

**Socio-environmental vulnerability as a consequence of urban problems  
in Brazil: An overview**

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## **ABSTRACT**

The expansion of human occupation over the limits of cities leads to the depletion of infrastructure, impacts on its dynamics and imposes mobility difficulties. This type of territorial occupation results in urbanization patterns that undermine equity, efficiency and the continuity of the city as a support for social life. Therefore, this article aims to reflect on the importance of socio-environmental vulnerability in territorial planning and its use to guarantee the social function of the city. In order to reach the objective, an integrative review was used using the following questions: What approaches have guided the approaches to socio-environmental vulnerability in undergraduate and graduate courses? What are the methodologies for applying socio-environmental vulnerability that can be identified in the publications? For the selection of articles, the Scientific Electronic Library Online (SCIELO) database was used. It can be seen that research on socio-environmental vulnerability has contributed satisfactorily to the importance of this topic in Brazil, which allows progress through the use of new techniques and tools, which enabled a favorable diagnosis of socio-environmental vulnerability factors in the country. Brazilian context. However, it was found that in Brazil there is great potential to make a qualitative leap in several areas, including the issue of territorial planning, which should associate measures of an ethical, social, economic and environmental nature that carry out the maximum of Brazilian environmental legislation. With regard to land use and occupation, there is still a lack of awareness for an orderly, balanced and fair occupation.

**KEYWORDS:** Social fragility. Ambiental degradation. Urbanization.

## **INTRODUCTION**

Urban production actions are reaching worrying thresholds in the largest Brazilian cities. These thresholds highlight risks to the very functioning of cities. As in a cascading effect, the excessive density of intra-urban areas induces peripheral dispersion. The expansion of human occupation over the limits of cities leads to the depletion of infrastructure, impacts on its dynamics and imposes mobility difficulties. This type of territorial occupation sometimes results in urbanization patterns that undermine equity, efficiency and the continuity of the city as a support for social life (RIBEIRO, 2014).

In addition, in peripheral countries, it is notable that urban growth has not followed economic growth, favoring the emergence of cities with major deficiencies in equipment, jobs, services and marked environmental degradation (RIBEIRO; MENDES, 2015).

For Jacobi (1995), there is a direct relationship between exposure to environmental risks and precarious access to public services. The very absence of urban infrastructure (water, sewage, garbage collection, channeling of streams, etc.) exposes the populations residing in these areas to environmental risks, such as waterborne diseases, showing that there is a tendency for groups of low-income residents live in areas with poor urban and sanitary conditions, in situations of risk and environmental degradation. The most common explanation is that these areas are the only ones accessible to the poorest population, either because they are public, preservation or peripheral areas, or because they are undervalued regions in the real estate market, due to risk characteristics and lack of urban infrastructure (JACOBI, 1995; 2006; SOUZA, 2006).

For Corrêa (2001), environmental degradation is related to urban segregation, which is considered the representation or spatial and geographic (re)production of social segregation, being almost always related to the process of division and class struggle, in which the population the poorest tend to live in areas that are further away and less accessible to large economic

centers. These segregated spaces, moreover, tend to have a low availability of infrastructure, such as paving, basic sanitation, leisure spaces, among others.

For Almeida (2010) the omnipresence of risk is undeniable. With the human presence, the risk does not cease to exist (there is no “zero risk”), it just varies in time and space. Risk is an eminently social construct, that is, it is a human perception, which varies by an individual or group of individuals of the probability of occurrence of a potentially dangerous and harm-causing event, whose consequences are a function of intrinsic vulnerability.

Thus, according to Maier (2014), urban socio-environmental vulnerability is also linked to the phenomena of population density, urban spatial segregation, processes of social exclusion and environmental injustices, processes directly linked to population growth and the lack of policies effective public.

Hence the notion of vulnerability is generally defined as a situation in which three basic components are present: exposure to risk, inability to respond to an adverse event and difficulty in adapting to the materialization of risk (MOSER, 1998). At the same time that in the territorial planning of the urban environment, it is necessary to consider natural factors, such as relief, climate, soil, vegetation and water courses, because when spaces are not designed to be adequate to these factors, they can interfere significantly in the environmental quality of cities.

According to Santos (2005), the city itself, as a social relationship and as materiality, becomes a creator of poverty, both because of the socioeconomic model, which it supports, and because of its physical structure, which makes the inhabitants of the periphery (and the tenements) even poorer people. Poverty is not just the fact of the current socioeconomic model, nor just a phenomenon inscribed in the nature of things, but a product of precise social processes of deposition of land, work instruments, the means that allow the reproduction of the conditions of existence; disciplining bodies and mentalities; and, exploitation of the workforce for goods and wealth that are appropriated by others. This model, “roughly speaking”, is one of the central drivers of the production of social inequality and, consequently, of poverty, its most visible effect (ASCELRAD, 2009).

Thus, this development model shows that neither the problems nor the environmental amenities are random, much less the distribution to the population, as some social groups are more vulnerable, subjected to greater burdens of the environmental consequences of economic activities.

In this context, how can socio-environmental vulnerability contribute to better territorial planning? Are the spaces of social vulnerability interrelated with those of environmental risks? Given the above, the objective is to reflect on the importance of socio-environmental vulnerability in territorial planning and its use to guarantee the social function of the city through an integrative review.

The relevance of this study consists in the production and reflection of theoretical knowledge for environmentalists, geographers, teachers, academics and researchers about the use of socio-environmental vulnerability as an instrument of sustainable development for the city.

## **METHODOLOGY**

For the elaboration of this integrative review, the steps described by Mendes, Silveira and Galvão (2008) were followed, which are: the establishment of the questions and objectives of the integrative review; establishment of inclusion and exclusion criteria for articles (sample selection); definition of the information to be extracted from the selected articles; analysis of results; discussion and presentation of the results and the last step consisted of the presentation of the review.

Thus, to guide the integrative review, the following questions were formulated: What approaches have guided the approaches to socio-environmental vulnerability in undergraduate and graduate courses? What methodologies for applying socio-environmental vulnerability can be identified in the publications?

For the selection of articles, the Scientific Electronic Library Online (SCIELO) database was used. Thus, an attempt was made to expand the scope of the research, minimizing possible biases at this stage of the integrative review elaboration process.

The inclusion criteria of the defined articles were: articles published in the selected database, articles available in full online, articles that meet the descriptors and study questions. As exclusion criteria: articles available only in abstract and articles that do not meet the study's questions.

Due to the specific characteristics for accessing the selected database, the strategy used to locate the articles was adapted, having as a guideline the question and the inclusion criteria of the integrative review, previously established to maintain coherence in the search for articles and avoid possible biases.

To survey the articles in the databases, the controlled descriptors were used: socio-environmental vulnerability, risk, environmental degradation and territorial planning. The search was performed through online access, using the descriptors in Portuguese and the three inclusion criteria. The final sample of this integrative review consisted of 05 articles.

To collect data from the articles that were included in the integrative review, an instrument was developed, which includes the following items: identification of the article, methodological characteristics of the study, objectives or research questions, results and implications. The articles received denominations by number, being art. 1, art. 2 and so on. Table 1 provides a summary of the articles analyzed (APPENDIX A).

The presentation of the results and discussion of the data obtained was done in a descriptive way, allowing the reader to evaluate the applicability of the integrative review elaborated, in order to achieve the objective of this method, that is, to positively impact the quality of the practice of socio-environmental vulnerability, providing subsidies for teaching and everyday practice.

## **RESULTS AND DISCUSSION**

Article 01, "Assessment of Brazilian methodologies of socio-environmental vulnerability as a result of urban problems in Brazil" (MAIOR; CÂNDIDO, 2014), intends to reflect and analyze the main socio-environmental vulnerability assessment methodologies proposed and applied in specific contexts in Brazil, through of a theoretical-comparative essay using a set of evaluation criteria taken from the variables existing in the various models researched.

In this context, Maior (2014) emphasizes that the concern of studies that involve socio-environmental vulnerability, in an urban Latin American context, is to offer a panel on the socio-environmental factors that influence and are influenced by the establishment of the poor population in risk areas, the which can cause damage. Thus, in the Brazilian context, since the last century, there has been an urban demographic increase that has direct consequences on the structuring and order of the main Brazilian cities, deregulating the socio-environmental system, exposing the urban population to vulnerability, especially in central areas of preservation or in peripheral areas, where environmental risk factors become disastrous in the face of the socioeconomic instability of the poor population.

As for the results obtained, it was found that all models use the same methodological procedure, based on data from the Brazilian Institute of Geography and Statistics (IBGE) and the cartographic overlap of environmental risks with social risks distributed in the urban space studied, using the multivariate analysis.

Faced with the new profile of contemporary society, environmental problems are anchored in economic and social values. In this sense, Sheng (2001) emphasizes that economic values are related to social values, as a subset. Even if the economic values that dictate the activities performed by the human being, it is the social values that determine the representative and critical attitudes towards the solution of the problems. Therefore, it is up to society to discuss and internalize environmental issues as a vital factor in the permanence of beings on Earth so that the process of maturation and improvement of policies in favor of improving environmental quality becomes more accelerated.

In this article, it was concluded that there is a need to improve the environmental dimension, treated superficially in the analyzed studies, and the incorporation of other variables to encompass other dimensions not contemplated in these five models studied. Regarding environmental variables, Maior (2014) considers the need for relevance to indicators related to the exposure of natural risks existing in urban spaces in Brazil, such as floods, landslides, landslides, windstorms, hailstorms and cyclones. On the other hand, the study focused on a single dimension of environmental risk, such as those studied by Alves (2006) and Almeida (2010), disregard the existence of other threats that may occur in the same geographical context, and, even worse, in a period time, which would lead to greater vulnerability.

Article 02, "Methodology for Mapping Social and Environmental Vulnerability: Case of the Municipality of Caucaia, State of Ceará" (MEDEIROS; SOUZA, 2016), was carried out through an integrated analysis of data, using geoprocessing tools, of vulnerability maps environmental and social areas with high socio-environmental vulnerability were identified, with the objective of developing a methodology that makes it possible to map this phenomenon, having as a case study the municipality of Caucaia, State of Ceará.

According to Medeiros (2014), there is a worldwide trend of population agglomeration in urban areas due to the accelerated urbanization process that has occurred in recent decades. In the case of Brazil, the demographic transition from rural to urban areas has promoted profound changes in the distribution of people in the territory.

In Article 02, it was found that vulnerability corresponds to a set of processes and conditions resulting from environmental, biological, social, economic and political factors that increase susceptibility to the impact of a given risk. In this analysis bias, it is mentioned that

social vulnerability stems from phenomena, with different causes and consequences, which can unequally affect the population residing in a given place.

In this way, Penna and Ferreira (2014) define vulnerability as a social risk, characterized by the concentration of precariousness (or lack) of collective services and public investments in infrastructure (assets and opportunity structures), which, therefore, in this way, they cause the social lack of protection of the most needy communities. Vulnerability may or may not be associated with environmental risks, such as, for example, dwellings located in high-slope areas (danger of landslides and burying of people and dwellings) or subject to flooding.

It can be concluded in this article that, in relation to environmental vulnerability, it refers to the integrated set of environmental factors (ecological and biological) that, in the face of human activities, occurring or that may manifest, it can undergo changes affecting, totally or partially, the ecological stability of a place.

Therefore, environmental vulnerability can be understood from the analysis of the ecodynamic characteristics of environmental systems, also relating to the ability of the physical environment to respond to the adverse effects caused by anthropogenic actions (SOUZA, 2000; TAGLIANI, 2002; SANTOS; CALDEYRO, 2007) . In turn, socio-environmental vulnerability brings together environmental and social vulnerability simultaneously, materializing in a certain territory in a given time frame (DESCHAMPS, 2004).

Article 03, "Socio-environmental vulnerability, disaster risk reduction and building resilience – lessons from the earthquake in Haiti and from the heavy rains in the Serrana Region, Brazil" (FREITAS et al., 2012) of a bibliographic nature aims through a contribution from conceptual nature and examples of disasters in countries with different levels of development, the earthquake in Haiti and the heavy rains in the Serrana Region (Rio de Janeiro, Brazil), demonstrate how socio-environmental vulnerability creates conditions for disasters, while at the same time limits strategies for prevention and mitigation.

Freitas et al. (2012) emphasize that disaster risks are socially constituted through processes that are structured in the dynamics of economic and social development, as well as social and environmental protection. And it is on these processes that the concepts and practices that constitute the bases for disaster risk reduction and socio-environmental vulnerability, as well as for the construction of resilience, must be based.

In Article 03, it was found that despite the practical difficulties of applicability, the purpose of socio-environmental vulnerability has been confirmed as a way to contribute to the reduction of disaster risks, and should combine a set of policies that prevent the occurrence and limit (mitigation and preparedness) the consequences (loss and damage) arising from disasters.

It was concluded that socio-environmental vulnerability is a central aspect for understanding disasters, and it cannot be disregarded that risk reduction and resilience capacities cannot be decontextualized from the processes that generate them. Thus, for Freitas et al. (2012), the issue of developing skills and strengthening capacities to become resilient involves changes in patterns, from cognitive patterns (the way in which the world around us and its events are interpreted) to policies and actions that result in macro social determinants. , economic and environmental aspects that result not only in the basic aspects of living, but also in access to work, income, food, education, health, housing, environmental sanitation, among others, as well as where one lives and works, such as the use and land occupation, and

environmental management and appropriation of natural resources, articulated and integrated with systemic policies oriented towards ecological sustainability and social justice as pillars of sustainable development.

Article 04, "Socio-environmental vulnerability, floods and health repercussions in peripheral regions: the case of Alagoas, Brazil" (FREIRE; BONFIM; NATENZON, 2014) was built through research in the Scielo and Medline database, books, dissertations and theses. In addition, articles published in the local and national press about floods in Alagoas were raised and analyzed. For data collection, a visit was also made to the Santa Fé Prison Colony, located in the municipality of União dos Palmares, Alagoas, where part of the population affected by floods is sheltered. as a case study the floods that occurred in the State of Alagoas, Brazil, in 2010.

According to Freire, Bonfim and Natenzon (2014), global population growth, poverty, land scarcity and urbanization in different countries have increased the number of people living in disaster-prone areas. In association with climate change, such facts have caused an increase in the occurrence of disasters triggered and intensified by extreme events. In recent years, floods have increased in frequency and intensity in urban centers, whether due to natural conditions or human activities through deforestation, soil degradation, urbanization and inefficient urban drainage.

From this perspective, disasters result from an adverse event, natural or caused by human action, on a vulnerable ecosystem, causing human, material and environmental damage and consequent economic and social losses. Therefore, disaster involves natural hazards and vulnerability.

It was found, in Article 04, that the connection of the concept of vulnerability with collective health demonstrates that, in conditions of vulnerability, not only are the risks of suffering diseases, injuries and deaths from disasters greater, but that their effects go to in addition to the immediate ones (deaths and diseases), extending over time and chronicling precarious living and health conditions. In the future, floods will present a greater frequency, intensity and severity. Therefore, health action should take place in prevention, care and monitoring strategies for geographic areas with greater exposure to natural hazards, associated with occupation by populations with greater social vulnerability.

It is worth noting that vulnerability results, among other things, from precarious living conditions. Even among the vulnerable, there are some groups that become even more vulnerable, experiencing a situation of chronification of the disaster, perpetuating the vicious cycle of poverty and precarious living conditions, with no possibility of change.

In this case study, the concepts of disaster risk and its association with social vulnerability were problematized, as well as the pertinence with the historical and social framework of Alagoas, in addition to showing that it is possible to prevent and mitigate disasters by adopting measures that avoid impacts negative effects on the population, on goods, services and, of course, on the environment.

Article 05, "Socio-environmental vulnerability index: a methodological proposal using the case of Rio de Janeiro, Brazil" (MALTA; COSTA; MAGRINI, 2017) was a study carried out by bibliographic research with the objective of identifying, characterizing and analyzing populations in socio-environmental vulnerability situation in the city of Rio de Janeiro, consolidating social,

economic, environmental, health and public safety indicators, in a synthesis index – the Socio-environmental Vulnerability Index.

In this context, Malta, Costa and Magrini (2017) emphasize that the term vulnerability has become a keyword in studies on environmental risk and climate change. At the same time, this may be one of the reasons for its growing popularity. In this context, it highlights the different definitions of vulnerability that have emerged and are used in different disciplinary contexts, and which are related to sustainability, natural and environmental risks, in addition to the context of climate change, both in social and economic areas.

In this article, it was found that the issue of vulnerability is complex and that each situation, vulnerable population or region has a need for specific information, and for this reason there are several indices, each one developed for a certain reality, with different objectives and uses.

In this way, the objective of the present study is to identify, characterize and analyze populations in situations of socio-environmental vulnerability, through the construction of a representative index of social, economic, urban infrastructure, environmental, health and safety variables public.

It was concluded, then, that the present article hopes to contribute, in a satisfactory way, with subsidies to support the formulation and implementation of public policies, since for these actions it is essential to spatially locate the areas that concentrate the most vulnerable population segments in the dimensions considered.

## **FINAL CONSIDERATIONS**

The five articles analyzed contributed satisfactorily to the importance of studies on socio-environmental vulnerability in Brazil, which allows progress through the use of new techniques and tools, which enabled a favorable diagnosis of the factors that favor socio-environmental vulnerability in the Brazilian context. , in each territorial and temporal specificity considered.

There is an evolution in the importance of the theme, not only for the environment as an intrinsic factor, but also for the economic development of the country as it traverses the various paths that follow territorial planning. In order to promote a better quality of life and the environment, socio-environmental vulnerability is established as a guideline for the performance of economic activities, in addition to establishing parameters for developmental relations in the social and environmental field, the economy and natural resources that have become fundamental factors. to enable, or not, the implementation of enterprises and the development of the city.

Socio-environmental vulnerability is considered an instrument capable of promoting the application of sustainable measures in line with the country's socioeconomic development. From this perspective, it is possible to use socio-environmental vulnerability for better territorial planning and environmental management of the city's territory. Through mapping of social and environmental indices, it becomes possible to identify the relationships between the distribution of space and socio-environmental problems in cities, providing a view of the spatial distribution of vulnerabilities. Such mapping makes it possible for the government to act



coherently with the propositions of sustainability, given that environmental diagnoses and mitigation and/or compensation programs, when prepared with ethical, social and environmental commitment, are the tools that permeate the balance between human actions and the conservation of the environment.

Based on art. 225 of the Federal Constitution, it is concluded that the foundation for the human being to have the right to an ecologically balanced environment, a good for common use by the people and essential to a healthy quality of life, environmental ethics is necessary as an instrument of reflection on the position of the human being as a qualified and privileged occupant of the environment. It is not possible to transform natural, environmental and social resources into property owned by a single group in the direction of public affairs (BRASIL, 1998).

Even if there are unethical postures and dubious processes in the course of actions that order the socio-environmental development of the city, the growth of Brazilian environmental policies that are constantly on the rise for the best performance of sustainability practices is of great importance. Another positive point that vulnerability places within the socio-environmental scenario is the principle of co-responsibility, which invites social actors to take decisions and postures that turn, even if indirectly, to social and environmental development.

Theoretical mechanisms for socio-environmental vulnerability are available to society. Among these mechanisms, the formulation of indices proves to be efficient in the search for the protection and preservation of the environment and in the improvement of mechanisms for defining priorities in public policies.

It is worth noting that environmental problems arise when there is a lack of socio-environmental commitment in the spheres that compete with the power of action, that is, environmental agencies, society as a whole, and entrepreneurs. When they are driven by the profits of the activities, they exclusively allow economic values to prevail in decision-making, allowing actions that do not always contemplate the environment with all its value. As environmental legislation is still permissive and fragmented, it becomes possible for actions to be implemented legally, within the legal scope, but which do not meet environmental ethical principles.

It appears that in Brazil there is great potential to make a qualitative leap in several areas, including the issue of territorial planning, which should associate measures of an ethical, social, economic and environmental nature that achieve the maximum of Brazilian environmental legislation. However, with regard to land use and occupation, there is still a lack of awareness for an orderly, balanced and fair occupation.

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**APPENDIX A - Summary table of analyzed articles**

NUMBER	TITLE	AUTHORS	OBJECTIVE	METHODOLOGY	RESULTS	CONCLUSION
01	Evaluation of Brazilian methodologies of socio-environmental vulnerability as a result of the urban problem in Brazil.	M.M.S. Maior / G.A. Cândido	Reflect and analyze the main methodologies for assessing socio-environmental vulnerability proposed and applied in specific contexts in Brazil.	It was carried out through a theoretical-comparative test using a set of evaluation criteria taken from the variables existing in the different models researched from different methodologies of vulnerability study.	The results indicate that the models contributed to the advancement of studies on socio-environmental vulnerability in Brazil, enabling an accurate diagnosis of the factors that contribute to accentuating and mitigating the phenomenon.	It was found that the study models were of great importance to serve as a basis for studies of socio-environmental vulnerability in Brazil. However, constant adaptations of the methodologies created are necessary, as well as the creation of new technologies that can reliably translate the dynamics and complexity of urbanization, especially for the most needy communities.
02	Methodology for mapping socio-environmental vulnerability: case of the Municipality of Caucaia, State of Ciera	C.N. Medeiros/ M.J.N. Souza	Develop a methodology that makes it possible to map socio-environmental vulnerability, taking the municipality of Caucaia as a case study.	An integrated analysis was carried out using geoprocessing tools for environmental and social vulnerability maps, making it possible to identify areas with high socio-environmental vulnerability.	Areas with high socio-environmental vulnerability were identified. These areas are mostly occupied irregularly, in places of high environmental vulnerability by the population in an unfavorable situation in terms of per capita income, education and housing.	The mapping of socio-environmental vulnerability in order to contribute to the planning of actions that lead to sustainable development, effectively subsidizing the process of territorial planning in the municipality of Caucaia.
03	Socio-environmental vulnerability, disaster risk reduction and building resilience – lessons from the earthquake in Haiti and heavy rains in the mountainous region of Brazil.	C.M. Freitas/ M.L. Carvalho/ E.F. Ximenes/ E.F. Arraes/ J.O. Gomes	Contribute in a conceptual way, through examples of disasters in countries with different levels of development, such as the earthquake in Haiti and heavy rains in the Serrana Region (Rio de Janeiro, Brazil), demonstrating how socio-environmental vulnerability creates conditions for disasters at the same time. While limiting strategies for prevention and mitigation.	Bibliographic research	Some of the disasters that the construction of resilience require in contexts of socio-environmental vulnerability are pointed out, which include changes in social, economic and environmental development patterns oriented towards ecological sustainability and social justice as pillars for sustainable development.	It concludes that disaster risks constitute the dynamics of economic and social development, as well as social and environmental protection, which must be based on the concepts and practices that constitute the bases for disaster risk reduction and socio-environmental sustainability, as well as for building resilience.
04	Socio-environmental vulnerability, floods and health repercussions in peripheral regions: the case of Alagoas, Brazil	N.C.F. Freire/ C.V. Bonfim/ C.E. Natenzon	To analyze the socio-environmental vulnerability of populations affected by disasters, adopting as a case study the floods that occurred in the State of Alagoas, Brazil	Search the Scielo and Medline database, books, dissertations and theses. In addition, articles published in the local and national press about these floods were raised and analyzed. A visit was also made to the Boa Fé Prison Colony located in the Municipality of União dos Palmares (AL).	It was concluded that vulnerability results, among other things, from the precarious living conditions of the population. And that even the vulnerable, there are some groups that become more vulnerable, experiencing without the possibility of changing a situation of cornification of the disaster, of perpetuating the vicious cycle of poverty and precarious living conditions.	The case study served to problematize the concepts of risks and disasters and their association with social vulnerability, as well as the pertinence with the historical and social framework of Alagoas.
05	Socio-environmental vulnerability index: a methodological proposal using the case of Rio de Janeiro, Brazil.	F.S. Malta/ E.M. Costa/ A. Magrini	Identify, characterize and analyze populations in situations of socio-environmental vulnerability in the Municipality of Rio de Janeiro, consolidating social, economic, environmental, health and public safety indicators, in a synthesis index - The socio-environmental vulnerability index.	It was based on multicriteria analysis of decision support integrated to a Geographic Information System. The data sources used were the IBGE Demographic Census - 2010, Fundação Geo-Rio and Instituto de Segurança Pública do Estado do Rio de Janeiro.	The results demonstrate that socio-environmental vulnerability in Rio de Janeiro is aggravated by situations of risk and environmental degradation. These aspects are accentuated by the densification of slum areas, where the most vulnerable strata reside, in a process of environmental and urban exclusion.	The study allows spatially locating more vulnerable areas, emphasizing the importance of these tools to guide resource allocation, formulation and implementation of more adequate public policies.

Source: Prepared and organized by the authors, 2021.