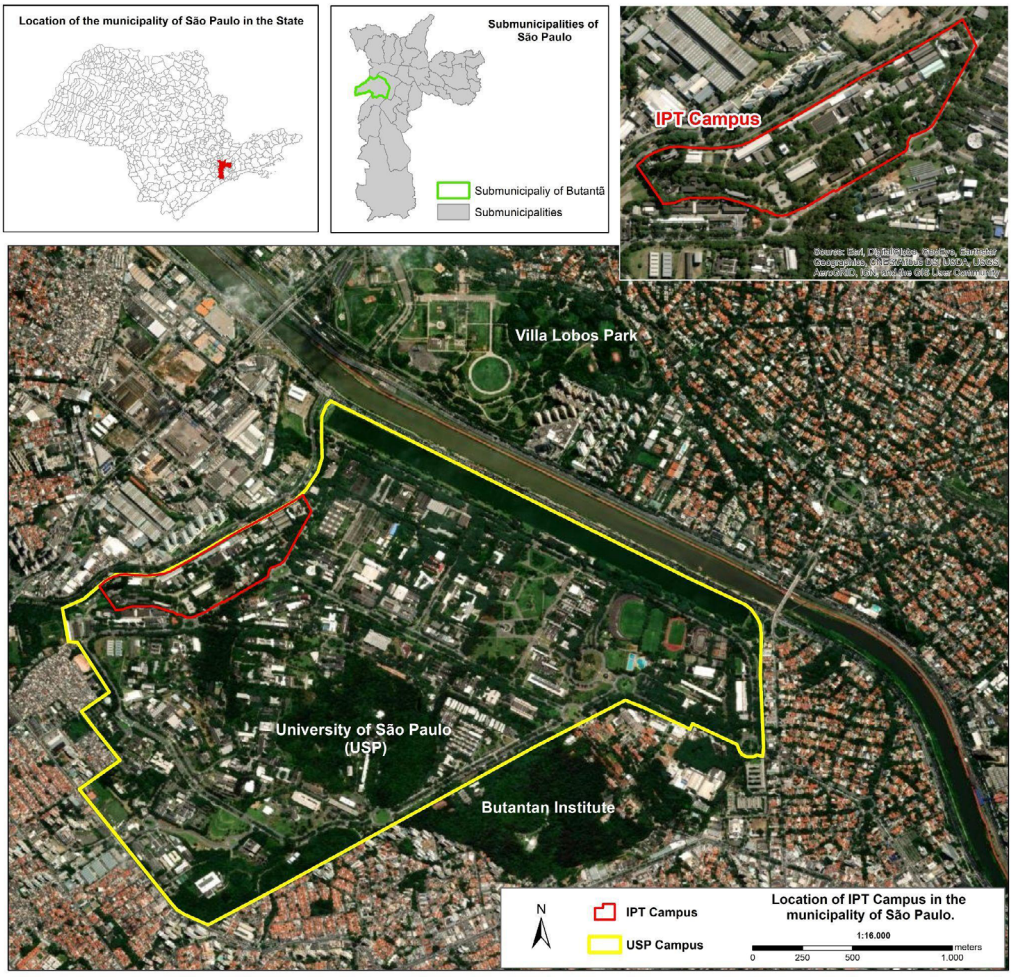
People often move out to the countryside, or to coastal areas, in pursuit of rest and tranquility, to have contact with nature. Why should they not make the place where they live in conducive to that too? After all, metropolises keep on growing and demanding more green space; thus, these precious regions will become increasingly scarce without proper management.

The aims of the current study were to analyze the link between people and Urban Forest in workplaces and the influence of Urban Forest on their well-being, as well as to better understand company employees' perception about the Urban Forest's potential to generate natural environmental services to support the management of green areas in work environments.

Materials and Methods

The current study was carried out at the Campus of the Technological Research Institute of São Paulo State (IPT). The aforementioned Campus is located in the area under the responsibility of Butantã's subprefecture, which is one of the 32 subprefectures of São Paulo City, Brazil (Figure 1). This subprefecture accounts for 3.7% of the aforementioned municipality's area and it is featured by its prevalent residential, horizontal, medium and high-standard use. It encompasses important public, institutional and social facilities, such as the University of São Paulo (USP) and Butantan Institute, and protects its green areas, as well as comprises significant number of public parks (SOLERA *et al.*, 2020). Based on Figure 1, one can see significant incidence of green areas in IPT, whose area covers 65,760 m^2 and accounts for 31% of the campus area. This urban forest, which comprises approximately 1,900 trees in the IPT Campus, was first analyzed five years ago. It was done to enable carrying out floristic survey, tree diagnosis and tree-falling risk analysis, in order to create a safe and sustainable urban forest with the potential to generate environmental services. These objectives were in line with activities performed by the socio-environmental Responsibility and Governance Committee, which uses these data to generate sustainability reports, as well as to comply with indicators established in its socio-environmental responsibility and governance policy, as well as with the Institute's environmental, social and governance principles (ESG).

Figure 1. IPT Campus location in São Paulo City, São Paulo State, Brazil



Source: Elaborated by the authors.

IPT employees' perceptions about urban the potential of forests to generate natural environmental services associated with human well-being were collected during a primary survey based on online-questionnaire application. Qualitative research was the exploratory methodology used to conduct further investigations at the second research stage. Although it provides insights and helps better understanding the context of the investigated problem, it is important completing it with quantitative research to find more significant results (CHAER; DINIZ; RIBEIRO, 2011). Other researchers, such as Monico (2001), Ribeiro (2009), Pina (2011), Silva *et al.* (2016) and Moreira (2018), have also used this tool to better understand the investigated community's perception.

The option made to use an online questionnaire was based on its low cost. In ad-

dition, this fast-process tool is accessible at any place and time, in addition to ensuring anonymity, allowing comfort and to not introducing interviewer's bias to participants, as often observed in one-on-one interviews (BÊRNI, 2002).

According to Bêrni (2002), one of the disadvantages of conducting online research lies on its low response rate, which ranges from 20% to 40%, whereas one-on-one interviews reach 95%.

Questions to be elaborated in order to reach research goals were described before the questionnaire design was established, based on the ideas introduced bellow:

a) Perception about urban forest: understanding community's perception about the Institute's trees;
b) Influence on health: benefits provided by IPT's green areas for the physical and mental health of the Institute's community and;
c) Well-being in work environments: advantages provided by green areas as one of the factors capable of increasing yield in work environments.

Meetings were held with the team of researchers, who were part of IPT's Forestry Center. It was done in order to define questions and set the questionnaire. The following guidelines were defined: itemizing the most appropriate multiple choice questions; the need of having open fields to allow answers that were not among multiple choice alternatives; question language and form to favor simple and direct language to be understood by different respondent profiles; ideal number of questions used to collect data, on all topics of interest, and to be quickly answered.

Questionnaire elaboration was based on free tools available on the Internet - it featured quick and reliable access to be filled in and to meet the goals listed in items a), b), and c).

The herein adopted questionnaires were made available to be filled online, via Google Forms; the access link was sent to the IPT community, which comprised 1,043 employees (IPT employees and third-party workers); 657 (63%) were men and 386 (37%) were women, according to information provided by the People Management Coordination of IPT. Respondents were informed that filling out the questionnaire was a voluntary task. The questionnaire was spread through IPT's intranet and through the link "IPT in 5 minutes", which are employee information mechanisms often adopted by the Institute. The questionnaire remained available to the IPT community from December 6th, 2019 to January 31st, 2020.

Results

In total, 212 (20%) of the 1,043 IPT employees have answered the questionnaire; this result is consistent with what was expected for an online survey (BÊRNI, 2002). If

we take into consideration the IPT employees' universe, which encompasses 657 men and 386 women, it would be expected to have more men answering the questionnaire, since they account for 63% of the IPT community. However, although women are minority in this community (37% of the total number of employees), they accounted for more than 50% of the total number of questionnaire's respondents (Chart 2). Garcia (1992) and Sang *et al.* (2016) have also found similar result in research about the women/nature connection. However, it is necessary conducting an in-depth case study at IPT Campus.

IPT's People Management Coordination provided the age group of only 816 employees (78% of the Institute's community universe). Thus, it was not possible performing a comparative analysis about IPT community's adherence to the study based on age group. According to Chart 2, the highest response rate was recorded for age group 31-40 years. Sang *et al.* (2016) have evidenced that older residents showed more interest than the younger ones in nature-related activities. This result can be part of a new study focused on investigating accurate answers in the IPT Campus' case.

Chart 2 - Respondents' profile (age group and gender)

AGE GROUP	**RESPONDENTS**	
No answer	1	0.5%
Up to 20 years old	2	0.9%
From 21 to 30 years old	46	21.7%
From 31 to 40 years old	62	29.2%
From 41 to 50 years old	30	14.2%
From 51 to 60 years old	37	17.5%
Over 60 years old	34	16.0%
TOTAL	212	-
GENDER	**RESPONDENTS**	
Female	114	53.8%
Male	98	46.2%
TOTAL	212	-

Source: Elaborated by the authors.

Chart 3 - Respondents' perception about IPT's urban forest.

PERCEPTION ABOUT IPT'S URBAN FOREST	RESPONSES	
Presence of trees		
Positive perception	211	99.5%
Negative perception	1	0.5%
Benefits provided by trees		
All options	153	72.2%
Beauty	11	5.2%
Fruits	3	1.4%
Others	11	5.2%
Heat reduction	23	10.8%
Shadow	4	1.9%
Shadow, heat reduction and beauty	6	2.8%
I do not know	1	0.5%
Attention attracted by singular trees		
Yes	170	80.2%
No	40	18.9%
Identification of singular trees (popular names)	159	75.0%
Problems caused by trees		
Falling branches	69	32.5%
Falling trees	65	30.7%
None	30	14.2%
Falling branches, animals and insects	1	0.5%
Dirt	1	0.5%
All options	13	6.1%
Animals and insects	2	0.9%
I do not know	2	0.9%
Others	10	4.7%

Falling trees and branches	15	7.1%
Falling trees and branches, and dirt	4	1.9%
Potential activities in green areas		
Physical activities	12	5.7%
Rest	33	15.6%
Environmental education	15	7.1%
Social activities	46	21.7%
None	2	0.9%
Others	11	5.2%
All options	87	41.0%
Trails	6	2.8%
Diseases related to lack of trees		
Yes	155	73.1%
No	57	26.9%
Identification of diseases related to lack of trees	130	61.3%
Interest in planting a tree		
Yes	168	79.2%
No	44	20.8%

Source: Elaborated by the authors.

Chart 3 shows respondents' perception about IPT's urban forest. Most respondents felt good about the presence of trees in the IPT Campus. There was only one negative answer, and it showed that urban forests in work environments are perceived and valued by virtually 100% of the IPT community. This result is consistent with the one reported in the survey conducted by the American Public Health Association (2003), which observed satisfaction among the population living close to green areas, a fact that indicated their benefits to the aforementioned community's health and well-being.

Chart 3 shows that most respondents took into consideration all benefits provided by trees to their well-being. This factor shows that respondents perceived and valued IPT's urban forest due to its ability to provide "beauty", "fruits", "heat reduction" and "shade" to work environments. Heat reduction was the most perceived and valued benefit among responses with one single selected option; it was followed by "beauty", "shade" and "fruits". According to Monico (2001), benefits, such as "beauty" and "shade", were considered the most important gains by the investigated community; in other words, thermal comfort and visual appreciation were the aspects mostly valued, both in the current study and in the one conducted by Monico (2001). According to the research carried out by Dacanal, Labaki and Silva (2010), five urban forest fragments in Campinas

City – SP (Brazil) contribute to the city's thermal comfort. The specific microclimate features of these places, such as fresh air and perception about fresh air, were mentioned by the investigated population. Thus, they can be associated with environmental comfort, which is attributed to the presence of nature.

Respondents who selected the option "others" have listed other benefits that indicated their perception about, and appreciation of, new benefits provided by trees grown in IPT Campus, in addition to the ones previously herein seen as the most important benefits at questionnaire elaboration time.

Accordingly, benefits like "stress reduction" and "noise pollution reduction" were mentioned in the experiment conducted by Cook and Haverbeke (1977), who proved that walls covered by trees and shrubs, among other plants, effectively contribute to reach these outcomes. According to Zanlorenzi (2020, unpublished data), plant structures can change sound waves to ease the discomfort caused by noise pollution. One hypothesis is that sound intensity mitigation in decibels should not be significant, but there may be changes in sound frequencies when they pass through the vegetation, and this process may change user's perception, since the human ear perceives sound frequencies in a different manner. Cook and Haverbeke (1977) have also addressed aspects capable of promoting a sense of well-being, quality of life and benefits to physical and mental health. However, and according to Londe and Mendes (2014), the quality of urban forest management is essential for the aforementioned gain to be efficient. Lourenço *et al.* (2016) corroborated this statement by highlighting that well-managed urban forests are the means to achieve greater satisfaction with urban health, as a whole.

"Air quality", "soil protection", "biodiversity preservation", and "medicinal use" were indicated by respondents in the current study. Medicinal use was also observed in the study about ecotherapy, according to which, individuals can recover through passive involvement, based on the use of human senses, or through active involvement, as observed in horticulture (FEITOSA *et al.,* 2014; NILSSON *et al.,* 2010).

Respondents have also mentioned the "raw materials' supply for handicrafts", based on the use of branches and seeds. According to Oliveira *et al.* (2014), this is an alternative to boost awareness about the use of natural resources and about their ecological and socio-cultural importance.

These results have indicated respondents' knowledge about the benefits provided by trees for their well-being.

Results on the attention attracted by singular trees have shown that most respondents marked "yes"; many of them identified approximately 42 tree species by their popular names. Justifications for the result presented by respondents in the blanks comprised big trees' size; trunks and roots' shape; flowers' colors; trees' scent; childhood memories; trees' age and their historical importance; the presence of endangered trees, like Brazilwood; and the presence of a never-before-seen tree, such as cacao tree; as well as trees growing on roofs and in cracks found in buildings; fruit trees used for consumption and bird-attracting purposes; large number of eucalyptus trees, their aroma, and the soil damage caused by them; and shrubs and other ornamental plants, such as azaleas,

camellias, rose bushes and palm trees.

In addition, a small number of interviewees did not know how to mention the popular name of the observed trees, at the time to describe their justifications. They only specified their location, features, such as fruit trees or blooming trees, whereas others have mentioned that all trees drew attention. Most of them used species' popular name to describe them.

Results observed for this question have shown, in details, the investigated community's perception about, and appreciation of, the urban forest in the IPT Campus. Moreover, participants have indicated the trees capable of catching their attention and the reasons why these trees have instigated them. Most of the reasons given by participants referred to pleasant sensations, and it shows the important role played by IPT's natural heritage in the well-being of its community. It is essential understanding the role played by green areas, as well as their value, to enable greater and conscious interaction with the Campus community in order to effectively get e these benefits (WHITBURN, 2014).

Respondents defined "falling branches" and "falling trees" as the main issues associated with the negative aspects of trees' presence in the IPT Campus. These results reflect a given concern, since falling branches and trees can affect people, material goods and buildings in work environments. This information reinforces the need of continuously managing trees in the IPT Campus, without interruptions between new contract negotiations to hire outsourcing to carry out this task. According to Amaral (2014), Defesa Civil (2019) and Silva (2021), the apprehension caused by likely risks imposed by trees, mainly by poorly managed ones, is noticed by the overall population, since these hazardous events are often observed in Brazil, mainly in the summer, when strong winds and heavy rainfall take place and can lead the loss of human lives.

In addition, part of respondents did not link issues to trees in the IPT Campus, despite the cases of falling branches and trees at the Institute. This factor may be associated with lack of communication about accidents caused by branches and trees, or to lack of knowledge about both the possibility and the need of managing IPT's trees, since urban forests should also be managed to avoid accidents resulting from these events. A small part of respondents selected all options for issues caused by trees in the IPT Campus, namely: "dirt", presence of "animals" and "insects", and "falling trees" and "branches". Nineteen (19) respondents among those who selected option "others" described issues caused by trees in the blanks, namely: the development of a more efficient green patrimony management plan, commitment of all employees and outspread of the acquired knowledge to raise awareness of the organization's green area; likely accidents with fruits; material damage; poorly-done pruning and pest-related issues. Some of these very same conflicts with trees, such as lack of planning and falling branches, were observed by Cabral (2013). According to the aforementioned study, there is the perception that urban forests must adapt to cities' development conditions. However, it is also necessary taking into consideration that this development process must treat urban forests as important elements of cities, since trees play essential role in the quality of urban life.

"All options" was the most cited response about potential activities to be performed

in green areas at the IPT Campus; it was followed by "social spaces" and "rest". This result was also highlighted in studies conducted by Li (2009) and Kotera, Richardson and Sheffield (2020), who indicated that *shinrin-yoku*, also known as "bathing in the forest" or "absorbing the forest atmosphere" (this term emerged in Japan, back in the 1980s), can considerably decrease stress levels.

Green areas at IPT Campus were also described as places for "environmental education" and as "exercising" area. According to Pasanen, Tyrvainen and Korpela (2014), outdoor exercising, in nature, has positive impact on individuals' physical and mental health.

Results have also evidenced that green areas can be used as place for "trekking"; only a small number of respondents did not indicate any potential activity to be performed in the green areas at IPT Campus. Seventeen (17) respondents who selected option "others" have indicated actions to increase the use of green areas at IPT in the blanks, namely: implementing community gardens; planting plant species to be assessed; installing more benches close to trees; encouraging the culture of using these environments for picnics and meetings; and installing species identification markers for environmental education, leisure and contemplation purposes. Alternatives associated with "exercising", "social interaction", "environmental education" and "rest" were also mentioned.

Most respondents selected option "yes" to refer to the association between lack of trees and incidence of diseases. Many of them have indicated diseases associated with lack of trees.

These diseases cover both mental illnesses, such as "psychological illnesses" and "stress", and physical illnesses, such as "respiratory diseases" and those related to "increased heat and UV rays", "zoonoses", and "heart disease", which were associated by respondents with lack of trees. "Respiratory diseases" were the most indicated ones; they were followed by "psychological diseases" and "stress". "Zoonoses" and "heart disease" were the least mentioned health issues associated with lack of trees.

According to Carvalho (2013), there is a "psychopathology underlying human relationship with nature"; in other words, distance from natural environments linked to resulting diseases. Psychological diseases are linked to the development of an alienated thought structure that maintains this ecocide cycle. Diseases associated with "increased heat and UV rays" were also mentioned. Gasparrini *et al.* (2015) have evidenced that extreme temperatures, either heat or cold, are risk factors for many death cases.

These results have shown that a significant fraction of respondents perceived the value of IPT's urban forest to maintain the physical and mental health of Institute's employees.

With respect to the last question, it was observed that most respondents would be interested in planting trees. This finding has evidenced that most respondents value the tree-planting activity and were willing to participate in this process, which is not always easy, since it requires manual labor to dig a hole. This factor is likely associated with the pleasant feeling of planting plant species and with the possibility of actively participating in the growth of a living being that will integrate the landscape for a long period-of-

time. This process allows planters to interact with the planted trees, over time. Planters could, for example, show their colleagues the trees they helped planting and they could also take care of these trees. This practice could be adopted as relaxing activity to help reducing day-to-day stress in workplaces, as well as to improve IPT employees' physical and mental health.

Amaral *et al.* (2020) have analyzed the potential to use human interaction with plants as education tool. They observed positive results for the quality of life of a group of students.

According to Correa *et al.* (2019), the incidence of forests in urban environments is increasingly scarce; consequently, fewer ecosystem services, such as moments of reflection and connection with nature, are provided to the population. Human contact with, and the inclusion of activities in, nature are essential for leisure purposes, for improvements in individuals' quality of life and for the development of different skills and emotions. Society must understand that it is intrinsically linked to the natural environment and that it is not an entity apart from it.

Discussion

Based on the current results, most of the IPT community understands the important role played by urban forests in work environments, as well as their benefits to their well-being. In addition to the herein observed environmental perception, employees were concerned with, and suggested, actions to help better managing green areas, based on a more efficient planning. The need of better using these areas for social interaction and resting purposes was also pointed out. Among respondents' propositions, one finds encouraging knowledge outspread for environmental education purposes.

Results have indicated the importance of mapping areas suitable for outdoor exercising within the Campus, such as the practice of local hiking, among other sports, to help improving employees' physical and mental health. These activities can be carried out before and after the work shift, as well as at lunchtime. It is important identifying and mapping trees to be used in environmental education actions, such as the location of ancient trees, fruit trees, and flower trees, preparing itineraries for nature contemplation, leisure, and for fruit, seed and leaf picking for further consumption, planting and use in handicraft activities. The herein indicated use of natural and environmental resources makes it essential developing a handbook for the harvesting and sustainable use of resources to avoid their predatory use. It is necessary monitoring the existing species and assessing the ones with the potential to provide environmental services, such as providing shade to help mitigating the heat in work environments (this benefit was highly valued by respondents); providing fruits, seeds and leaves for various purposes; enabling scenic beauty; and help improving individuals' physical and mental health.

The main issues associated with trees in the IPT Campus were herein addressed. These findings can help planning the location for new plantings, selecting the best spe-

cies to be planted in parking lots, buildings and places where there is large circulation of people, and implementing the proper management of existing species to help mitigating the risk of accidents caused by trees, branches and fruits. The current findings also point towards the need of conducting periodic tree monitoring to help reducing associated risks, as well as of reporting risks associated with the presence of insects and animals, or any unwanted effects of trees' presence perceived by the IPT community. The IPT board was aware of this need and developed a continuous management plan focused on trees grown in the campus, mainly for risk prevention purposes. It also developed a plan for gradual trees' replacement, be them at risk or old, based on planting new tree species and on expanding wooded green areas. IPT board also adopted a sustainable tree management practice based on using pruning waste. This ongoing management project is in line with activities developed by the Socio-Environmental Responsibility and Governance Committee, which uses data generated in this project in two other projects (waste and water management) to generate its sustainability report and to comply with efficiency indicators set in its socio-environmental responsibility and governance policy, as well as with the Institute's environmental, social and governance principles (ESG). Survey findings have also indicated that IPT's urban forest is linked to pleasant sensations, and it has evidenced the important role played by natural heritage in its community's well-being. This factor is essential for forest management processes, since it indicates not only the need of understanding the species living in the Campus, but also of selecting species capable of providing environmental services valued by the community for new plantings, besides indicating the points of social coexistence, such as the installation of benches in strategic locations to enable a larger number of employees to enjoy the benefits from IPT's trees and green areas.

Results have shown that the hypothesis of lack of trees in the IPT Campus is perceived as harmful to employees' health. Diseases associated with it comprise pathologies affecting individuals' minds – such as psychological illnesses and stress - and physical illnesses – such as respiratory diseases and other health conditions associated with increased heat and UV rays, zoonoses and heart diseases. This finding can be used to better indicate the use of urban forests to help reducing stress at work and improving IPT workers' physical and mental health. It also shows strong association between IPT's green areas and its employees' well-being. One of the possible actions indicated by the current results to help improving these items refers to workers' involvement in tree-planting processes aimed at providing pleasant sensations linked to land management and to the practice of monitoring the development of planted trees. These actions allow planters to interact with planted trees, over time; moreover, they have positive impact on IPT employees' physical and mental health.

The current survey, which was based on questionnaire application, was an important tool for IPT community's reflection about, and involvement in, the process to manage green areas in their workplace. Having a more participatory perspective from workers is essential to reach the first Urban Forest planning stage and its efficient management process.

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AMBIENTE & SOCIEDADE 25 anos 25 años 25 years

SciELO

Percepção sobre a Floresta urbana e sua influência para o bem-estar no ambiente de trabalho

Barbie Vieira Lima
Raquel Dias de Aguiar Moraes Amaral
Caroline Almeida Souza
Mariana Hortelani Carneseca Longo

Resumo: A floresta urbana é considerada de importante relevância tendo em vista seu papel na redução dos efeitos climáticos e na diminuição das ações negativas do homem sobre a qualidade de vida das pessoas. As árvores proporcionam bem-estar às pessoas, estando estas relacionadas à prestação de serviços ambientais. A percepção humana sobre a natureza é essencial para manter o equilíbrio no desenvolvimento das cidades considerando o ambiente natural como parte delas. Nesse contexto, o objetivo deste estudo foi analisar a percepção dos trabalhadores do Instituto de Pesquisas Tecnológicas sobre sua floresta urbana para subsidiar o seu manejo. Os resultados, com base na aplicação de um questionário online, demonstraram uma influência positiva e negativa relacionada à floresta urbana no cotidiano da comunidade em seu ambiente de trabalho. Os trabalhadores têm contribuído com propostas de ações que podem apoiar a melhoria da gestão ambiental no Campus do Instituto.

Palavras-chave: Floresta urbana, saúde, bem-estar, ambiente de trabalho.

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Artigo Original

AMBIENTE & SOCIEDADE 25 anos 25 años 25 years

SciELO

Percepción del bosque urbano y su influencia en el bienestar en el entorno laboral

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Artículo Original

Resumen: El bosque urbano se considera importante por su papel en la reducción de los efectos climáticos y de las acciones negativas humanas sobre la calidad de vida. Los árboles generan bienestar a las personas, estando relacionados con la prestación de servicios ambientales. La percepción humana sobre la naturaleza es fundamental para mantener el equilibrio en el desarrollo de las ciudades considerando el entorno natural como parte de ellas. En este contexto, el objetivo de este estudio ha sido analizar la percepción de los trabajadores del Instituto de Investigaciones Tecnológicas sobre su bosque urbano para apoyar su manejo. Los resultados, basados en la aplicación de un cuestionario virtual, han demostrado una influencia positiva y negativa relacionada con el bosque urbano en las actividades de la comunidad en su ambiente de trabajo. Los trabajadores han contribuido con propuestas de acciones que pueden apoyar la mejora de la gestión ambiental del Instituto.

Palabras-clave: Silvicultura urbana, bienestar, salud, ambiente de trabajo.