Background in forest engineering to work in urban forestry

Kelly Iapuque Rodrigues de Sousa
Masters Student, Agriculture Department, UFLA, Brazil.
kellyiapuque@gmail.com

Lucas Amaral de Melo
PhD Professor Forest Engineering Department,, UFLA, Brazil.
Lucas.amaral@ufla.br

Michele Valquíria dos Reis
PhD Professor Agriculture Department, UFLA, Brazil.
michele.reis@ufla.br

ABSTRACT

Urban Forestry provides multiple ecosystem services and contributes to the resilience of cities. However there are no studies that discuss the background of professionals who work in this field. Thus, it was proposed to analyze the presence of the subject of Urban Forestry in Forest Engineering courses in Brazil. Searches were carried out in the e-MEC Registry to locate the Universities, and on their websites to find the Pedagogical Project or the Curriculum Matrix. To analyze the contents of the Syllabus, the IRAMUTEQ software was used. 68 Forest Engineering courses were located, which are offered by 60 universities and cover 24 states of the country, highlighting the North and Southeast regions, which offer 20 and 16 courses, respectively. 59 Pedagogical Projects were found and there was a lack of standard in the structure and content of the document. In the Curriculum Matrices, 79 subjects on Urban Forestry were identified, but only 27 exclusively address the theme. It was noticed that most of the subjects offered are complementary; only 12 are mandatory and, at the same time, only on Urban Forestry. The subject "Urban Forestry and Landscaping" appears 25 times. However, the two themes have different approaches and, in this case, the main focus was on Landscaping. The analysis of Text Segments of the 65 Syllabuses showed that most of the texts were about Landscaping. It was concluded that there is a deficiency in the background in Forest Engineering in Brazil concerning Urban Forestry, due to the low number of compulsory subjects offered.

KEYWORDS: Silviculture. Pedagogical project. Urban Green Areas.

1 INTRODUCTION

The urban population in Brazil corresponds to 84% of the country total residents (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA - IBGE; 2010). Due to the population increase in urban centers, there was an environmental imbalance due to the removal of vegetation and land occupation for the expansion of buildings. The numerous environmental problems resulting from little vegetation affect the health and well-being of the population (STANGANINI; LOLLO, 2018; ALVES et al., 2020).

The presence of a quality Urban Forestry in cities can contribute to the mitigation of the results of environmental degradation and provide several ecosystem services, bringing numerous benefits to society, among which the following stand out: reduction in pollution, increase in drainage areas that favor the reduction in floods, reduction in noise pollution, reduction in stress, contact with nature, leisure areas, among others (KUO; SULLIVAN, 2001; BIONDI, 2015; LOCATELLI et al., 2017; SILVA *et al.*, 2019; REIS et al., 2020; WOLF et al., 2020).

To provide quality ecosystem services, Urban Forestry must be implemented through appropriate technical criteria. The lack of planning can cause damage to the structures due to the incompatibility of the environment with the planted species (CUNHA et al., 2020). In addition to the technical attributes, it is necessary to deal directly with the population. When Urban Forestry is already implemented, it is necessary to know how to dialogue about the resolutions of conflicts between the vegetation and the structure (sidewalk, wall, electrical network). For the implementation of an Urban Forestry project, it is important to know the population, their ideas, desires, characteristics; besides, the project must be adequate to the reality of that society (MESSIAS et al., 2019).

The population's dissatisfaction with the conflicts of unplanned vegetation is commonly seen in newspaper news, such as problems with lighting (MENEZES, 2018) and sidewalk lifting, affecting accessibility (CAROLINA; PARANAIBA; 2015); services performed with a lack of specialized technical preparation, irregular pruning (A TRIBUNA, 2021); base of cemented trees (ALMEIDA; 2020) and poorly programmed cuts (CHUVA; NEVES; 2021).

Among the professionals who can work in Urban Forestry, we have the Forest Engineer. The Forest Engineering course's premise is to provide professionals with a background to develop specific skills and abilities, among them: Being able to study technical and economic feasibility; make adequate planning; know how to design, specify, supervise, coordinate and technically guide; be able to carry out inspection, evaluation, arbitration, report and technical opinions; work in multidisciplinary teams, among others (BRASIL, 2006).

The desired characteristics of the Forest Engineering graduate denote that they are qualified to work in Urban Forestry implementation and management projects. However, there are no studies that evaluate the Pedagogical Projects, Curriculum Matrix and Syllabuses of the Urban Forestry subject, to understand how the topic is treated throughout the course.

2 OBJECTIVE

The objective of this study was to analyze the presence of the subject of Urban Forestry in Forest Engineering courses in Brazil, seeking to know how is the distribution of the offer of the subject by region and the content of Syllabuses for its performance in the implementation and management of urban green spaces.

3 METHODOLOGY

3.1 Forest Engineering Courses

To collect data about Forestry Engineering courses, a search was carried out in the database of the National Registry of Higher Education Courses and Institutions in Brazil of the Ministry of Education (Cadastro e-MEC, 2020). On this website, it is possible to locate the records of all undergraduate courses, active and inactive, of Higher Education Institutions in Brazil.

Through the website *Cadastro e-MEC*, 83 Forest Engineering courses were located, of which seven were inactive and 76 were active.

The following information was collected regarding the Forest Engineering courses offered in Brazil: state, municipality, campus, course start date, course score in the National Student Performance Exam, name of the HEI, type of HEI (federal or private), course modality (classroom or distance learning), course status (active or inactive).

3.2 Analysis of the Pedagogical Project (PPC) and/or curriculum matrix

After surveying the courses, a search was carried out on the website of each university that contained the Forest Engineering course, in order to have access to the Pedagogical Project (PPC) and/or the current curriculum matrix. Of the 76 active e-MEC courses, eight did not contain any available information about the course. For such universities, information was requested through the e-mail address available on the website, at least twice. Therefore, for the accomplishment of this work, 68 courses were analyzed, offered in 60 different higher education institutions in Brazil.

The free software IRAMUTEQ (version 0.7 alpha 2) was used to plot the word cloud graph and for descending hierarchical classification (DHC) of the contents of the syllabuses. The DHC of the syllabuses analyzed 165 Text Segments, which corresponds to 80.41% of the text segments used.

4 RESULTS

In Brazil, there are more than 40,000 undergraduate courses, 24,402 of which are Bachelor's degrees. The Higher Education Institutions that offer the courses total 2,608; those Private have 2,306 institutions, while 302 refer to Public ones. As for the data by administrative category, which covers Agriculture, Forestry, Fishery and Veterinary, 521 institutions are found, offering 1240 courses, out of

which 76 are in Forest Engineering (INEP, 2020). Of the 68 courses analyzed, only five are from Private Institutions (TABLE 1).

Table 1- Number of Universities per Region and Administrative Category that offer the Forest Engineering course

| Regions	Public HEI			Private HEI		Total	%
	Federal	State	Municipal	FP	NP		
South	6	2	1	-	1	10	14.7
Southeast	11	2		3	-	16	23.53
Midwest	7	3	1	-	-	11	16.18
North	13	6	-	-	1	20	29.41
Northeast	9	2		-	-	11	16.18
Total	46	15	2	3	2	68	-
%	67.6%	22%	3%	4.4%	3%	-	100%

Caption: FP (For-profit); NP (Non-profit)
Source: Research data, 2020

The first National Forestry School began in Brazil, on May 30, 1960, at Universidade Rural do Estado de Minas Gerais, in Viçosa. The purpose was to fill the demand for qualified professionals, since those who operated in the forestry market were Agronomy graduates. However, in the Agronomy course, only a general subject was offered that addressed the topic of forestry, which was not sufficient for the desired expansion of the sector in Brazil (BRASIL, 1960; SOUZA, 1961; MACEDO, 2003).

In the first and second years, the subjects of Escola Nacional de Floresta were from the basic cycle and common to Agronomy students. In the third year, specific content was included, silviculture, dendrology, genetics applied to forests, ecology and phytogeography, forest inventories and constructions, forest protection, forest product technology and optional subjects (BRASIL, 1960).

Due to internal and structural problems, it was necessary to relocate the course. In 1963, a decree was signed on the transfer of the Escola Nacional de Floresta to Curitiba in the state of Paraná, at the current Universidade Federal do Paraná (BRASIL, 1963). However, in 1964, the Escola Superior de Florestas was created in Viçosa, with eight students who chose to stay in the city, which is today, Universidade Federal de Viçosa (MACEDO, 2003). From this milestone, several institutions emerged over the years (GRAPH 1).

Graph 1 – Number of Forest Engineering Courses created per decade in Brazil
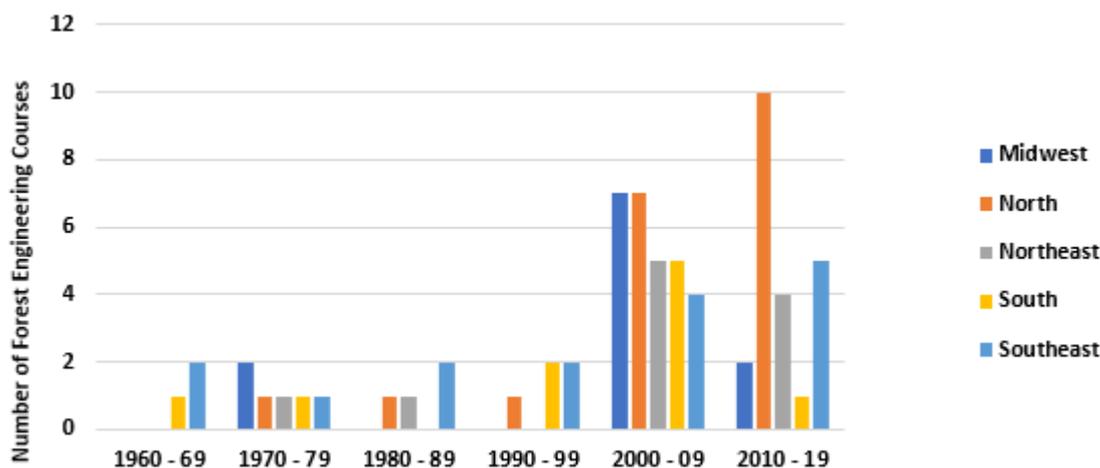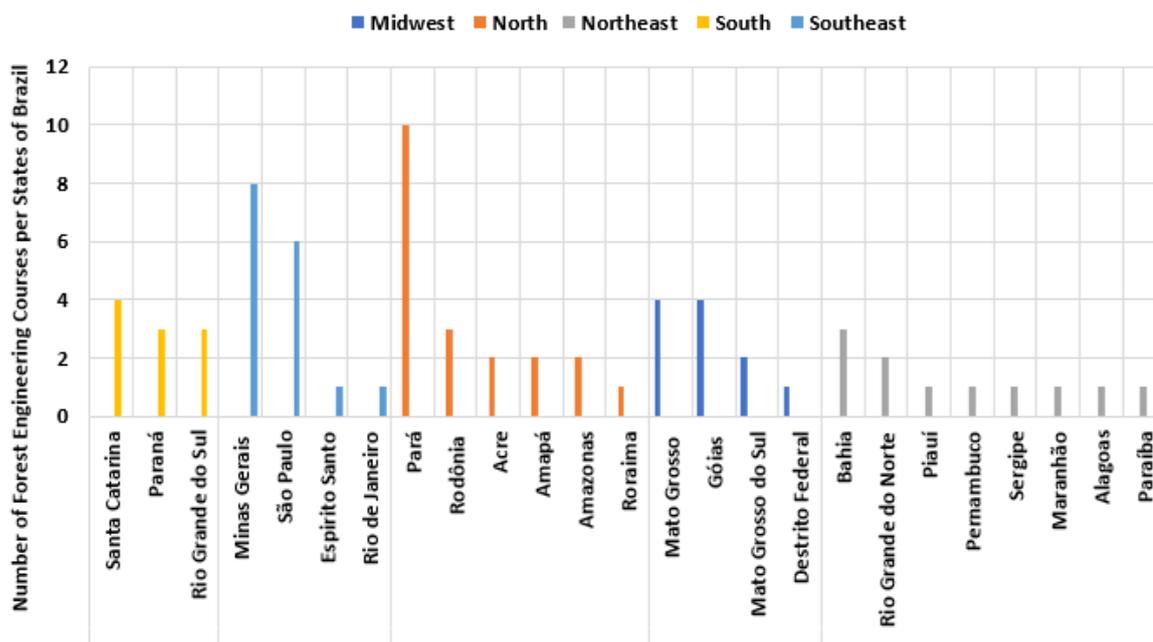

Source: Research data, 2020

Access to higher education was severely restricted in some regions and socioeconomically disadvantaged locations were at greater disadvantage in terms of the number of courses and vacancies offered (CORBUCCI, 2014). It can be seen that, in the first 40 years after the creation of the Forest Engineering course, the number of courses in the North, Northeast and Midwest regions (7 courses) was lower than in the South and Southeast (11 courses). Considering the coverage in territory and number of states, the North, Northeast and Midwest regions add up to 19 states, and the South and Southeast regions, seven.

Analyzing access to higher education in Brazil, it was observed that, after the 2000s, there were initiatives to increase the number of vacancies and entrances all over the country, in an attempt to reduce regional inequalities. In the case of Forest Engineering, there was a significant increase in the number of courses created in the period from 2000 to 2009. In the North and Midwest regions, there were seven courses each, Northeast and Southeast with five each and, in the South, four courses (CORBUCCI, 2014; PAULA; ALMEIDA, 2020).

The implementation of the Support Program for Restructuring and Expansion Plans for Federal Universities (*Programa de Apoio a Planos de Reestruturação e Expansão das Universidades Federais*, REUNI) in 2007, contributed to the expansion of universities mainly in the North and Northeast (CORBUCCI, 2014). The objective was "[...] to create conditions for the expansion of access and permanence in higher education, at the undergraduate level, for better use of the physical structure and human resources existing in federal universities" (BRASIL, 2007, Art. 1). After 2008, eight Forest Engineering courses were created in the North region, followed by the Northeast, Southeast and Midwest, with five new courses, and the South region, with two courses.

The Forestry Engineering course is present in almost all Brazilian states. In the state of Ceará, the course is not listed and in Tocantins the course is active in the e-MEC Registry, but without information on the Pedagogical Project or curriculum matrix on the university website; thus, it was not included in the analyses (GRAPH 2).

Graph 2 – Number of Forest Engineering Courses per Region and States of Brazil

Source: Research data, 2020

The state of Pará has the largest number of Forest Engineering courses. However, there are not ten different universities that offer the course, but five, with two universities being the main responsible for the high number of courses: Universidade Federal Rural da Amazônia, with four campuses that offer the course and Universidade do Estado do Pará, with three. In Minas Gerais and São Paulo, the number of Forest Engineering courses corresponds to the number of institutions that offer the course.

In 2004, the federal government instituted the National Higher Education Assessment System (*Sistema Nacional de Avaliação da Educação Superior*, SINAES), which evaluates courses, institutions and student performance. The evaluation of the performance of both freshmen and graduating students is carried out through the National Student Performance Exam (*Exame Nacional de Desempenho dos Estudantes*, ENADE). The document clarifies that the evaluation must be taken as a basis for the procedures for renewing accreditation of Higher Education Institutions, authorization, recognition and renewal of recognition of undergraduate courses. However, it allows each institution to identify deficiencies and progress, and thus improve courses in order to give professionals a background with better skills to act in society (BRASIL, 2004, Art. 5; MEDEIROS FILHO et al., 2019).

In the last ENADE assessment, in 2019, the scores of 58 Educational Institutions were found. Only one institution in the South Region obtained the maximum score, five and, in the Southeast Region, three (INEP, 2019) (TABLE 2).

Table 2 - Score of Education Institutions per Region of Brazil in ENADE 2019

Region	Score in ENADE				
	1	2	3	4	5
South	-	-	5	4	1
Southeast	1	-	3	7	3
Midwest	1	2	3	5	-
North	4	2	5	2	-
Northeast	-	2	5	3	-
Total	6	6	21	21	4
Percentage	10.3%	10.3%	36.3%	36.3%	6.8%

Source: Research data, 2020

Most institutions (72.6%) have a score of three and four, and the institutions of the South and Southeast regions obtained more scores four than the regions Northeast, North and Midwest. Obtaining better scores in ENADE is important, as it is essential that Higher Education Institutions obtain a minimum performance to have agreements with bodies, such as PROUNI and FIES, to enable access to the scientific database or to make resources available from the Brazilian Development Bank (*Banco Nacional de Desenvolvimento Econômico e Social*, BNDES) (BRITO, 2008; BERTOLIN; MARCON, 2015; SURCIN, 2020).

The National Curriculum Guidelines (*Diretrizes Curriculares Nacionais*, DCN) for the Forest Engineering undergraduate course were instituted in 2006 and the maximum implementation period was two years after the date of publication. Previously, the minimum curriculum defined by the Ministry of Education (MEC) for undergraduate courses in the country was in force. The DCN aims to leave a static sphere, and start with a broad background, preparing better professionals to serve a society that is constantly changing (BRASIL, 2006; TEIXEIRA JUNIOR, 2020).

The DCN contains all the guidelines for the content that must be included in Forest Engineering courses in all Higher Education Institutions. There are indications about: curriculum components, Pedagogical Project, profile of the graduate student, competences and abilities,

curriculum contents, supervised curriculum internship and complementary activities. In the Pedagogical Project, social, scientific and technological aspects must be observed, so that the graduates have a critical and comprehensive background, and be able to act in society with ethics and a humanist perspective (BRAZIL, 2006, Art. 3, § 1).

After 15 years of publication of the National Curriculum Guidelines (DCN), 59 Pedagogical Projects containing the curriculum matrix of the course were found available on the universities website. For nine other courses, the Pedagogical Project was not available, only the curriculum matrix (GRAPH 3).

Graph 3 – PPC of Forest Engineering Courses per Region of Brazil
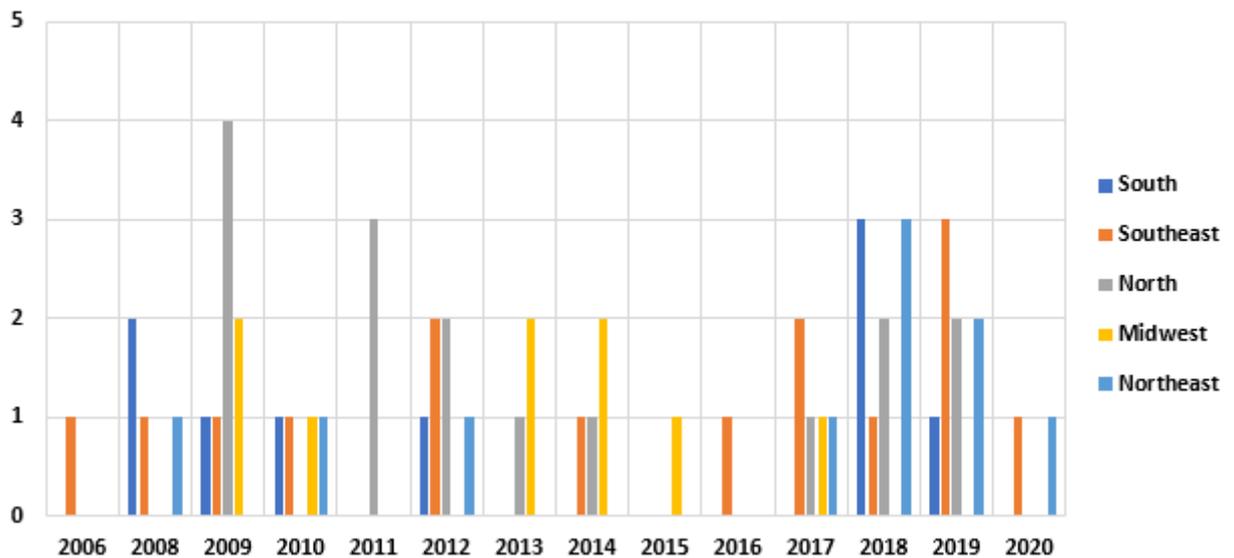
Source: Research data, 2020

In the South region, 9 Pedagogical Projects were found, 15 in the Southeast region, 9 in the Midwest region, 16 in the North region and 10 in the Northeast region. The region with the greatest deficit in Project numbers was the North, with four projects not located.

According to the Forest Engineering DCN, the content of the Pedagogical Project must contain: general objectives of the course, contextualized in relation to its institutional, political, geographic and social insertions; objective conditions of offer and the vocation of the course; ways of conducting interdisciplinarity; modes of integration between theory and practice; forms of evaluation of teaching and learning, among others (BRASIL, 2006, Art. 3, § 1).

It was noticed that there is no standardization in the elaboration of the content. Some institutions have a Pedagogical Project with an average of 200 pages, detailing some aspects such as: history of the creation of the course, contexts and institutional policies of the course, profile of the graduate, curriculum syllabus, among other items. Other institutions created a leaner Pedagogical Project, and an eight-page document was found, where some information defined by the DCN was absent.

Among the analyzed Forest Engineering courses, it was found that there are 79 subjects with the theme involving Urban Forestry; some Institutions offer more than one subject. The region with the highest number of subjects is the Southeast with 22, followed by the North with 19 and the South with 15 (TABLE 3).

Table 3 - Number of Urban Forestry Subjects per Region of Brazil

Regions	Subjects
Southeast	22
North	19
South	15
Northeast	12
Midwest	11
Total	**79**

Source: Research data, 2020

The names of the disciplines were observed and the one that appears most frequently, 25 times, is called "Urban Forestry and Landscaping" (*Arborização Urbana e Paisagismo*), followed by "Urban Silviculture" (*Silvicultura Urbana*) with 15, "Urban Forestry" (*Arborização Urbana*) and "Urban Silviculture and Landscaping" (*Silvicultura Urbana e Paisagismo*) with five each. and "Urban Ecology" (*Ecologia Urbana*) with three. The other 26 subjects represented with smaller letters in the word cloud were attended once or twice (FIGURE 1).

Figure 1 – Word Cloud of the most frequent subjects in the curriculum matrices
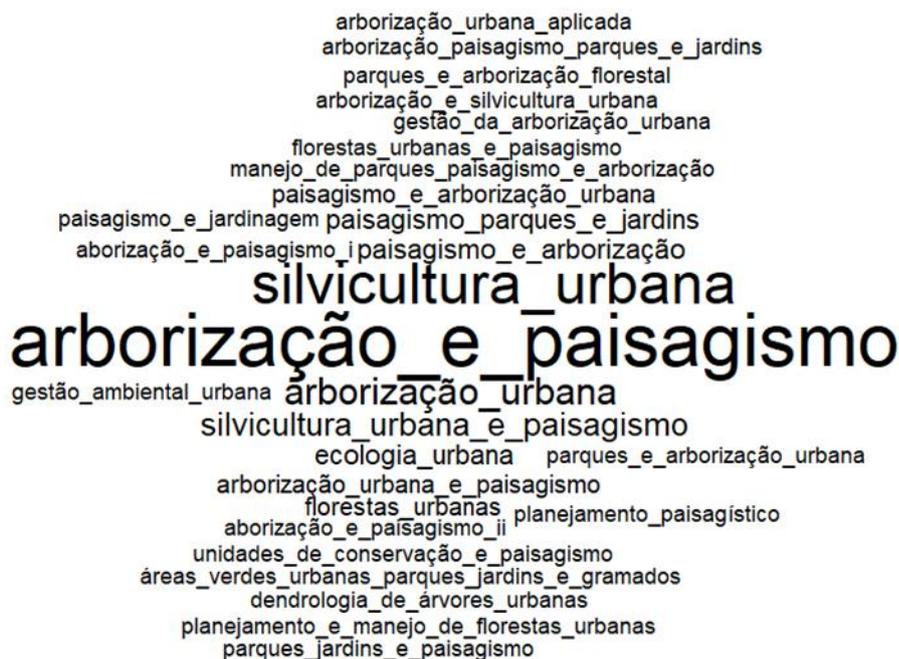

* Portuguese language was used for the analysis of Word Cloud in the Iramuteq software.
Source: Research data, 2020

It was noticed that 26 subjects are solely on the theme Urban Forestry, the other 53 deal with the subject together with other themes. It should be noted that the topics treated together by a single subject, address issues of the same large area, but with completely different approaches. As an example, in the Landscaping subject, Urban Forestry is a topic within several subjects, while in the Urban Forestry subject alone, it will address issues from choosing the appropriate species, through implementation, maintenance, conduct and management of the entire process.

When analyzing the way in which the subject is offered, 35 were found as mandatory and 44 as complementary/optional. The North region has the largest number of subjects in the compulsory category (GRAPH 4).

Graph 4 – Subject of Urban Forestry in Forest Engineering Courses by Region and Category
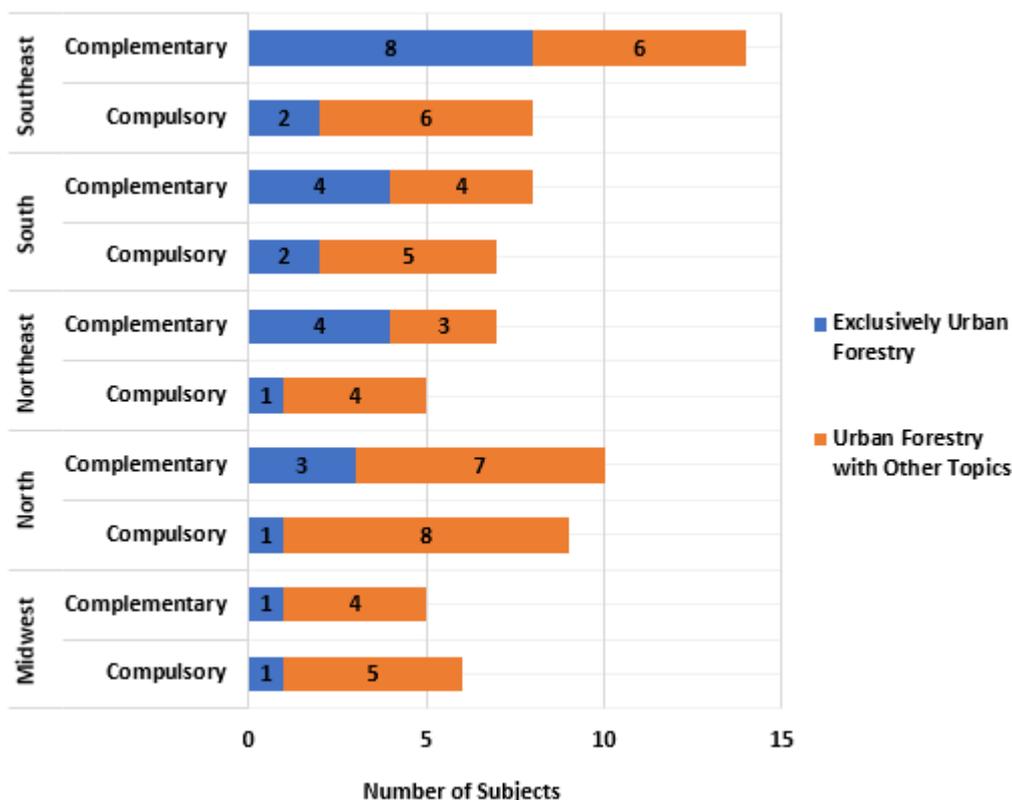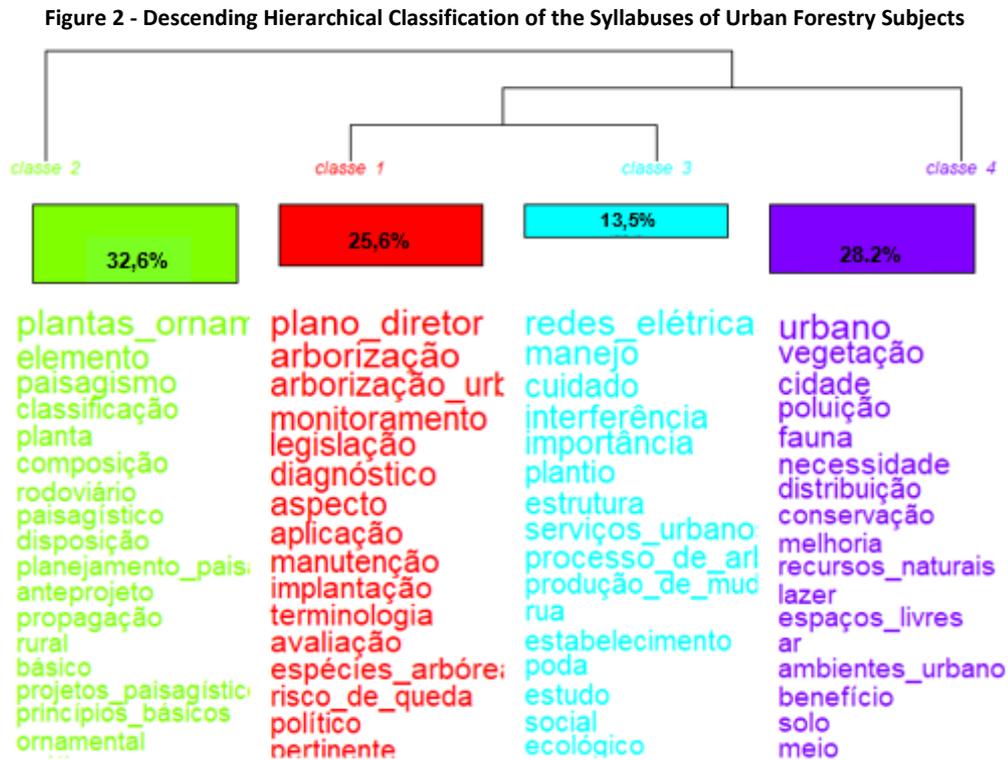

Source: Research data, 2020

The number of subjects on Urban Forestry appears to be high; however, upon closer inspection, only 12 subjects only address the topic of Urban Forestry and are at the same time in the compulsory curriculum of the courses. It is understood that in courses in which the subject is in the Complementary/Optional category, Forest Engineering students may not have contact with the theme during their studies, as it is necessary for the student to choose to take the discipline.

To reduce this problem, the theme can be presented in the initial phase of the course, in which the subjects are presented to the students; create Study Centers; develop Scientific Initiation activities on the subject in Institutions. In addition, more lines of research are needed in the Graduate Program in urban themes, so that the student who is interested in the area, also has the possibility of qualifying and deepening their knowledge.

In relation to the Course Syllabuses, 65 were found, in the Pedagogical Project or on the websites of Higher Education Institutions. Some Syllabuses were well structured, with text explaining the purpose of the topics to be addressed, others contained only the title of the topics. The analysis was evaluated with the aid of the IRAMUTEQ software, which has been widely used in research for the analysis of textual data (CAMARGO; JUSTO, 2013). The Descending Hierarchical Classification (DHC) resulted in a dendrogram that shows the grouping of text segments in the Syllabuses, making it possible to evaluate the classes with the similarities of the contents.

The analyzed *corpus* consisted of 65 texts, separated into 194 Text Segments, with use of 156 Segments (80.41%), a value above the minimum 70% suggested in the literature (SALVIATI, 2017). All the words that appear in the figure obtained chi-square ($\chi2$) above 3.80 and all (P-value < 5%), guaranteeing that the aggregation within the classes was significant. Word size is related to the

frequency of appearances in the analyzed Text Segments (FIGURE 2).

Figure 2 - Descending Hierarchical Classification of the Syllabuses of Urban Forestry Subjects

classe 2 — 32,6%
plantas_ornam
elemento
paisagismo
classificação
planta
composição
rodoviário
paisagístico
disposição
planejamento_pais
anteprojeto
propagação
rural
básico
projetos_paisagístic
princípios_básicos
ornamental

classe 1 — 25,6%
plano_diretor
arborização
arborização_urb
monitoramento
legislação
diagnóstico
aspecto
aplicação
manutenção
implantação
terminologia
avaliação
espécies_arbóre:
risco_de_queda
político
pertinente

classe 3 — 13,5%
redes_elétrica
manejo
cuidado
interferência
importância
plantio
estrutura
serviços_urbano:
processo_de_arl
produção_de_mud
rua
estabelecimento
poda
estudo
social
ecológico

classe 4 — 28,2%
urbano
vegetação
cidade
poluição
fauna
necessidade
distribuição
conservação
melhoria
recursos_naturais
lazer
espaços_livres
ar
ambientes_urbano
benefício
solo
meio

* To understand the reality of the Course Syllabuses of the Forest Engineering course, it was necessary to carry out the analysis in the language in which the Course Syllabuses were written, that is, Portuguese language.
Source: Research data, 2020

The classes are divided into three branches, with classes 2 and 4 being both separate and not similar to each other or to the other classes. The similarities between the contents are in classes 1 and 3, once they are connected in the dendrogram.

Class 2 deals with issues related to Landscaping, being the one with the most Text Segment, denoting that the textual structures of the Syllabuses were made up of more topics related to the theme. The word that stood out the most was: "Ornamental Plants" (*Plantas Ornamentais*). Observing the Text Segments, it was noticed that "Element" (*Elemento*), "Classification" (*Classificação*), "Plants" (*Plantas*) and "Composition" (*Composição*) that appeared in the dendrogram, are related to landscaping, for example, "Landscape Elements"(*Elementos do Paisagismo*), "Landscape Classification" (*Classificação da Paisagem*), " Plants in Landscaping" (*Plantas no Paisagismo*) and "Composition of Landscape Projects" (*Composição de Projetos Paisagísticos*).

Class 4 deals with Text Segments more broadly focused on urban vegetation. The words that appear the most are: "Urban" (*Urbano*), "City" (*Cidade*), "Vegetation" (*Vegetação*), "Pollution" (*Poluição*) and "Fauna" (*Fauna*). It can be seen that there is a relevant space in the Syllabuses dedicated to dealing with these terms, which is important, since many students are unaware of the environmental impacts within cities and the benefits of Urban Vegetation.

Classes 1 and 3 are very close and, together, they add up to 39.1%, both of which are focused on Urban Forestry, from seedling production to the evaluation of the implemented species. In class 1, the term "master plan" (*Plano Diretor*) is highlighted, being frequently mentioned in the Syllabuses, followed by "Forestry" (*Arborização*), "Urban Forestry" (*Arborização Urbana*), "monitoring'' (*Monitoramento*) and "legislation" (*Legislação*). In class 3, there is evidence of terms such as "electrical

networks" (*Redes Elétricas*), "interference" (*interferência*) and "pruning" (*poda*), subjects commonly discussed when it comes to trees in cities. The aggregated classes are on very specific subjects and show that their space in the Syllabuses needs more relevance, since professionals who will work with Urban Forestry need this knowledge.

516 recommended bibliographies were found in the Syllabuses and, in some, this information was absent. The titles, for the most part, are: Manuals or Guides for Urban Forestry, subjects on Urban Forests and Urban Trees. The most cited authors were: Haroldo Nogueira de Paiva and Wantuelfer Gonçalves, 76 times; Harri Lorenzi 30 times and Harri Lorenzi with other authors 29 citations. It is noteworthy that 29% of the authors were indicated only once.

As for the titles indicated in the Bibliography, 181 or 32% had only one indication; the most indicated are in the board below (BOARD 1).

Board 1 – Main Bibliographies Indicated in the Syllabuses

Author	Title	Indications
Haroldo Nogueira de Paiva; Wantuelfer Gonçalves	*Florestas urbanas: Planejamento para a Melhoria Da Qualidade de Vida*	15
Harri Lorenzi	*Árvores Brasileiras: Manual de Identificação e Cultivo de Plantas Arbóreas Nativas do Brasil*	23
Harri Lorenzi; Hermes Moreira de Souza	*Plantas Ornamentais no Brasil: Arbustivas, Herbáceas e Trepadeiras*	12
Aderbal Gomes da Silva; Haroldo Nogueira de Paiva; Wantuelfer Gonçalves;	*Avaliando a Arborização Urbana*	16
Wantuelfer Gonçalves; Haroldo Nogueira de Paiva	*Silvicultura Urbana: Implantação e Manejo*	15
José Augusto de Lira Filho, Haroldo Nogueira de Paiva	*Árvores para o Ambiente Urbano*	15
Wantuelfer Gonçalves, Haroldo Nogueira de Paiva	*Paisagismo - Princípios Básicos*	12

Source: Research data, 2020

When categorizing the titles of the Bibliographies, 232 indications are on Urban Forestry and 160 on Landscaping. Regarding the publication date, 56% have dates between 2000 and 2009 and 26% from 1999 to 1956. It can be understood that it is necessary to insert more recent bibliographies, since current debates that are part of Urban Forestry management, such as smart, sustainable cities and nature-based solutions need to be introduced to students.

The professional's performance in an urban environment involves several different aspects of monoculture implementation, conservation of forest diversity, forest protection, wood technology, etc. In the implementation and conduction of Urban Forestry projects, it is necessary to have a close dialogue with the local community, to know social and structural aspects of urban cities, know about the laws that cover Urban Forestry, know how to analyze the appropriate species for the urban environment, in addition to strategies for working with limited public resources.

It is understood that forestry production to supply various sectors has been the focus of Forest Engineering courses since its inception. Countless problems in the urban forestry of cities are mostly due to lack of planning and result from the performance of unqualified professionals. The subject of Urban Forestry provides knowledge about the themes and can prepare the future professional to occupy positions in urban areas, transforming the green structure of the city.

5 CONCLUSION

More than 50% of Forest Engineering courses take place in the North and Southeast regions. Many courses have been implemented in the last two decades. There is no standardization in the Pedagogical Project regarding the offer of subjects directly related to the Urban Forestry theme.

In the curriculum matrices, the highest percentage of subjects are offered as a supplement. Subjects solely on Urban Forestry, compulsory, represented only 15% of the subjects found. The subject most frequently found was "Urban Forestry and Landscaping". However, the content of most of Syllabuses refers to Landscaping themes.

Of the recommended bibliographies, only 18% are from 2010 to 2020, requiring the insertion of more documents with approaches to the current needs of cities to provide professionals with a background so they are better prepared to work in the urban environment.

REFERÊNCIAS

A TRIBUNA. Arborização: Poda irregular continua preocupando no Centro. **A Tribuna Mato Grasso**, 29 jun. 2021. Disponível em: https://www.atribunamt.com.br/2021/06/29/arborizacao-poda-irregular-continua-preocupando-no-centro/. Acesso em: 1 fev. 2021.

ALMEIDA, Iago. Base de árvore é cimentada no Centro de Varginha e ação gera críticas nas redes sociais; Prefeitura retira concreto e afirma que houve erro operacional de empreiteira. **Varginha Online**, Notícias, Cidades, 02 out. 2020. Disponível em: https://www.varginhaonline.com.br/186081/base-de-arvore-e-cimentada-no-centro-de-varginha-e-acao-gera-criticas-nas-redes-sociais-prefeitura-retira-concreto-e-afirma-que-houve-erro-operacional-de-empreiteira.html. Acesso em: 1 fev. 2021.

ALVES, Luã C. et al. Degradação do rio Paraíba do Sul no Município de Três Rios: causas e consequências. **Revista Brasileira de Gestão Ambiental**, [s. l.], v. 14, n. 2, p. 248-259, 2020. Disponível em: https://www.gvaa.com.br/revista/index.php/RBGA/article/view/7555. Acesso em: 1 fev. 2021.

BERTOLIN, Júlio C. G.; MARCON, Telmo. O (des)entendimento de qualidade na educação superior brasileira – Das quimeras do provão e do ENADE à realidade do capital cultural dos estudantes. **Avaliação: Revista da Avaliação da Educação Superior**, Campinas, v. 20, n. 1, p. 105-122, 2015. Disponível em: https://doi.org/10.590/S1414-40772015000100008. Acesso em: 1 fev. 2021.

BIONDI, Daniela. **Floresta urbana**. Curitiba: O Autor, 2015.

BRASIL. **Decreto nº 48.247**, de 30 de maio de 1960. Cria a Escola Nacional de florestas e dá outras providências. Brasília: Presidência da República, 1960. Disponível em: https://legis.senado.leg.br/norma/470821/publicacao/15790257. Acesso em: 1 fev. 2021.

BRASIL. **Decreto nº 52.828**, de 14 de novembro de 1963. Incorpora a Escola Nacional de Florestas, criada pelo decreto nº 48.247 de 30 de maio de 1960, à Universidade do Paraná, e dá outras providências. Brasília: Presidência da República, 1963. Disponível em: https://legis.senado.leg.br/norma/475508/publicacao/15665572. Acesso em: 1 fev. 2021.

BRASIL. **Decreto nº 6.096**, de 24 de abril de 2007. Institui o Programa de Apoio a Planos de Reestruturação e Expansão das Universidades Federais - REUNI. Brasília: Presidência da República, 2007. Disponível em: http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2007/decreto/d6096.htm. Acesso em: 1 fev. 2021.

BRASIL. **Lei nº 10.861**, de 14 de abril de 2004. Institui o Sistema Nacional de Avaliação da Educação Superior – SINAES e dá outras providências. Brasília: Presidência da República, 2004. Disponível em: http://www.planalto.gov.br/ccivil_03/_ato2004-2006/2004/lei/l10.861.htm. Acesso em: 1 fev. 2021.

BRASIL. **Resolução nº 3**, de 2 de fevereiro de 2006. Institui as Diretrizes Curriculares Nacionais para o curso de graduação em Engenharia Florestal e dá outras providências. Brasília: Presidência da República, 2006. Disponível em:

http://portal.mec.gov.br/cne/arquivos/pdf/rces03_06.pdf. Acesso em: 1 fev. 2021.

BRITO, Márcia R. F. de. O SINAES e o ENADE: da concepção à implantação. **Avaliação: Revista da Avaliação da Educação Superior**, [s. l.], v. 13, n. 3, p. 841-850, 2008. Disponível em: http://periodicos.uniso.br/ojs/index.php/avaliacao/article/view/287. Acesso em: 1 fev. 2021.

CADASTRO NACIONAL DE CURSOS E INSTITUIÇÕES DE EDUCAÇÃO SUPERIOR. Portal que contém a base de dados oficial dos cursos e Instituições de Educação Superior - IES. Brasília: MEC, 2020. Disponível em: https://emec.mec.gov.br/. Acesso em: 1 fev. 2021.

CAMARGO, Brigido V.; JUSTO, Ana M. IRAMUTEQ: um software gratuito para análise de dados textuais. **Temas em Psicologia**, Ribeirão Preto, v. 21, n. 2, p. 513-518, 2013. Disponível em: <http://dx.doi.org/10.9788/TP2013.2-16>. Acesso em: 18 fev. 2021.

CAROLINA, Paula; PARANAIBA, Guilherme. Cadeirantes mostram que normas de acessibilidade ainda são descumpridas em BH. **Estado de Minas**, Gerais, 19 out. 2015. Disponível em: https://www.em.com.br/app/noticia/gerais/2015/10/19/interna_gerais,699146/cadeirantes-mostram-que-normas-de-acessibilidade-ainda-sao-descumprida.shtml. Acesso em: 1 fev. 2021.

CHUVA, Ana P.; NEVES, Clayton. Moradores ficam surpresos com corte de árvores em praça na Vila Margarida. **Campo Grande News**, Capital, 01 jun. 2021. Disponível em: https://www.campograndenews.com.br/cidades/capital/moradores-ficam-surpresos-com-corte-de-arvores-em-praca-na-vila-margarida. Acesso em: 1 fev. 2021.

CORBUCCI, Paulo R. **Evolução do acesso de jovens à Educação Superior no Brasil**. Rio de Janeiro: Ipea, 2014. Disponível em: https://www.ipea.gov.br/portal/index.php?option=com_content&view=article&id=22089. Acesso em: 1 fev. 2021.

CUNHA, Vagner L. C. de. M. et al. Conflitos da arborização com elementos urbanos na cidade de Valença, estado do Rio de Janeiro. **Revista da Sociedade Brasileira de Arborização Urbana**, Curitiba, v. 15, n. 2, p. 28-41, 2020. Disponível em: http://dx.doi.org/10.5380/revsbau.v15i2.69850. Acesso em: 1 fev. 2021.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA. **Censo Demográfico 2010**: Principais resultados - População residente por situação de domicílio, 2010. Rio de Janeiro: IBGE, 2010. Disponível em: https://www.ibge.gov.br/estatisticas/sociais/habitacao/9662-censo-demografico-2010.html?edicao=9673&t=destaques. Acesso em: 1 fev. 2021.

INSTITUTO NACIONAL DE ESTUDOS E PESQUISAS EDUCACIONAIS ANÍSIO TEIXEIRA. **Sinopse Estatística da Educação Superior 2019**. Brasília: Inep, 2020. Disponível em: http://portal.inep.gov.br/basica-censo-escolar-sinopse-sinopse. Acesso em: 1 fev. 2021.

INSTITUTO NACIONAL DE ESTUDOS E PESQUISAS EDUCACIONAIS ANÍSIO TEIXEIRA. **Provas e Gabaritos**. Brasília: Inep, 2021. Disponível em: http://inep.gov.br/educacao-superior/enade/provas-e-gabaritos. Acesso em: 1 fev. 2021.

KUO, Frances E.; SULLIVAN, William C. Environment and Crime in the Inner City: Does Vegetation Reduce Crime? **Environment and Behavior**, [s. l.], v. 33, n. 3, p. 343-367, 2001. Disponível em: https://doi.org/10.1177/0013916501333002. Acesso em: 1 fev. 2021.

LOCATELLI, Marcela M. et al. Planejamento de espaços verdes para minimização do escoamento superficial das águas pluviais. **Revista LABVERDE**, [s. l.], v. 8, n. 2, p. 75-89, 2017. Disponível em: https://doi.org/10.11606/issn.2179-2275.v8i2p75-89. Acesso em: 1 fev. 2021.

MACEDO, José H. P. **A Engenharia Florestal da Universidade Federal do Paraná**: história e evolução da primeira do Brasil. Curitiba: J. H. P. Macedo, 2003.

MEDEIROS FILHO, Antonio E. C. et al. Fatores associados ao desempenho discente no Exame Nacional de Desempenho dos Estudantes (ENADE): uma revisão integrativa. **Revista Expressão Católica**, [s. l.], v. 8, n. 1, p. 87-96, 2019. Disponível em:

http://publicacoesacademicas.unicatolicaquixada.edu.br/index.php/rec/article/view/2543/0. Acesso em: 1 fev. 2021.

MESSIAS, Edna B. DE M. et al. Diagnóstico sobre a arborização urbana do município de Maribondo - AL. **Diversitas Journal**, [s. l.], v. 4, n. 3, p. 749-763, 2019. Disponível em: https://periodicos.ifal.edu.br/diversitas_journal/article/view/741. Acesso em: 1 fev. 2021.

MENEZES, Gabriel. Moradores de Ipanema queixam-se da falta de poda nas árvores. **O Globo**, Rio de Janeiro, 15 fev. 2018. Disponível em: https://oglobo.globo.com/rio/bairros/moradores-de-ipanema-queixam-se-da-falta-de-poda-nas-arvores-22396747. Acesso em: 1 fev. 2021.

PAULA, Camila H. de; ALMEIDA, Fernanda M. de. O programa Reuni e o desempenho das Ifes brasileiras. **Ensaio: Avaliação e Políticas Públicas em Educação**, [s. l.], v. 28, n. 109, p. 1054-1075, 2020. Disponível em: https://doi.org/10.1590/s0104-40362020002801869. Acesso em: 1 fev. 2021.

SALVIATI, Maria E. **Manual do Aplicativo Iramuteq**. Planaltina: IRAMUTEQ, 2017. Disponível em: http://www.iramuteq.org/documentation#section-1. Acesso em: 1 fev. 2021.

SILVA, Erica M. F. da et al. Um novo ecossistema: florestas urbanas construídas pelo Estado e pelos ativistas. **Estudos Avançados**, [s. l.], v. 33, n. 97, p. 81-102, 2019. Disponível em: http://dx.doi.org/10.1590/s0103-4014.2019.3397.005. Acesso em: 1 fev. 2021.

SOUZA, Paulo F. de. (1961). Histórico da Escola de Florestas U.F.P relatório de Atividades 1960-1961. **Revista Florestal**, [s. l.], p. 39-43. Disponível em: http://www.centralflorestal.com.br/2020/10/documento-historico-de-1961-destaca.html#:~:text=Em%2004%20de%20mar%C3%A7o%20de,capital%20da%20rep%C3%BAblica%20para%20Bras%C3%ADlia. Acesso em: 1 fev. 2021.

STANGANINI, Fábio N.; LOLLO, José A. de. O crescimento da área urbana da cidade de São Carlos/SP entre os anos de 2010 e 2015: o avanço da degradação ambiental. **urbe. Revista Brasileira de Gestão Urbana**, [s. l.], v. 10, n. Supl. 1, p. 118-128, 2018. Disponível em: https://doi.org/10.1590/2175-3369.010.SUPL1.AO14. Acesso em: 1 fev. 2021.

SURCIN, Gisele de M. O Exame Nacional dos Cursos Superiores no Brasil (ENADE): das origens aos dias de hoje. **Revista da Academia Brasileira de Filologia**, [s. l.], ano. XXII, n. XXIV, p. 65-73, 2020. Disponível em: http://www.filologia.com.br/revistasabf.htm. Acesso em: 1 fev. 2021.

TEIXEIRA JUNIOR, Paulo R. Diretrizes Curriculares Nacionais para o Ensino Superior: a lógica das competências em foco. **Crítica Educativa**, [s. l.], v. 6, n. 1, p. 1-18, 2020. Disponível em: https://doi.org/10.22476/revcted.v6.id483. Acesso em: 1 fev. 2021.

WOLF, Kathleen L. et al. Urban Trees and Human Health: A Scoping Review. I**nternational Journal of Environmental Research and Public Health**, [s. l.], v. 17, n. 12, p. 1-30, 2020. Disponível em: https://doi.org/10.3390/ijerph17124371. Acesso em: 1 fev. 2021.