

**Parana pine landscape and social life cycle assessment (S-LCA)  
supporting sustainable local development**

**Avaliação da paisagem do pinho Paraná e do ciclo de vida social  
(S-LCA), apoiando o desenvolvimento local sustentável**

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**ABSTRACT**

There is a need to increase new perspectives studies and to include culture value, cultural heritage and traditional communities in balance with their environment. While Cultural Heritage has been studied for centuries, the Cultural Landscape originated new concepts. Protecting cultural landscapes contributes to maintain and increase natural values, and to aggregate several tangible and intangible values. In recent years, methods of life cycle assessment, LCA and (social) S-LCA, have evolved into the analysis of products and

services impacts along the value chain, allying approaches of social performance, in order to achieve sustainable development. A case study was conducted at Colônia Murici (State Paraná, Brazil), a rural agricultural community, with Polish ethnic prevalence, inserted in the historical context of European immigration at the late 19th century. It addresses the challenge of preserving their Araucaria (Paraná Pine) wooden architecture and their Cultural Landscape. The aim of this study is to present a literature review survey of S-LCA focused on Cultural Heritage, and examine interviews with specialists and community members. The study of S-LCA methodology demonstrated that the specialists and community members participation is essential, specially in stakeholders definition and in the recognition of impact subcategories. Understanding social and cultural structure, besides the communities engagement, is the first step for heritage management. Respecting biomes and the Araucaria Forest emerged as the most relevant subcategory. The pine image represented by Paranista Movement artists at the beginning of the 20th century became an element of regional identity and the Araucaria remains its symbolic value in the specialists evaluation. The cultural dimension is a decisive component, beside the Cultural Heritage, as necessary indicators in the establishment of goals, in monitoring sustainable local development and in supporting decision-makers.

**Keywords:** cultural heritage, wooden architecture, traditional rural communities, social life cycle assessment (S-LCA), sustainable local development.

## RESUMO

Há a necessidade de implementar novos estudos e incluir o valor da cultura, o patrimônio cultural e as comunidades tradicionais em equilíbrio com o meio ambiente. Enquanto o Patrimônio Cultural tem sido estudado por séculos, a Paisagem Cultural origina novos conceitos. Proteger as paisagens culturais contribui para manter e aumentar os valores naturais e agregar diversos valores tangíveis e intangíveis. Nos últimos anos, os métodos de avaliação do ciclo de vida, ACV e (social) ACV-S, têm desenvolvido análises dos impactos dos produtos e serviços ao longo da cadeia de valor, aliando abordagens de desempenho social, a fim de alcançar o desenvolvimento sustentável. Um estudo de caso foi realizado na Colônia Murici (Estado do Paraná, Brasil), uma comunidade rural agrícola, com predominância da etnia polonesa, inserida no contexto histórico da imigração europeia no final do século XIX e envolvida no desafio de preservar a arquitetura em madeira de Araucária (Pinheiro do Paraná) e na Paisagem Cultural. O objetivo deste estudo é apresentar uma análise bibliométrica sobre ACV-S com foco no Patrimônio Cultural e examinar entrevistas com especialistas e membros da comunidade. O estudo da metodologia da ACV-S demonstrou que a participação de especialistas e membros da comunidade é essencial, especialmente na definição dos *stakeholders* e no reconhecimento das subcategorias de impacto. Compreender a estrutura social e cultural, além do engajamento das comunidades, é o primeiro passo na gestão do Patrimônio. Respeito aos biomas e a Floresta de Araucária distinguiu-se como a subcategoria mais relevante. A imagem do pinheiro representada pelos artistas do Movimento Paranista no início do século XX tornou-se elemento de identidade regional e a Araucária mantém seu valor simbólico na avaliação dos especialistas. A dimensão cultural é um componente decisivo, ao lado do Patrimônio Cultural, como indicadores necessários no estabelecimento de metas, no monitoramento do desenvolvimento sustentável local e no apoio aos decisores.

**Palavras-chave:** patrimônio cultural, arquitetura da madeira, comunidades rurais tradicionais, avaliação social do ciclo de vida (ACV-S), desenvolvimento sustentável local.

## 1 INTRODUCTION

The sustainability debate started with the ecological crisis that occurred between the 1960s and 1980s, caused by global environmental disasters, by nature's destruction, by the concern of economic and population advancement and others. New alternatives regarding the relationship between contemporary society and environment were discussed. Since the Brundtland Report, prepared by the World Commission on Environment and Development (WCED), published in 1987, the emphasis shifted to the human element, treating the theme as "sustainable development" (Bellen, 2006).

Integrating business corporations and decision-making without causing environmental damage, while taking into account fundamental social responsibilities, was the basis for a new three pillars sustainability concept (Elkington, 1998). The balance between economic, environmental and social dimensions became a global goal, involving policies, managers and economists of several sectors. However, the imbalance in developing countries is evident, where there is greater pressure on environmental resources, where the economy depends heavily on nature reserves exploration and where environmental and social protection laws are weak (Lehman, 1999). In these countries, social inequality is often more intense in rural than in urban areas, and occurs with a greater degree of damage to workers in the agriculture sector. There, profits do not remain in the region, but the irreversible environmental and social damage (Njoka et al. 2013; Alsamawi et al. 2014).

Since the 1990s, in view of the growing awareness of environmental protection, and the need to analyze positive and negative impacts on products and services, the innovative Life Cycle Assessment (LCA) methodology, also called "cradle to grave analysis", was added to the previous methods (ABNT-ISO 14040, 2009).

In 2005, new discussions started taking into account the actors involved in production, and emphasizing social sphere impacts analysis. They were consolidated in the guidelines for Social Assessment of the Life Cycle (S-LCA), published in 2009 by the United Nations Environment Programme (UNEP), and by the Society of Environmental Toxicology and Chemistry (SETAC). "S-LCA provides information on social and socio-economic aspects for decision making, instigating dialogue on the social and socio-economic aspects of production and consumption, in the prospect to improve performance of organizations and ultimately the well-being of stakeholders"

(UNEP/SETAC, 2009, p.37). Recently, in 2020 the development of the updated Guidelines has been accomplished by bringing together a large group of practitioners, academics, and members of the private sector (UNEP/SETAC, 2020, p.18).

The S-LCA is in large part based on the ISO 14040 framework for Environmental Life Cycle Assessment (E-LCA), the methodologies aim to mirror the LCA phases comprising goal and scope definition, inventory analysis, impact assessment and interpretation (Jørgensen et al. 2010; Benoît, 2010; UNEP/SETAC, 2020).

The guidelines for the S-LCA approach involve five stakeholder categories: *Local community, Society, Workers, Consumers and Value chain actors*. These are related to social issues and impact categories, namely: human rights, working conditions, cultural heritage, governance, socio-economic repercussions (Benoît, 2010).

The subcategories can be complemented and must be compatible with socially determined attributes to that community and its geographical occupation. Cultural Heritage has importance is inserted as a subcategory related to the stakeholder Local Community such as: access to material and immaterial resources, community engagement, delocalization and migration, and respect for special communities (ethnic, indigenous groups) (UNEP/SETAC, 2009).

The Convention concerning the Protection of the World Cultural and Natural Heritage dates from 1972 ratified by Brazil in September 1977. In this sense the United Nations Educational, Scientific and Cultural Organization (UNESCO) is responsible to promoting the protection and preservation of cultural and natural heritage around the world. “The Cultural Heritage is fundamental to peoples' memory, identity and creativity and the richness of cultures”. By definition it consists of monuments, buildings or sites, which have exceptional archaeological, scientific, ethnological (etc.) value; the Natural Heritage consists of physical, biological and geological outstanding formations (etc.), that also have scientific, conservation or exceptional and universal aesthetic value. Considering the importance to transmission of knowledge and to traditional communities, the Intangible Cultural Heritage consists not only of the physical aspects that constitute culture but various other elements and manifestations, transmitted orally or gesturally, collectively rebuilt (UNESCO, 2022).

There was a great advance in 1992, influenced by the debates at the “Earth Summit Rio-92”, with the introduction of the Cultural Landscape category in the context of sustainable land use for the purpose of the world's heritage conservation. This category recognizes the “exceptional combinations of natural and cultural elements”, creating the

opportunity to register new sites that incorporate these characteristics, and contain several tangible and intangible values. The importance of indigenous and traditional communities in maintaining biological diversity through sustainable land use was also recognized, as was the protection of cultural landscapes, which contributes to maintain and increase landscape natural values. In 2005, a paragraph on sustainable development was included in the Operational Guidelines of the World Heritage Committee (Rössler 2003, Rössler 2012, p.27).

While Cultural Heritage has been studied for centuries, the Cultural Landscape provides new concepts. In Brazil, the Instituto do Patrimônio Histórico e Artístico Nacional (IPHAN) promulgated, through Ordinance N° 127 of 2009, the Chancel of Cultural Landscape. Its article 1° emphasizes the “cultural importance of peculiar portions of the national territory, representative of the process of interaction between man and natural environment, to which human life and science have imprinted or attributed values”. The document “values the harmonious relationship with nature, stimulating the affective dimension with the territory and having as a premise the populations quality of life”. It intensifies the need for interaction between public authorities, civil society and the private sector, in order to promote management and protection (IPHAN, 2009, p.13).

The integrated vision of sustainable development considers spatial and cultural issues to be inseparable from the process, which occurs as a result of the harmonious interaction of the spatial, social, environmental, cultural and economic dimensions. The interrelationships between dimensions are controlled by the institutions that determine rules, and influence society behavior (Silva, 2008). Researchers highlight the essential role of culture and its function as the fourth pillar of sustainability: a significant component, heart to efficient strategies and tool for managers to achieve sustainable development (Hawkes, 2001; Axelsson et al., 2013; Pizzirani et al., 2018).

Despite the emergence of innovative life cycle techniques, there are difficulties regarding the use of impacts assessment methodologies. According to Pizzirani et al. (2018) even if inserted in the S-LCA items, there is no guarantee of the cultural values inclusion, in particular cultural indicators that are still limited and underrepresented.

The cultural theme is broad and the assessments can be subjective. There is complexity in the quantification of intangible values, among them: religious traditions, know-how (*savoir-faire*), oral and artistic expressions, which are particular elements that represent a community's identity. Laws and policies in general include internationally

recognized heritage, but picturesque landscapes and traditional local culture faces greater challenges in preservation and assets valorization.

The aim of this study is to present a literature review survey of S-LCA focused on Cultural Heritage, proposing an analysis of the main stakeholder categories and subcategories of impact groups. Interviews were made with specialists and community members, considering the professional experience, and the involvement of these actors in Cultural Heritage preservation scenario. The case study conducted in Colônia Murici addresses the community's challenge of preserving their wooden architecture and their cultural landscape and the necessity to support decision-makers regarding local sustainable development.

## **2 STUDY AREA AND ANTECEDENTS**

### **2.1 COLÔNIA MURICI, A CASE OF STUDY**

Founded in 1878, Colônia Murici is located in the rural area of the municipality of São José dos Pinhais, Paraná. It was part of the Brazilian immigration policy (late 19th century) to occupy Southern Brazil with small agricultural properties, using European labor in order to supply urban centers. The Polish concentrated the largest ethnic group coming to the State (Wachowicz, 1970; Nadalin, 2001).

The Araucaria Forest predominated in the Southern Region of Brazil, and covered large areas of Paraná, this wood exploitation configured an economic cycle (Imaguire Jr and Imaguire, 2011). Big land areas with huge Araucarias, such was the landscape that immigrants from Poland, Italy and other countries founded. The exploration of Araucaria was intense due to houses and bridges construction, it was also sold as firewood and other products. Subsistence agriculture prevailed for many years (Turbanski, 1978; Marochi, 2006).

Excellent carpenters and joiners came in that period. They built wooden houses with axes and saws, adorned with 'lambrequins'. They made also doors, windows and furniture from the abundant raw material, applying the know-how and techniques brought and taught from father to son. In Colônia Murici immigrants of Polish origin built log houses (Figure 1), executing walls with whole Araucaria - a medieval technique originated from the rich Coniferous regions of northern and eastern Europe (Weimer, 2005; Bernardo, 2013).

Later, with the implementation of sawmills powered by steam, there were wood in varying quantities and sizes. Boards placed next to each other vertically, nailed to the

structure at the base and the top, the cracks covered by slats, created a lighter wall with greater versatility in construction. Such system is called “tábua e mata-junta” (Figure 2), It was extensively used for houses, factories and churches. Many wooden houses remain still part of Paraná’s landscape (Imaguire Jr and Imaguire, 2011; Bernardo, 2013).

Figure 1 - Log house of Araucaria Pine, located in Colônia Murici.



Source: Bernardo (2013).

Figure 2 - House of “tábua e mata-junta” system, decorated by lambrequins.



Source: Bernardo (2013).

The Cultural Landscape - the relationship between man and nature - shows the profile of trees with tall, straight trunks that support the branches at the top of the canopy in chandelier, a characteristic design of *Araucaria angustifolia*. These remnants contrast with the sinuosity of the fields in long extensions of plantations and wooden constructions. In this context, wooden houses represent the material value (inheritance of the constructive technique) and the intangible value of the know-how passed from generation to generation. Among intangible values are: carpentry, agricultural techniques, religious traditions, typical gastronomy, and scenic, art plastic, music forms of expression.

## 2.2 PARANÁ PINE IN ART AND LANDSCAPE

The pine image is associated with a regional identity for Paraná's inhabitants (Lobo, 2012). Unlike other states, at the beginning of the 20th century, Paraná did not have specific cultural traits. Then artists, intellectuals and politicians engaged in creating a cultural identity for the local population (Camargo, 2007), and the Paranista Movement emerged.

Its main artists, João Turin (1878-1948), Lange de Morretes (1892-1954) and João Ghelfi (1890-1925) developed a new regional art, inspired by nature and elaborated from symbolic elements such as the pine and the pinion (Pereira, 1996).

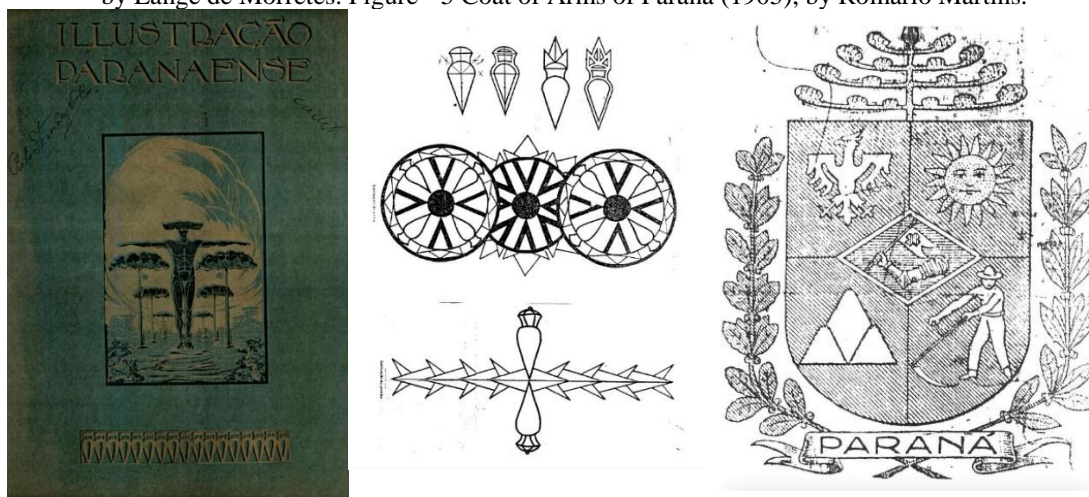
The Illustration Paranaense magazine created in 1927 was a landmark of these ideals. Its cover, a drawing by João Turin (Figure 3), reflects the man in perfect harmony with the pine forest. His position with open arms, in classical balance, refers to the Vitruvian Man by da Vinci (Camargo, 2007). In the pine tree iconology the man is associated with haughtiness, strength and robustness, feeling of belonging to the land and the birth of a local culture.

The pine and its seeds stylizations, decorations and icons were used as theme and spread throughout Curitiba Figure 4, (Dudeque, 2001). Landscape painting was a genre adopted by several painters, living up to the beauty and exuberance of regional nature, they portrayed the fields and the Araucaria Forests' silhouette. The role of art in the construction of an imaginary and a common tradition were evident.

The pine was represented on coats of arms, like the State of Paraná's of 1905 (Figura 5), and adopted as part of the name of several municipalities: Curitiba, São José dos Pinhais and Araucária. Curitiba's name derives from the native tree: 'Curii' is an indigenous expression that means an abundance of pine trees. The Araucaria became the ultimate symbol of paranists ideals (Pereira, 1996).



Figure 3 - Revista Ilustração Paranaense, cover design by João Turin. Figure 4 - Pinion icons, drawing by Lange de Morretes. Figure - 5 Coat of Arms of Paraná (1905), by Romário Martins.



Source: Pereira (1996).

The interest in the landscape remains in the art of many more recent artists. In the exhibition “Remanescentes”, held in 2020 by the Ateliê.39, a group of watercolorists inspired by vegetation, fields and historic buildings, portrayed the cultural landscape of Colônia Murici Figure 6, Figure 7 (Carvalho and Bernardo, 2020).

Figure 6 - Araucaria log storeroom, Figure 7 - Colônia Murici landscapes.



Source: Watercolor artists of Ateliê.39 – Remanescentes exhibition (2020).

### 3 MATERIAL AND METHODS

This research actively utilized participatory techniques such as discussion with members of the municipality secretariats and with multidisciplinary specialists in the area of history, environment, patrimony and active in culture and art of region. Also visits to investigate the aspirations and goals of the community, were made. Case study using mixed methods approach and working in close collaboration with members of community are proposed by Pizzirani et al. (2018).

In the first phase, a bibliometric analysis was carried out to assess the state of the art of S-LCA. Semi-structured interviews and questionnaires were conducted in second phase. During this phase to the participants could better assimilate the importance of the study, talking about and showing images about the Cultural Heritage and Landscape of Colônia Murici. It was explained in which consist the S-LCA methodologie, including the definitions and the stakeholders categories and subcategories recommended by the UNEP / SETAC (UNEP/SETAC, 2009; UNEP/SETAC, 2013). The interviews were carried out with the presentation of printed and online material so that the questionnaire was answered (Attachment 1-2). In the third phase the data were compiled in excel tables.

### 3.1 BIBLIOMETRIC ANALYSIS

Using the keyword “Social Life Cycle Assessment” an extensive review on the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES, 2019) journals on-line platform was carried out, considering the period between 2009 and 2019. The review was mainly based on journal articles and on a smaller proportion of conference articles and abstracts, reports and book chapters which resulted in a total of 456 articles.

The articles were grouped by year, registered by title, by the journal where they were published, and by the authors names and their origin institutions. Based on the content, objective and methodology, two keywords were chosen and the articles were selected from them.

Listed in Table 1 are the 14 items that guided the articles classification. The nomenclature from *A* to *J* followed Venkatesh (2018) sectors, with some adaptations. The item Fashion and Jewelery was excluded. For this study, the following items were inserted: *K - Education, Culture and Heitage* (object of this study) and a specific category for *L - Suply chain*. The item *M - Review and methodololy*, was inserted based on the study by Di Cesare et al. (2018), who divided the articles into theoretical frameworks and case studies. The objective here was to highlight the theoretical articles about S-LCA and the related methodologies. Finally, the item *N - Others*, present themes that were not directly related to any of the subjects described.

Table 1 - Classification items for S-LCA publications from 2009 to 2019.

<b>A</b>	Agriculture, forestry, dairy farming, fishing
<b>B</b>	Food and beverages
<b>C</b>	Energy and fuels, transportation
<b>D</b>	Equipment, machinery, automobiles, manufacturing
<b>E</b>	Mining, metalworking
<b>F</b>	Textiles and related consumer goods
<b>G</b>	Waste management, recycling
<b>H</b>	Chemicals, cosmetics and pharmaceuticals
<b>I</b>	Society, health, households
<b>J</b>	Cities, building and construction
<b>K</b>	Education, culture, heritage
<b>L</b>	Supply chain
<b>M</b>	Review, methodology
<b>N</b>	Others

Source: adapted from Venkatesh (2018).

As a result, a relative proportion of topics studied about S-LCA was obtained within the eleven years period. From this selection, graphs were made, which quantify the most recurrent themes in that period.

### 3.2 QUESTIONNAIRE WITH SPECIALISTS

The questionnaires were based on S-LCAs literature review, and on visits and previous interviews with the community. This was followed by the classification of stakeholder categories and subcategories according to the UNEP / SETAC proposition (UNEP/SETAC, 2009; UNEP/SETAC, 2013) (Figure 8).

Figure 8 – List of stakeholder categories and subcategories.

Stakeholder categories	Subcategories
<b>Stakeholder "worker"</b>	Freedom of Association and Collective Bargaining Child Labour Fair Salary Working Hours Forced Labour Equal opportunities/Discrimination Health and Safety Social Benefits/Social Security
<b>Stakeholder "consumer"</b>	Health & Safety Feedback Mechanism Consumer Privacy Transparency End of life responsibility
<b>Stakeholder "local community"</b>	Access to material resources Access to immaterial resources Delocalization and Migration Cultural Heritage Safe & healthy living conditions Respect of indigenous rights Community engagement Local employment Secure living conditions
<b>Stakeholder "society"</b>	Public commitments to sustainability issues Contribution to economic development Prevention & mitigation of armed conflicts Technology development Corruption
<b>Value chain actors* not including consumers</b>	Fair competition Promoting social responsibility Supplier relationships Respect of intellectual property rights

Source: (UNEP/SETAC, 2009).

The decision regarding the selection of items arose from the meetings of the Conselho Municipal do Patrimônio Cultural (COMPAC). For four months, we followed the council meetings in order to better understand the regions particular context.

The questionnaires (Attachment 2) application consisted of the studies objective explanation, in the context of the cultural landscape of Colônia Muricis preservation, a brief explanation of the S-LCA methodology (UNEP/SETAC, 2009), and the visualization of reference images on cultural heritage and landscape. Then, the interviewees listed their main interest groups and classified the most relevant subcategories, giving a score from 1 to 5 to: 1- Not importante, 2- Of little importance, 3- Somewhat important, 4- Very important, 5- Most important.

In order to verify the Araucaria as a symbolic cultural element, they analyzed the three images Figure 3, Figure 4, Figure 5 authored by intellectuals from the Paranista Movement, inserted in the questionnaire.

Thus, twenty specialists answered the questionnaire: public management representatives of São José dos Pinhais, university researchers and professionals of historical, environmental and Cultural Heritage areas were selected, all members of the local community and involved in cultural actions.

The municipal departments of São José dos Pinhais that have the greatest role regarding the preservation of the natural and cultural heritage are the: Secretaria Municipal do Meio Ambiente (SEMMA); Secretaria Municipal de Urbanismo, Transporte e Trânsito (SEMUTT); Secretaria Municipal de Agricultura e Abastecimento (SEMAG); Secretaria de Indústria, Comércio e Turismo (SICTUR) and Secretaria Municipal de Cultura (SEMUC). They are responsible respectively for the protection of ecosystems, territorial and urban planning, economic development based on agriculture and promotion of rural tourism, and for the maintenance of artistic and cultural expressions and traditions. Members of COMPAC, the Associação de Moradores Comerciantes e Agricultores da Colônia Murici (AMCAM) and members of the Catholic Churchs leadership were also interviewed. All these sectors are responsible for promoting well-being, and local social, economic and cultural development.

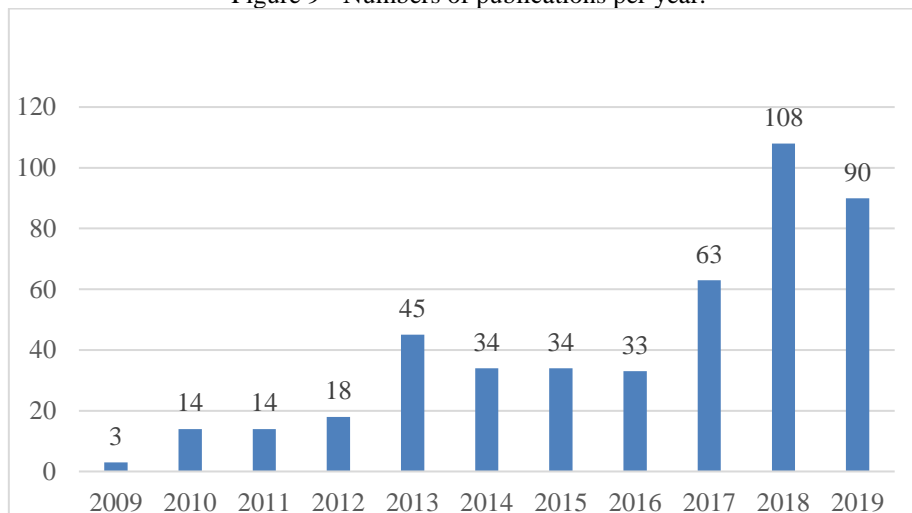
## 4 RESULTS AND DISCUSSION

### 4.1 RESULTS OF BIBLIOMETRIC ANALYSIS

Searching for articles on S-LCA in the database platform of the CAPES journals portal resulted in 456 articles published between 2009 and 2019. The largest number of articles were published in 2018, with a total of 108 articles (Figure 9).

The initial milestone was the year 2009, when the guidelines were launched (UNEP/SETAC, 2009; UNEP/SETAC, 2013). The year 2013 brought a significant number articles, showing interest in the social approach in scientific literature, is also the year that Methodological Sheets was published. Over the years there has been a diversity of themes including new sectors and case studies. The number of publications has increased progressively, especially in the last three years.

Figure 9 - Numbers of publications per year.



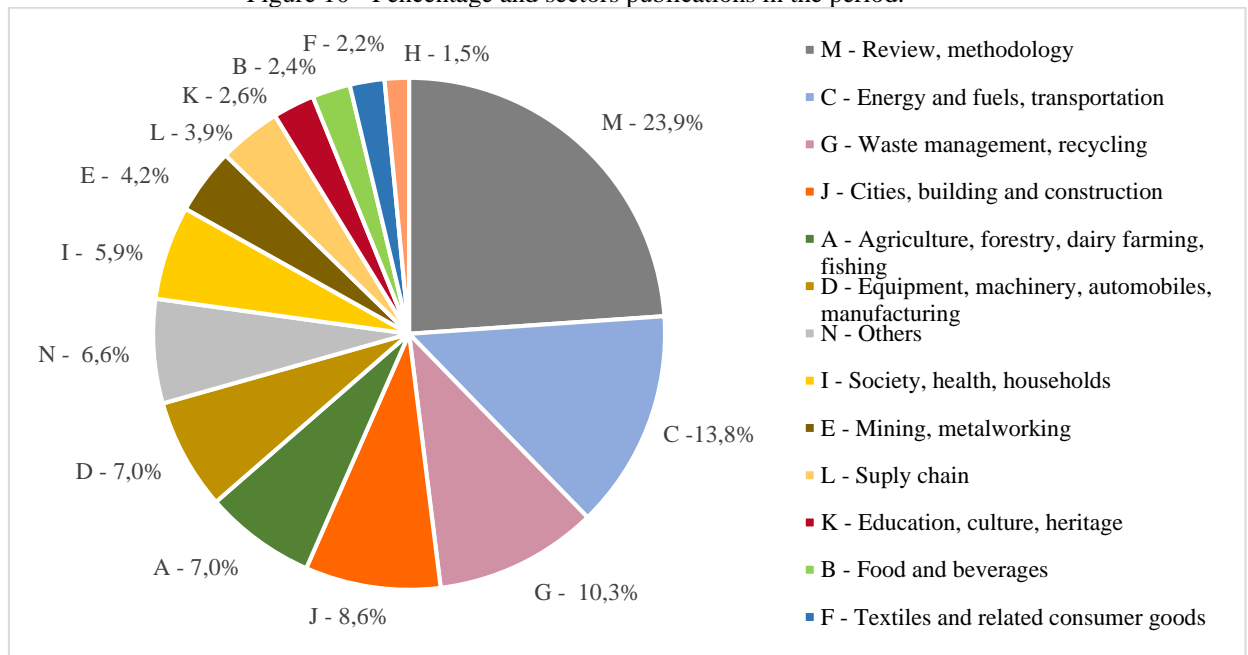
Source: our elaboration.

The largest number of publications is related to the theoretical discussion of the S-LCA theme. The item *M - Review/methodology* contains 108 articles that cover the techniques history and development, articles for theoretical discussion and topic reviews. Many of these studies are linked mainly to LCA, and other associated to Life Cycle Sustainability Assessment (LCSA), Life Cycle Costing (LCC), Environmental Life Cycle Assessment (E-LCA) and Life Cycle Impact Assessment (LCIA). They also involve studies of databases and calculation methods, and the critical evaluation of these methodologies. In total they represent the largest result equal to 23.9%.

Lead the case studies the *C- Energy and fuels, transportation* sector with 13.8%. Related to this theme are renewable energies, the production of photovoltaic panels and

biodiesel, and other energy sources; publications are associated with social sustainability and energy justice (Figure 10). With 10.3% of case studies, follows the sector *G - Waste management, recycling*, which includes publications on urban solid wastes risk, which deal with waste in general, with the final processes of water resources in industries, and with recycled packaging materials. The greater volume of publications reflects the concern related to energy supply and the worldwide production of waste, taking into account social conditions and adverse impacts on workers.

Figure 10 - Percentage and sectors publications in the period.



Source: our elaboration.

Important issues related to urban planning, civil construction and the development of materials with less environmental impact in cities are related in *J - Cities, building and construction*, with 8.6% of the publications. Examples of the application of S-LCA combined with the LCA methodology have been used to verify the performance of materials throughout the workers life cycle and health. In the proportion of 7.0%, *A - Agriculture, forestry, dairy farming, fishing* presented publications that discuss methods of social sustainability in agriculture, involving animal and vegetable extraction, livestock, fishing and the forestry. Also 7.0% of the publications relate to *D - Equipment, machinery, automobiles, manufacturing*, that bring up social issues involving industry, automobile production and other equipment such as cell phones and computers. With about 5.9% of the total, *I - Society, health, households* addresses well-being and health,

presenting data on social and health problems that affect families, such as tobacco, corruption and others, related to social responsibility.

Under 5% but not less important are the articles related to: *E - Mining, metalworking* (4,2%), *L - Supply chain* (3,9%), *K - Education, Culture and Heritage* (2,6%), *B - Food and beverages* (2,4%), *F - Textiles and related consumer goods* (2,2%), *H - Chemicals, cosmetics and pharmaceuticals* (1,5%) (Figure 10).

The publications that did not fit in the previous items were considered *N - Others*, with the index of 6.58%. Different products and topics such as tourism, nanotechnology, artificial intelligence and assistive technology are part of this.

Regarding the object of this study, twelve articles were identified and included in the item *K - Education, Culture and Heritage*. These represent 2.6% of the total, and show that case studies which relate to Cultural Heritage and the S-LCA technique are still underreported.

A philosophical approach is dealt with in the study by Martín et al. (2012) remembering that for the production of future heritage, synergies are required, which imply changes in economy, public policies and philosophy. Technical performance of heritage conservation, innovation in the use of nano-safe and sustainable products in the practice of restoration are addressed in the research by Semenzin et al. (2019).

Authors like Blundo et al. (2014), Blundo et al. (2018), Pizzirani et al. (2014), Pizzirani et al. (2018) and Axelsson et al. (2013) wrote the most relevant articles dealing with the S-LCA theory and practice in culture and Cultural Heritage, and the application of related assessment methodologies.

Blundo et al. (2014) and Blundo et al. (2018) contributed greatly to the studies. The authors proposed a new life cycle approach in assessing the environmental, economic and social impact related to restoration activities, and focused on management and valorization of Cultural Heritage. They provided a tool with the conceptual protocol of “Cultural Heritage Life Cycle Management (CH-LCM)” in order to contribute to the assessment impacts, and the definition of main indicators and stakeholder. On the same theme Khorassani et al. (2019) discuss the potentiality of S-LCA, and its application in the restoration case study of the medieval fortress Uncastillo located in Spain. The ACV technique was also applied, evaluating the advantages and hotspots in recovery and reuse of historical work. The framework developed from S-LCA guidelines proved to be an adequate tool for the assessment of social aspects related to interventions in Cultural

Heritage, “an effective method for improving innovative managerial practices towards the sustainability” (Blundo et al., 2018, p.221).

A literature review was undertaken by Pizzirani et al. (2014) who recognized culture as an important component to be incorporated into assessment techniques, and relevant regarding the definition of public policies and decision-making. They reviewed the concepts of culture and the cultural values presence in LCA, S-LCA and LCSA. The authors highlighted the potential for integrating culture into LCSA as potential benefits and challenges.

A participatory case study on New Zealands indigenous community conducted by Pizzirani et al. (2018) applied LCSA and a Cultural Indicator Matrix to assess the impacts of use of native forestry. The result demonstrated LCSA as an efficient methodology: it stands out as culturally-inclusive. A technique that allowed participants to ‘validate’ and ‘direct’ evaluation of alternative forestry use options for their land. Transparency, participating and continuous communication between everyone, participants and evaluators, were crucial in the process.

It is worth mentioning the study by Axelson et al. (2013) aimed to visualize social and cultural sustainability as a contribution to the planning of Swedish municipalities. They identified criteria, indicators and combining verifiers of regional importance. Maps to visualize and emphasizing the results of cultural indicators are presented as Cultural Landscape (in number of active farmers per km<sup>2</sup>) and Cultural Heritage (in number of historical remains per km<sup>2</sup>). They concluded that it is possible to operationalize such concepts using available official data, and to include social and cultural values in planning.

## **5 RESEARCH WITH SPECIALISTS RESULTS**

### **5.1 STAKEHOLDERS DEFINITION**

The results of the questionnaire and the research with specialists and community members are shown in Table 2 and Figure 11.

Table 2 represents the correspondence of the groups defined in UNEP / SETAC to the Stakeholder groups suggested by the specialists, according to the Cultural Heritage reference and the Cultural Landscapes valorization of Colônia Murici. The indicated groups are presented in decreasing form, highlighting the first item in which there was the greatest conformity in the given answers. The interest subcategories are correlated. In a successive stage, the most relevant subcategories were prioritized.



Table 2 - Classification of stakeholders and subcategories

Stakeholders	Colônia Murici proposal stakeholders groups	Prioritization of subcategories
<b>Local community</b>	Local residents	Access to material resources
	Farmers, land owners	Access to immaterial resources
	Descendants of immigrants and historical buildings owners	Delocalization and Migration
	Catholic religious	Community engagement
	Traditional groups, polish folk dance AMCAM	Conscience and heritage education
<b>Society</b>	Municipality of São José dos Pinhais and the Secretariats	Public commitments to sustainability issues
	AMCAM	Contribution to economic development
	Cooperatives, School, Parish church	Technology development
	University, professionals of historical and cultural heritage area	Promoting social responsibility
	State government	Corruption
<b>Workers</b>	Agricultural and pecuarist workers, local market	Freedom of Association and Collective Bargaining
	Teachers and school employees	Child Labour
	Culture promoters	Local employment
	Ecclesial community	Equal opportunities/Discrimination
	Professionals of tourism and gastronomy area	Health and Safety
	Goods and services external suppliers	Social Benefits
<b>Consumers</b>	Tourists	Respecting biomes and Araucaria forest
	Local residents	Knowledge and management heritage risks
	Residents of São José dos Pinhais	
<b>Value chain actors</b>	COMPAC	Respect of intellectual property rights
	CMPDU	Fair competition
	SICTUR	
	AMCAM	
	IPHAN - PR	Projects and social actions

Colônia Muricis residents are considered the main actors of the *Local community* group, as are landowners, immigrant descendants, owners of historic buildings, the religious, the traditional Polish folk dance group and Associação de Moradores Comerciantes e Agricultores da Colônia Murici (AMCAM). The repercussion of governance in the *Society* group takes into account the role of the São José dos Pinhais municipality, the Secretariats, the State government, cooperatives, AMCAM, the Parish church, the University and professionals related to heritage which act in local decisions.

The main players in the *Workers* group are small producers, family farm workers, ranchers, local market workers, the ecclesial community, professionals dedicated to tourism, gastronomy, and education and culture. In the *Consumers* group, tourists are of greatest interest related to local socio-economic development. In the *Value chain actors* group, COMPAC stands out in the actions of safeguarding cultural heritage, together with IPHAN. The Conselho Municipal de Planejamento e Desenvolvimento Urbano (CMPDU) acts in the urban planning decisions. Secretaria de Indústria, Comércio e Turismo (SICTUR), the main tourism agency, and representatives of the AMCAM, support the decision-making.

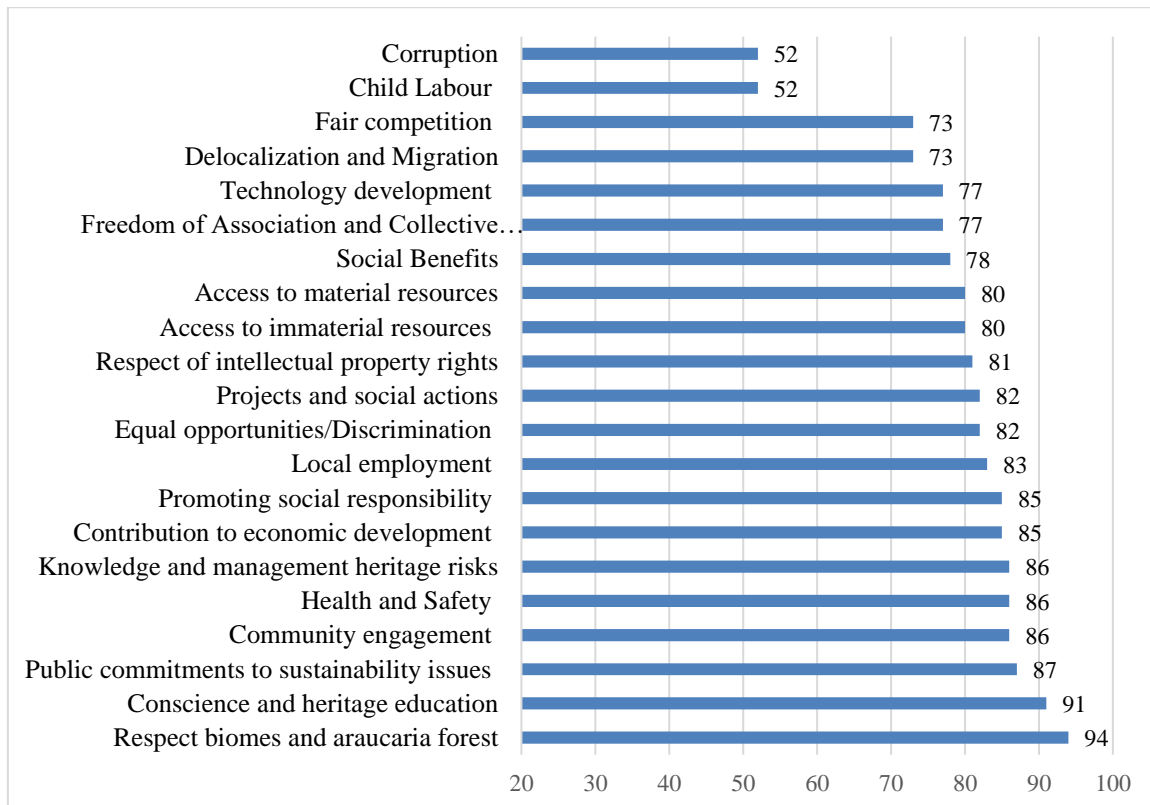
## 5.2 CLASSIFICATION OF SUBCATEGORIES

Regarding the subcategories, 21 items were classified, with a minimum score of 20 (not important) and a maximum of 100 (most important). Since all items scored above 50, all are considered important. The largest number reached a score above 80, showing that for the interviewees, most items are very important Fig. 11.

On a prioritization scale, *Respect biomes and Araucaria forest* and *Public commitments to sustainability issues* were the most important items. “Environmental problems must be considered as negative impacts on the preservation of the cultural landscape”. The invasion of native forests areas has been recurrent, with damage to the flora and fauna, warns the environment specialist. The old properties, some of which originated from the first immigrant families, are being subdivided. “Profit comes from the sale of the land, but the occupation has led to deforestation”. The creation of uncontrolled subdivisions, the advancement of real estate speculation and the recent Miringuava dam project have had negative impacts on historic sites. The lack of specific legislation to protect the Cultural Landscape and to encourage buildings restoration was highlighted by members of COMPAC.

Regarding *Conscience and heritage education*, *Knowledge and management heritage risks*, the valorization of culture through support for folk groups and existing events was pointed out as a relevant goal. The exploration of local products such as typical foods, with the creation of cafes and restaurants would boost trade and tourism once the use of historic wooden buildings is still low. In addition, there should be greater promotion of Cultural Heritage combined with already consolidated events. For example, the Rural Circuit of Murici, which is part of the ‘Caminhadas Internacionais na Natureza’, and ‘Festa da Colheita’ – traditional celebration of good harvest – which takes place annually in March with mass and typical activities. The interviewees also emphasize the need for democratic participation involving the community in decision-making and their dynamism as the opportunity to transmit knowledge and dignify local know-how. In this sense, it is essential to involve cultural promoters and schools in heritage and environmental education from elementary school to the elderly.

Figura 11 - Classification of impact subcategories.



Source: our elaboration.

In descending sequence follow the items *Community engagement, Projects and social actions, Promoting social responsibility*. Noteworthy is the lack of integration between members of the community and with the municipality secretariats, which is pointed out as one of the factors of negative impact on socioeconomic development. There is a need for an integrated management of the promotion of projects linked to social and cultural actions.

*Health and Safety, Local employment, Equal opportunities/Discrimination, Social Benefits* involve the most direct impacts on well-being, related to working conditions, health and safety of agricultural workers. There are few organic producers in the region, since several difficulties permeate this modality: high inputs cost, products distribution, lack of active cooperatives, and the still low demand for organics. An effort has been made to encourage the use of biological pesticides “a path for the development of organic agriculture in the region”, said a representative of the rural syndicate.

The specialists added subcategories: social criteria for hiring, cultural geographic perception, wage justice and gender equality. They highlighted the environmental heritage and the natural beauties: vegetation, rivers, trails and rural roads, and reinforced

the need to encourage agriculture without pesticides. Finally, they suggested the creation of a local brand emphasizing natural and cultural values.

### 5.3 PARANÁ PINE: A CULTURAL SYMBOL

The result of the three images inserted in the questionnaire, artistic-symbolic elements established in the past during the Paranista Movement, were identified by the specialists and community members.

The connection between nature and the symbolic value of Araucaria, in João Turin's drawings for the magazine *Illustration Paranaense*, was recognized by 70% of the interviewees. The State's coat of arms, by Romário Martins, was the best identified symbol as well as the icons associated with the pine and its seeds the "pinhão" designed by Lange de Morretes, which were recognized by 90% of the interviewees.

This demonstrates that the pine and the pinion images are consolidated as an identity element of Paraná, are strong symbols and are linked to the local cultural spirit. The names of these works authors, however, were identified by only 30%. A sign that knowledge of history and art must be reinforced.

## 6 CONCLUSION AND SUGGESTIONS

Sustainability is not a recent argument on the agenda of decision-makers, and for most involved stakeholders, recognizing the environmental, economic and social implications of current models is the first step for necessary changes.

The S-LCA technique has been presented through the growing number of annual publications from 2009 to 2019, mainly in the last three years, identified in several case study sectors in many countries. Researchers investigate the sustainability of social performance, proving that the assessment of materials life cycle, distribution and marketing should not be considered outside the context of human rights, but within health, well-being and safety, right work conditions, cultural heritage, governance and socioeconomic repercussions. These guarantee the development of traditional communities, especially those linked to family farming, such as the case study presented here.

This study highlight that the use of S-LCA methodology demonstrates that the participation of experts and community members is essential in stakeholders definition and in the recognition of impact subcategories. *Respecting biomes and the Araucaria forest* was the most relevant subcategory, highlighting the environmental dimension.

Demonstrates the concerning with the future of the forests and threat extinction of species. Araucaria is a natural Brazilian heritage, are consolidated as an identity element of Paraná and remains a cultural symbol in the specialists evaluation. The cultural dimension and the Cultural Heritage are decisive components, necessary indicators to establish goals and to monitor local development.

For future studies, we recommended to combine S-LCA with other methodologies such as LCC, LCA; to use LCSA in the approach of cultural values, to expand the analysis with the verification of variables from updated local data, view this information on maps, and include the cultural landscape indicator in the evaluations (Axelson et al., 2013; Pizzirani et al., 2014).

We conclude that the identification of the stakeholders involved in Cultural Heritage management is the first step towards efficient evaluation methodologies, and helps to understand social and cultural structures. However, the lack of social integration - *Community engagement* - is a point to overcome, since there is a communication lack between different sectors. In addition to the qualitative analysis, it is necessary to involve the municipal secretariats in obtaining data, and to integrate the various actors in the value chain, namely COMPAC, CMPDU, SICTUR, AMCAM, IPHAN and also Secretaria Municipal do Meio Ambiente (SEMMA); Secretaria Municipal de Urbanismo, Transporte e Trânsito (SEMUTT); Secretaria Municipal de Agricultura e Abastecimento (SEMAG); Secretaria Municipal de Cultura (SEMUC). These qualitative analysis will originate constant new information to decision-makers.

In conclusion, organizations should more actively promote the preservation of historic wooden buildings. Emphasizing economic dimension, making sustainable use of tourism-related products and services, which will increase the economy and generate new jobs. In addition, it should encourage handicrafts, folk and religious groups. It is necessary to give greater support to associations and family farming cooperatives, so that they develop their role and move towards environmentally friendly agriculture. These terms combined with heritage and environmental education will assist in the integration of the Cultural Landscape in the context of valuing local traditional goods and preserving them to future generations.

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## REFERENCES

- ABNT. NBR ISO 14040, 2009. Avaliação do Ciclo de Vida: Princípios e Estrutura, Associação Brasileira de Normas Técnicas.
- Alsamawi, A.; Murray, J.; Lenzen, M.; Moran, D.; Kanemoto, K., 2014. The Inequality Footprints of Nations: A Novel Approach to Quantitative Accounting of Income Inequality. PLoS One, Oct (9): 1-10.
- Axelsson, R.; Angelstam, P.; Degerman, E.; Teitelbaum, S.; Andersson, K.; Elbakidze, M.; Drotz, M. K., 2013. Social and cultural sustainability: criteria, indicators, verifier variables for measurement and maps for visualization to support planning. *Ambio* 42(2):215-228. <https://doi-org.ez22.periodicos.capes.gov.br/10.1007/s13280-012-0376-0>.
- Bellen, H. M., 2006. Indicadores de Sustentabilidade: Uma análise comparativa. FGV, Rio de Janeiro, 256 pp.
- Benoît, C.; Norris, G.A.; Valdivia, S.; Ciroth, A.; Moberg, A.; Bos, U.; Prakash, S.; Ugaya, C.; Beck, T., 2010. The guidelines for social life cycle assessment of products: just in time! *Int J Life Cycle Assess* 15(2):156-163. <https://doi.org/10.1007/s11367-009-0147-8>.
- Bernardo, J., 2013. Madeira e técnica: as edificações históricas da Colônia Murici. Ed. Autor, Curitiba, 168 pp.
- Blundo, D. S.; Ferrari, A. M.; Pini, M.; Riccardi, M. P.; García, J. F.; Hoyo F. del; Alfonso, P., 2014. The life cycle approach as an innovative methodology for the recovery and restoration of cultural heritage. *J. Cult. Herit.* 4 (2) (2014) 133-148. <https://doi.org/10.1016/j.culher.2018.01.008>
- Blundo, D. S.; Ferrari A. M.; Hoyo A. F. del; Riccardi, M. P.; Muiña, F. E. G., 2018. Improving sustainable cultural heritage restoration work through life cycle assessment based model. *J. Cult. Herit.*, (32):221-231. <https://doi.org/10.1016/j.culher.2018.01.008>.
- Camargo, G. V. L., 2007. Paranismo: arte, ideologia e relações sociais no Paraná (1853-1953). Doctoral thesis, Universidade Federal do Paraná UFPR.
- Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), 2020. (Accessed February 02, 2019) at: <https://www-periodicos-capes-gov-br.ez22.periodicos.capes.gov.br/>.
- Carvalho, J. P. G.; Bernardo, J. (orgs.), 2020. Exposição Remanescentes – Coletânea dos Aquarelistas do Ateliê.39. Casa da Cultura Pe. Karol Dworaczek, Colônia Murici SJP.
- Di Cesare, S. D; Silveri, F.; Sala, S.; Petti, L., 2018. Positive impacts in social life cycle assessment: state of the art and the way forward. *Int. J. Life Cycle Assess.*, (23): 406-421.
- Dudeque, L. T., 2001. Espirais de madeira: uma história da arquitetura de Curitiba, Estúdio Nobel: FAPESP, São Paulo 437 pp.

Elkington, J., 1998. Partnerships from cannibals with forks: The triple bottom line of 21st Century business. *Environmental Quality Management*, 8(1): 37-51.

Gil-Martín, L.M.; González-López, M.J.; Grindlay, A.L.; Segura-Naya, A.; Aschheim, M. A.; Hernández-Montes, E., 2012. Toward the production of future heritage structures: Considering durability in building performance and sustainability – A philosophical and historical overview. *Int. J. of Sustainable Built. Environment*, 1(2):269-273.

Hawkes, J., 2001. The fourth pillar of sustainability: culture's essential role in public planning. Cultural Development Network (Vic), Common Ground P/L, Melbourne.

Imaguire, Jr K.; Imaguire, M. R. G., 2011. A Casa de Araucária. (A casa de araucária: arquitetura da madeira em Curitiba; 1). Instituto Arquibrasil, Curitiba 102 pp.

Instituto do Patrimônio Histórico e Artístico Nacional, 2009. Paisagem Cultural, IPHAN, Brasília. (Accessed March 03, 2019) at:

[http://portal.iphan.gov.br/uploads/ckfinder/arquivos/Livreto\\_paisagem\\_cultural.pdf](http://portal.iphan.gov.br/uploads/ckfinder/arquivos/Livreto_paisagem_cultural.pdf).

Jørgensen A, Herrmann IT, Mortensen JB, 2010. Is LCC relevant in a sustainability assessment? Letter to the editor. *Int J Life Cycle Assess* 15(6):531–532 <https://doi.org/10.1007/s11367-010-0185-2>

Khorassani, S. M.; Ferrari, A. M.; Pini, M.; Blundo, D. S.; Muiña, F. E. G.; García, J. F., 2019. Environmental and social impact assessment of cultural heritage restoration and its application to the Uncastillo Fortress. *Int. J. Life Cycle Assess.* (24): 1297-1318. <https://doi-org.ez22.periodicos.capes.gov.br/10.1007/s11367-018-1493-1>.

Lehman, G., 1999. Disclosing new worlds: A role for social and environmental accounting and auditing. *Accounting, Organizations and Society*, (24):217-241.

Lobo, J. L., 2012. História e iconologia: conteúdo nas artes visuais. *Revista Direito e Práxis* 3 (5):110-138 DOI 10.12957/dep.2012.3797

Marochi, M. A., 2006. Imigrantes 1870 -1950: Os europeus em São José dos Pinhais. Travessa dos Editores, Curitiba, 323 pp.

Nadalin, S., 2001. O. Paraná: ocupação do território, população e migrações, SEED, Curitiba.

Njoka, J.; Kabugi, J.; Wilshaw, R.; Arnesen, M. et al., 2013. Exploring the links between international business and poverty reduction: Bouquets and beans from Kenya. Oxfam International, May: 1-26. DOI: 10.13140/RG.2.2.25979.44321.

Pereira, L.F.L., 1996. Paranismo: Cultura e imaginário no Paraná da I República. Dissertation, UFPR, Curitiba, 276 pp.

Pizzirani, S.; McLaren, S. J.; Seadon, J. K., 2014. Is there a place for culture in life cycle sustainability assessment? *Int J Life Cycle Assess* 19(6): 1316-1330 <https://doi-org.ez22.periodicos.capes.gov.br/10.1007/s11367-014-0722-5>.



Pizzirani, S.; McLaren, S. J.; Forster, M. E.; Pohatu, P.; Porou, TTW.; Warmenhoven, T. A., 2018. The distinctive recognition of culture within LCSA: realising the quadruple bottom line. *Int. J. Life Cycle Assess.* (23): 663-682. <https://doi-org.ez22.periodicos.capes.gov.br/10.1007/s11367-016-1193-7>

Rössler, M., 2003. Linking nature and culture: World Heritage cultural landscapes, In M. Rössler (ed.), *Cultural Landscapes*, United Nations Educational, Scientific and Cultural Organization (UNESCO), (7):10-15.

Rössler, M., 2012. Partners in site management. A shift in focus: heritage and community involvement. *World heritage*, United Nations Educational, Scientific and Cultural Organization (UNESCO), May (31):27-31.

Semenzin, E.; Giubilato, E.; Badetti, E.; Picone, M.; Ghirardini, A. V.; Hristozov, D.; Brunelli, A.; Marcomini, A., 2019. Guiding the development of sustainable nano-enabled products for the conservation of works of art: proposal for a framework implementing the Safe by Design concept. *Environ. Sci. Pollut. Res.*, (26): 26146-26158. <https://doi-org.ez22.periodicos.capes.gov.br/10.1007/s11356-019-05819-2>.

Silva, C. L. (Org.), 2008. *Desenvolvimento sustentável: um modelo analítico integrado e adaptativo*, Vozes, Petrópolis, v.1 176 pp.

Turbanski, S., 1978. *Murici - terra nossa*, Gráfica Vicentina, Curitiba, 244 pp.

UNEP, SETAC, 2009. *Guidelines for Social Life Cycle Assessment of Products – Lifecycle Initiative*. United Nations Environment Programme (UNEP), and Society of Environmental Toxicology and Chemistry (SETAC), Belgium.

UNEP, SETAC, 2013. *The Methodological Sheets for Subcategories in Social Life Cycle Assessment (S-LCA) Lifecycle Initiative*. United Nations Environment Programme (UNEP) and Society of Environmental Toxicology and Chemistry (SETAC).

UNEP, SETAC, 2020. *Guidelines for Social Life Cycle Assessment of Products and Organizations – Lifecycle Initiative*. United Nations Environment Programme (UNEP), and Society of Environmental Toxicology and Chemistry (SETAC), Belgium.

United Nations Educational, Scientific and Cultural Organization. *World Heritage in Brazil*(UNESCO), (Accessed March 05, 2022) at:<https://en.unesco.org/fieldoffice/brasil/expertise/world-heritage-brazil>.

Venkatesh, G., 2019. Critique of selected peerreviewed publications on applied social life cycle assessment: focus on cases from developing countries. *Clean Technologies and Environmental Policy*, 21 (2):413-430. <https://doi.org/10.1007/s10098-018-1644-x>.

Wachowicz, R. C., 1970. *Conjuntura emigratória polonesa no século XIX*. In: *Comunidade Brasileiro-Polonesa. Anais da...* (1) Imprimax, Curitiba.

Weimer, W., 2005. *Arquitetura popular da imigração alemã*, 2. ed., Ed. da UFRGS, Porto Alegre 296 pp.

## ANEXOS

# Attachment 1

**Patrimônio Cultural da Colônia Murici**

**Missão:**  
**Assegurar sua sobrevivência**

- Avaliação do ciclo de vida social (ACV-S) é uma técnica que visa avaliar os aspectos socioeconômicos e impactos dos produtos ao longo do ciclo de vida, considerando potenciais pontos críticos, a saber: direitos humanos, condições de trabalho, patrimônio cultural, pobreza, doença, conflitos políticos, etc.
- As diretrizes para a abordagem da ACV-S envolvem cinco categorias de grupos de interesse (comunidade local, sociedade, trabalhadores, consumidores e atores da cadeia de valor), subcategorias de impacto e indicadores correspondentes (UNEP e SETAC, 2009).

**Convidamos para uma reflexão sobre os grupos de interesses/subcategorias e indicadores, e solicitamos o preenchimento dos campos destacados conforme sua experiência e conhecimento:**

Página 1 – Em destaque, para relembrá-lo, seguem alguns itens do Patrimônio da Colônia Murici.  
Página 2 – Responder sobre os grupos de interesse  
Página 3 – Responder sobre os indicadores  
\*Suas respostas são essências para o êxito do estudo!\*

**1**

**Paisagem Cultural**

“Caracteriza-se por uma porção peculiar do território nacional, representativa do processo de interação do homem com o meio natural, à qual a vida e a ciência humana imprimiram marcas ou atribuíram valores” (IPHAN, 2009).



**2**

**Patrimônio Cultural e Natural**  
Instituto do Patrimônio Histórico e Artístico Nacional-IPHAN

**NATURAL** → Paisagem Cultural → *Araucaria angustifolia*

**CULTURAL** { MATERIAL → Arquitetura de madeira  
IMATERIAL → Técnicas construtivas "Saber fazer"



**3**

