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## Recycle Relevance and Sustainable Development



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### Definition

Due to the increasingly limited soil capacity to receive and absorb diverse types of waste generated by human activities, recycling becomes fundamental within solid waste management proposals, since it can minimize environmental contamination, reduce the extraction of resources, optimize energy use, protect limited resources, and conserve ecosystems. Thus, recycling plays a key role in development and especially in sustainable development (Lalbahksh 2012).

### Introduction

The issue of solid waste is a problem that has occupied a great extent as one of the elements that contribute to the decline of the quality of the environment and life of the urban population, since its poor management causes serious damages to the physical and mental health of the

population, as well as polluting and destroying ecosystems.

Kuwahara (2014, p. 56) mentions that perhaps one of the most critical problems related to waste management is the fact that both generation and inadequate waste disposal can have adverse effects on the environment and the health of individuals, “with differentiated, if not exacerbated, impacts on the low-income population, particularly those who survive from collecting garbage that is improperly disposed in the dumps.”

Thus, addressing this disruptive and demanding issue, which demands great efforts and determination of several sectors of society, is one of the objectives of the 2030 Agenda for Sustainable Development, with which its concept is to meet the needs of the present without compromising the ability of future generations to meet their own needs (United Nations 2015).

However, it is pertinent to point out that the behavior of the human being over the ecosystem regarding the management of solid waste in the place where they inhabit has great influence to maintain the particularity of the environment. Therefore, it is understood that comprehending the environmental perception of each subject becomes an essential factor to analyze the personal point of view of value and behavior that direct the actions of the subject over the inhabited space.

The understanding of environmental perception contributes to the understanding of the

connection of the human being to the place in which he lives, thus contributing to the construction of proposals that enable the improvement of the environmental quality and life of the population. It is understood that the act or capacity to perceive something makes up a particular perspective, since the diagnosis and understanding of feelings and convictions play an extremely important role in the complex construction of values and attitudes that guide actions over the spaces which the subject occupies (Hoeffel and Fadini 2007).

Thus, this work, based on the study case on the Solid Waste Management Plan (SWMP) of UNIFAAT, aims at establishing the relationship between recycling and sustainability having as analysis instruments the operational results of the SWMP and the environmental perception of incoming and concluding students of UNIFAAT, about its insertion into the environment and also on specific issues related to solid waste.

## Waste, Perception and Environmental Education

According to the classification of the Brazilian Association of Technical Standards (ABNT 2014), waste is a result of diversified activities carried out by the human being. According to Philippi Jr et al. (2004), the human being lives in growing urban agglomerations, demanding immense amounts of resources and generating waste in the same proportions.

However, it should be mentioned that the existence of residues is marked by the emergence of the human being on planet Earth. Its practice focused on nomadism and the search for food and shelter for its survival left residues from its hunting and fishing activity. And as time went by as man became civilized and settled in a certain region, his need for convenience took on greater breadth, and consequently the production of waste intensified (Hempe and Noguera 2012).

With the Industrial Revolution, where its perspective was directed mainly to economic development and the possibility of ascending to large-scale production, there was an automatic increase in

consumption and, consequently, the drive for the unrestrained disposal of solid waste, which contributed to the environmental problems that haunt humanity, such as global warming, water crisis, air pollution, soil and water, accumulation of waste in the ecosystem, clogging of drainage networks, environmental degradation, and proliferation of vectors that transmit disease, among others (Hempe and Noguera 2012).

However, even in the face of all these problems, as well as the issue of excess generation and final disposal of solid waste, effective measures unfortunately are not being addressed with the necessary urgency.

According to the Brazilian Institute of Geography and Statistics (IBGE 2017):

The world population, which today is 6.1 billion people, is expected to reach 9.3 billion by 2050, a growth of 50%, which is expected to occur mainly in developing countries, which will account for 85% of the world's population by 2050. While the population will decline in 39 countries with low fecundity, concentrated, especially in Eastern Europe, the 49 least developed countries will almost triple in size, from 668 million to 1.8 billion.

In Brazil, in 2016, according to the Brazilian Association of Public Cleaning and Special Waste Companies (ABRELPE), the numbers referring to the generation of Urban Solid Waste (USW) revealed an annual total of almost 78.3 million tons. From these, the amount collected in 2016 was 71.3 million tons, which shows that 7 million tons of waste were not collected and, consequently, had an improper destination. In relation to inadequate disposal, 3331 Brazilian municipalities sent more than 29.7 million tons of waste, corresponding to 41.6% of that collected in 2016, to dumps or landfills, which do not have the set of systems and measures necessary for protection of the environment against damage and degradation (ABRELPE 2016).

Through the report on population growth and USW generation, it is noticeable, that the advance is exercised mutually, indicating the absence of inertia, and therefore, it is inevitable to reflect, regarding the collection of waste mechanism, which denotation is insufficient to meet this demand. Approximately 10% of the total waste

generated annually is not included in the collection process in the country and, consequently, leads to inadequate disposal (ABRELPE 2016).

In view of the context of the solid waste issue, there is a problem in the daily reality of society, presenting Environmental Education (EE) as fundamental to raise people awareness to the environment in which they live, in order to respect and conserve the environment and consequently the quality of life of human beings.

The EE does not necessarily require considering the pragmatic model of education, and academic knowledge is not necessary for it, but its approach is considered to be essential in a systematic and transversal way, relating the economic, political, social, cultural, and ecological spheres, which coexist and interact with each other in a fully harmonious way in order to contribute to the sustainable development of responsibility and moral values among the individuals who are part of all social spheres (Branco et al. 2011).

According to Article 10 of Law No. 9795 of 1999 that establishes the National Policy of Environmental Education:

Environmental Education should be developed as an integrated, continuous and permanent educational practice; at all levels and modalities of formal education, with the following guideline: environmental education should not be implanted as a specific discipline in the teaching curriculum; [...], and at all levels, should be incorporated as content that treats the subject as environmental ethics, in the specific professional activities to be developed. (Brasil 1999)

However, it is important to inquire that for the development of environmental awareness, it is extremely necessary to stimulate actions for EE, which vision is focused on environmental aspects and consequently on sustainable development. Cavalcanti (1997, pp. 386–87) states that:

The sustainability theme faces what Beck calls the paradigm of the society at risk. This implies the need to multiply social practices guided by the expansion of the right to information and environmental education in an integrative perspective. It is about empowering initiatives based on the assumption that greater access to information and transparency in the management of urban environmental problems may imply a reorganization of power and authority.

Sustainable development is based on a logic that meets the needs of the present without compromising the ability to meet the needs of future generations (CMMAD 1991). Even in the face of the possibility of compromise, the functioning of the economic development gear is inevitable, but the human being needs to become aware and know when to reduce the intensity of its operation in order to contribute to the recovery of the environment. For, based on Cavalcanti (2001), economic development no longer presents itself as an embracing possibility for the world, once its base needs to be revised due to the necessary and indispensable quest for sustainability.

So, in view of promoting Environmental Education and sustainable development, it is important to consider that each subject has an environmental perception, which often does not devote attention to their own living space due to habits and self-indulgence, the reflection of which occurs in inert acts, and in the permanence of ignorance in the face of the problems existing in the urban region in which he inhabits.

It is also understood that the intensity with which the individual feels the environment oscillates and differs according to their values, ideals, culture, and even gender. Therefore, the relation that human beings develop with the environment is considered to be elucidated in a different way, being able to present itself basically from a perspective of aesthetics: it can vary from the pleasure felt by seeing a landscape, to the sensation of beauty, which external stimulus causes a specific reaction, producing a perception. Or, it can be tactile: satisfaction while enjoying the breeze, the earth, and the water. However, the feeling acquired by the place in which one lives is the most difficult to describe, because it is the home, the means by which one earns his living (Tuan 1980).

Tuan (2005) believes that the environment may not be the direct circumstance for the feeling for the place or the environment; however the same propitiates sensorial stimulation which, acting as a captured image, models the joys and the convictions.

However, it is relevant to mention that human beings and nature have gradually distanced

themselves, converting their link into indirect, impersonal, and conflicting, due to abusive and unbridled practices against the ecosystem, regarding the use of natural resources, occupation, and territorial expansion and the practices of production, which were never performed in a harmonic way.

In view of this conception, it is evident that the pressure and demand generated by the economic sphere to which society lives and its merciless consequences are witnessed, felt, and reflected in human actions and perceptions regarding the natural ecosystem that exist around it, constantly affected in favor of progress and urban development. For Grün (1996, p. 22): “Of all the ecological crises that have already taken place today, we have a specificity: it is the first time that human beings are the main cause of an ecological crisis.”

In view of this, education transmits attachment of precepts and values, therefore, an ethics, to which consequently Environmental Education, presents itself as a guiding principle, being indissociable in the present day, in the face of this critical moment lived by the human race, as a consequence of the environment banalization and misrepresented values for their fulfillment and individual satisfaction (Carvalho 2012).

Therefore, it is relevant to highlight that Environmental Education has purposes that are intended to be achieved, such as the promotion of individual and collective actions aimed at raising awareness and consequently sensitizing people regarding the conservation of the environment, so that they leave the comfort zone and understand how to protect it and take care of it in the best way possible, in a way that its reflex is available methodically in the proper management of solid waste, without exempting from the responsibility of the correct disposal directive of the waste produced. In this way, through environmental education, it is possible to promote actions such as changes in habits and actions that collaborate to: reduce the amount of waste, reuse materials, transform waste that is useless, promote jobs and develop the economy in a sustainable way.

Therefore, Environmental Education becomes an important instrument for the sustainable development and behavior of an individual who is

critical and responsible for his actions toward the environment, in view of the attempt to create a new human mentality, thus creating a new model of behavior and seeking the balance between the human being and the environment.

## Case Study

In order to highlight the relationship between recycling and sustainability, and the role of the human being in this process, a case study based on the Solid Waste Management Plan (SWMP) of the UNIFAAT University Center located in Atibaia, Sao Paulo. The methodology adopted had three distinct phases:

*The exploratory* – which involved the presentation and analysis of the operational results of SWMP.

*Field work* – closed questions questionnaire application to incoming and concluding students of the institution’s undergraduate courses.

*Analysis and processing of the empirical and documental material* – data obtained in the exploratory and fieldwork phases were organized and analyzed aiming at integrating different aspects such as recycling, sustainability, and perception of the target public involved in the research (Minayo 2008).

The SWMP that is currently in operation began in 2014, an action developed by UNIFAAT’s Center for Studies, Research and Extension (CEPE) in association with the college maintenance sector, which is responsible for an important part of its operational management.

The creation of the PGRS occurred in response to a demand presented by the management of the institution, which sought to increase its environmental performance through the management and disposal of solid wastes generated at UNIFAAT. This demand originated from the merger between two main factors. First of all, the pressure of the municipal public power, which was supported by Law No. 12,305 of August 2, 2010 – National Solid Waste Policy (PNRS) (Brasil 2010), asked

the college to prepare a Solid Waste Management Plan, in order to ensure adequate management and disposal of the solid waste generated by the institution. A second factor was added, which contributed to boost the elaboration and execution of the plan – the expansion of the interest of the institution’s management for socio-environmental issues (Vernalha 2017).

The plan foresees a strategy that combines the type of segregation by groups – separation between dry and wet residues – multi-selective segregation – separation by materials (CEMPRE,). It is proposed to the public attending the university center that the waste generated in the institution is supposed to be separated into two large groups, which bring together various types of materials – recyclable and nonrecyclable (suggesting segregation by groups) – and a third more specific which includes only one type of material – recyclable paper (common to multi-selective segregation). In the group of recyclables, waste metal, plastic, glass, and Tetra Brik should be discarded. In the case of non-recyclables are included food waste, non-recyclable paper, napkins, Styrofoam and other materials whose recycling is economically unfeasible in the region (Vernalha 2017).

With about 3 years of operation, the program has been presenting some relevant results. Among them, the constant increase in the amount of recyclable materials that are sent to a municipal cooperative, Cooperativa São José, in the neighborhood of Caetetuba (Atibaia, state of São Paulo, Brazil), generating income to its members and their families, as well as the consequent reduction of the volume of waste that is sent to landfills, contributing to the extension of its useful life and avoiding the pollution of the physical environment – currently, about 160 bags of 100 L containing

recyclable material generated in UNIFAAT are sent to the cooperative every month (Vernalha 2017).

Referring specifically to the recycling of paper and cardboard waste generated in college, the management plan has reached the mark of about half a ton of material sent to recycling monthly through its commercialization in the recyclable waste market. In this way, a revenue has been generated which, although not substantially expressive, generates an important contribution once it is reinvested in the management plan itself, providing feedback and making the program more and more self-sufficient (Vernalha 2017).

It is still possible to mention a significant reduction in the cost associated with the destination of solid waste from the university center. Comparing the figures from 2014 to 2017 (both for the first half of the year), a reduction of around 78% in the absolute cost associated with solid waste disposal was identified, as well as a reduction of 80% in the relative value – cost per student. Since the number of students in 2017 is higher than in 2014 and considering that this is the main public that generates waste in the institution, it is understood that the relative value better accomplishes the function of measuring the actual effectiveness of the plan (Vernalha 2017).

In addition to the aforementioned benefits, it should be noted that the recycling of the waste also contributes to reducing the amount of natural resources extracted from the environment, since the introduction of recyclable material in the productive cycles, as an input, displaces the use of a part of virgin raw material that would have to be withdrawn directly from the natural environment.

Aiming to broaden the understanding of the results obtained by the UNIFAAT Solid Waste Management Plan, a survey was carried out with

**Recycle Relevance and Sustainable Development, Table 1** Gender

Category of answers	Incoming students		Concluding students	
	Male	657	57.2%	345
Female	476	41.5%	177	33.5%
No answer	15	1.3%	7	1.3%
Total	1148	100%	529	100%

**Recycle Relevance and Sustainable Development, Table 2** Age range

Category of answers	Incoming students		Concluding students	
	Count	Percentage	Count	Percentage
–18 years old	159	13.9%	1	0.2%
From 18 to 25 years old	724	63.1%	349	66.0%
From 26 to 30 years old	96	8.4%	97	18.3%
From 31 to 35 years old	72	6.3%	37	7.0%
From 36 to 40 years old	44	3.8%	16	3.0%
41 or more	51	4.4%	28	5.3%
No answer	2	0.2%	1	0.2%
Total	1148	100%	529	100%

1148 incoming students for the 2018 academic year and also with 529 concluding students. The data as well as their analyses are presented below.

Table 1 shows the gender of those involved in the research. As can be observed among the incoming students, 57.2% of the participants in the research are male and 41.5% female. Among the concluding students, 65.2% of the participants in the research are male and 33.5% female, demonstrating that there is a greater participation among male respondents, and this difference is more significant among the concluding students.

Observing Table 2 on the age group, it is noticed that the majority of the students participating in the study, both incoming (63.1%) and concluding (66%) students are between 18 and 25 years old, indicating a significant participation of young people in the research and in higher education.

When asked about the environment, a significant difference was observed in the comparison between the incoming and concluding students (Table 3). In the case of incoming students, 42.2% answered that the environment is associated with water, forests, soil/soil, climate, and animals and 15.5% biodiversity and 33.8% the interaction between social, cultural, political, economic, and ecological factors. Therefore, a significant number (57.7%) of incoming students attribute the concept of the environment to a vision in which the human being is not inserted. Regarding the concluding students, 26.7% mentioned that the environment is related to water, forests, soil/soil, climate, and animals; 10.6% biodiversity; and 56.7% the interaction between social, cultural, political, economic, biological,

**Recycle Relevance and Sustainable Development, Table 3** What is environment?

Category of answers	Incoming students		Concluding students	
	Count	Percentage	Count	Percentage
Water, forests, soil/earth, climate, and animals	484	42.2%	141	26.7%
Natural resources reservation	45	3.9%	18	3.4%
Biodiversity	178	15.5%	56	10.6%
Everything that was created by a higher being	42	3.7%	9	1.7%
Interaction between social, cultural, political, economic, biological, and ecological factors	388	33.8%	300	56.7%
No answer	11	1.0%	5	0.9%
Total	1148	100%	529	100%

and ecological factors. Thus among the graduating students, the complex view of the environment is more representative.

From these data it is possible to infer that the communication work of the Solid Waste Management Plan of UNIFAAT, together with the educational process promoted in the disciplines that focus on the environmental area, has contributed not only to demonstrate the importance of recycling and destination correctness of the waste but also for the broadening of the students' perspective regarding their inclusion in environmental design. This is an important result, because environmental problems mean not only the conflicts generated between individual/people and nature but also those generated between



**Recycle Relevance and Sustainable Development, Table 4** Knowledge about recyclable waste

Plastic				
Category of answers	Incoming students		Concluding students	
Recyclable	1108	96.5%	512	96.8%
Nonrecyclable	35	3%	15	2.8%
No answer	5	0.4%	2	0.4%
Total	1148	100%	529	100
Metal				
Category of answers	Incoming students		Concluding students	
Recyclable	956	83.3%	463	87.5%
Nonrecyclable	181	15.8%	62	11.7%
No answer	11	1.0%	4	0.8%
Total	1148	100%	529	100%
Glass				
Category of answers	Incoming students		Concluding students	
Recyclable	930	81.0%	461	87.1%
Nonrecyclable	210	18.3%	64	12.1%
No answer	8	0.7%	4	0.8%
Total	1148	100%	529	100%

individual/people and individual/people, in the perspective that it is not the nature that is in crisis, but rather the basis on which most societies today hold (Leff 2003).

In relation to the knowledge about which residues are recyclable, in Table 4 it can be noticed that there is no great difference in the knowledge of the incoming and concluding students, considering that the majority in all categories (plastic, metal, and glass) demonstrated knowledge of the types of waste that are recyclable. However, it is important to consider in the analysis that even with a less expressive number, students and graduates still have doubts about what recyclable waste is, especially referring to metal and glass. In this way, it is evident that it is necessary to work more on the educational process of the students in the academic scope aim to improve the knowledge about the correct destination of solid waste.

Finalmente a Table 5 demonstra o conhecimento dos alunos ingressantes e concluintes acerca dos resíduos considerados não recicláveis. Considerando os dados, assim como na análise da tabela anterior, não há diferenças significativas entre a percepção dos alunos ingressantes e concluintes. Uma questão relevante a ser notada é que ambos os grupos de entrevistados apresentam dúvidas sobre a reciclagem do isopor e o guardanapo, que tecnicamente são

considerados não recicláveis. Mais uma vez esta realidade reforça a importância de se ampliar o processo educativo no que se refere a destinação dos resíduos.

Comparing Tables 4 and 5 that address students' knowledge about recyclable and non-recyclable waste, it should be noticed that UNIFAAT's Solid Waste Management Plan has expressively invested in communication systems; as an example, it can be mentioned that in each classroom, there is a specific information on the correct destination for each type of waste, as well as in the student's manual and in each rubbish bin around the campus. Nevertheless, the research shows the need for educational processes that collaborate in a more significant way for the training of students in relation to socio-environmental problems in general and more specifically in solid waste management.

## Final Considerations

The development of this research evidenced the importance of recycling for sustainability based on the case study carried out from the UNIFAAT Solid Waste Management Plan. Thus, it was clear that higher education institutions play a

**Recycle Relevance and Sustainable Development, Table 5** Knowledge about nonrecyclable waste

Food leftovers				
Category of answers	Incoming students		Concluding students	
Recyclable	181	15.8%	70	13.2%
Nonrecyclable	957	83.4%	454	85.8%
No answer	10	0.9%	5	0.9%
Total	1148	100	529	100
Styrofoam				
Category of answers	Incoming students		Concluding students	
Recyclable	359	31.3%	120	22.7%
Nonrecyclable	777	67.7%	405	76.6%
No answer	12	1.0%	4	0.8%
Total	1148	100%	529	100%
Napkins				
Category of answers	Incoming students		Concluding students	
Recyclable	691	60.2%	288	54%
Nonrecyclable	449	39.1%	235	44%
No answer	8	0.7%	6	1%
Total	1148	100%	529	100

fundamental role in promoting sustainable development, whether in the training of students or, as an example, in the implementation of actions that seek to conserve the environment and improve the quality of life of human beings.

Such conclusion meets Sorrentino and Nascimento's vision (Sorrentino and Nascimento 2010, p. 19) for whom "Universities are still important references for the societies that shelter them and maintain them as centers of knowledge production and possibilities of solutions to problem by them experienced, as an opportunity to improve the quality of life and as a place of formation for our people."

More specifically, it can be said that the recycling of waste in UNIFAAT has contributed to reduce the amount of natural resources extracted from the environment, since the introduction of recyclable material in the productive cycles, as an input, displaces the use of a part of the virgin raw material that would have to be withdrawn directly from the natural environment. It is also important to mention that the cost reduction ratifies the relevance of the Solid Waste Management Plan for the objectives that support the sustainability tripod, in what refers more directly to the economic dimension.

Finally, the questionnaires application showed that the SWMP has collaborated to broaden the students' perception about what is environment, considering that the concluding students associate this concept with a more complex perspective. According to Carvalho (2012), a reductionist view of the environment, considering only one of its dimensions and neglecting the richness of the interaction between nature and human culture, prevents the glimpse of solutions to environmental problems. In this way, promoting an understanding in which the students see themselves as integral parts of the environment collaborates in overcoming this reductionist vision mentioned by the author.

Identifying the weaknesses of SWMP, verified mainly in terms of knowledge about recyclable or nonrecyclable waste, is part of the evaluative process, improvement of proposals, and the educational process itself, which must be critical, emancipatory, and transformative. Thus, one of the next steps is to work within the institution in a deeper way on the proposals of environmental education associated to the issue of waste, in a reflexive and committed process to the search for sustainability.



## References

- Associação Brasileira de Empresas de Limpeza Pública E Resíduos Especiais (2016) Panorama dos resíduos sólidos no Brasil 2016. Abrelpe, São Paulo. <http://www.abrelpe.org.br/Panorama/panorama2016.pdf>. Accessed 02 Oct 2017
- Associação Brasileira de Normas Técnicas (2014) NBR 10004. Resíduos sólidos: classificação, 2nd edn. ABNT, Rio de Janeiro
- Branco AFVC, Linard ZUSA, Sousa ACB (2011) Educação para o desenvolvimento sustentável e educação ambiental. *Conex Ci e Tecnol* 5(1):25–31
- Brasil (1999) Lei n. 9.795, de 27 de abril de 1999. Dispõe sobre a educação ambiental, institui a Política Nacional de Educação Ambiental e dá outras providências. [www.planalto.gov.br/ccivil\\_03/leis/19795.htm](http://www.planalto.gov.br/ccivil_03/leis/19795.htm). Accessed 10 Feb 2018
- Brasil (2010) Lei n 12.305, de 2 de agosto de 2010. Institui a Política Nacional de Resíduos Sólidos; altera a Lei nº 9.605, de 12 de fevereiro de 1998; e dá outras providências. [http://www.planalto.gov.br/ccivil\\_03/\\_ato2007-2010/2010/lei/112305.htm](http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2010/lei/112305.htm). Accessed 10 Feb 2018
- Carvalho ICM (2012) Educação ambiental: a formação do sujeito ecológico, 6th edn. Cortez, São Paulo
- Cavalcanti C (1997) Meio ambiente, desenvolvimento sustentável e políticas públicas. Cortez, São Paulo
- Cavalcanti C (2001) Desenvolvimento e natureza: estudos para uma sociedade sustentável, 3rd edn. Cortez, São Paulo
- Comissão Mundial sobre Meio Ambiente e Desenvolvimento (1991) Nosso Futuro Comum. Fundação Getúlio Vargas, Rio de Janeiro
- Grün M (1996) Ética e Educação Ambiental: a conexão necessária. Papyrus, São Paulo
- Hempe C, Noguera JOC (2012) A educação ambiental e os resíduos sólidos urbanos. *Revista Eletrônica em Gestão, Educação e Tecnologia Ambiental* 5(5):682–695
- Hoeffel JL, Fadini AAB (2007) Percepção Ambiental. In: Ferraro LA Jr (org). *Encontros e Caminhos: Formação de Educadoras (es) Ambientais e Coletivos Educadores*. v. 2. MMA, Brasília, pp 225–262
- Instituto Brasileiro de Geografia e Estatísticas (2017) ONU e IBGE divulgam relatórios de população. <https://ww2.ibge.gov.br/home/presidencia/noticias/11122001onu.shtm>. Accessed 10 Feb 2018
- Kuwahara MY (2014) Resíduos sólidos, desenvolvimento sustentável e qualidade de vida. In: Toneto R Jr, Saiani JCC, Dourado J (orgs) *Resíduos Sólidos no Brasil: oportunidades de desafios da lei federal n 12.305 (Lei de resíduos sólidos)*. Manole, Barueri, pp 54–100
- Lalbahksh E (2012) The impact of recycling urban space in sustainable development in developing countries. *APCBEE Procedia* 1:331–334
- Leff H (2003) Complexidade ambiental. Cortez, São Paulo
- Minayo MCS (2008) O desafio da pesquisa social. In: Minayo MCS (org). *Pesquisa social: teoria, método e criatividade*. 27th edn. Vozes, Petrópolis, pp 9–29
- Philippi A Jr, Romero MA, Bruna GC (2004) Uma introdução à questão ambiental. In: Philippi A Jr, Romero MA, Bruna GC (eds) *Curso de Gestão Ambiental*. Manole, Barueri, pp 4–16
- Sorrentino M, Nascimento EP (2010) Universidade e Políticas Públicas de Educação Ambiental. *Revista Educação em Foco, Juiz de Fora* 14(2):16–38
- Tuan Y (1980) Topofilia: um estudo da percepção, atitudes e valores do meio ambiente. Difel, São Paulo
- Tuan Y (2005) Paisagens do medo. UNESP, São Paulo
- United Nations (2015) The 2030 agenda for sustainable development. <https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf>. Accessed 10 Nov 2017
- Vernalha EBR (2017) Programa de gestão de resíduos sólidos das Faculdades Atibaia. FAAT, Atibaia