Resilience of key buildings in Hamedan against floods using LISREL structural equation modeling

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Introduction

Urban floods have been exacerbated by climate change and urbanization, as well as restrictions on the drainage of urban infrastructure, and over the past decade have had many negative effects on cities around the world [4]. As a result, the demand for more resilience has not been successful in many cases [2]. Accordingly, the resilience of key urban buildings is one of the necessities of urban resilience [3]. In this regard, research on urban resilience in events such as floods was reviewed, some of the most important of which are mentioned below. In 2019, Wang and colleagues evaluated the resilience of the urban basin to floods, and the CADDIES model was used to simulate floods .Based on the results, vulnerable basins were identified and strategies were developed to increase the city's resilience to floods [4]. In 2019, Barajas et al. worked on an article on the resilience of urban buildings in the face of flood risk in the Mexican metropolitan area, and addressed the resilience of buildings in Mexico City during the floods of recent decades. Findings show that building resilience is a complex and sequential process that of course depends on social, economic and institutional conditions [1].

Research Methods

In this research, in order to achieve the model of resilience of important buildings against floods, data analysis is performed in several stages, which include the following:

1- Identification of significant assets
2- Modeling river flow using HecRAS software
3- Adaptation of assets and modeling results from rivers in different return periods

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4- Counting assets affected by floods

5- Modeling of building resilience components using structural equation modeling of LISREL software

6-Counting and ranking the components extracted from the model using AHP-TOPSIS combined method

7- Ranking of key buildings affected by floods using AHP-TOPSIS combined method

Discussion and conclusion

The asset layers of the city of Hamedan and the rivers of the city have been adapted in the GIS context and five buildings of the University of Technology, the Faculty of Art and Architecture, Payam-e Noor University, the Blood Transfusion Building and the Amiran Hotel have been identified as vulnerable centers of Hamedan.

Conclusion

Components (adaptability-flexibility, connection of failure-safe feedback, dependence on environmental ecosystems, diversity, learning-memory-prediction, performance, response speed, fragmentation redundancy, resourcefulness, and robustness) are effective variables on flood resilience of buildings. In testing the hypothesis using the structural equation model, the software output indicates the suitability of the fitted structural model to test the research hypotheses.

Weighting indicators

Weight	Sub-components of resilience	Resilience components
0.049	Change while maintaining or improving performance	Compatibility - Flexibility
0.045	Evolution	
0.05	Adopt alternative strategies quickly	
0.027	Timely response to changing circumstances	
0.049	Open design and flexible structures	
0.007	Shock absorption	Connection - Feedback - Safety - Failure
0.012	Absorb the cumulative effects of challenges with a slow start	
0.007	Avoid catastrophic failure if you exceed the threshold	
0.013	Gradual failure instead of sudden	
0.024	Failure without cascading effects (demino effect(	
0.005	Parallel analysis of technology system - human	
0.014	Identify locking effects and possible discrepancies with reduction	
0.015	Identify synergies with other city policies, value added estimation	
0.012	Flood control	Dependence on local ecosystems
0.006	Bioclimatic design and management	

Weight	Sub-components of resilience	Resilience components
0.0146	Spatial diversity - key assets and tasks that are physically distributed and not all of them are affected by a specific event at any time	Variety
0.021	Functional Diversity - Multiple methods of dealing with a particular need	
0.013	Balance variation with potential cascading effects	
0.003	Learn from past experiences and failures	Learning-Memory - Prediction
0.003	Use information and experience to create fresh compatibility	
0.005	Avoid repeating past mistakes	
0.009	Collect, store, and share experiences	
0.007	Construction based on long-term value and city history	
0.02	Integrate resilience into long-term development scenarios	
0.056	Performance capacity	Function
0.013	System quality in a suitable and efficient way	
0.019	Self-sufficiency - reducing external dependence	
0.039	It performs better than other buildings	
0.007	In taking casualties, including mortality and disease	Response speed
0.015	Reorganize	
0.032	Maintain performance and re-establish it	
0.017	Restore structure	
0.013	Establish public order	
0.005	Prevent disruption in the future	
0.054	Systems replacement or systems agents	Redundancy - fragmentation
0.013	Buffer from external shocks or changes in demand	
0.026	Replacing components with modular parts	
0.077	Balance redundancy with potential cascading effects	
0.013	Identify and predict problems	plan
0.011	Prioritize	
0.014	Mobilize resources of visualization, planning, collaboration and action	
0.006	re-evaluation	
0.052	Integrate resilience into work and management processes	
0.03	Getting cooperation from citizens	
0.003	Surface resistance to stress	Strength
0.015	No degradation and loss of performance	
0.006	Capacities that ensure adequate margins	

Keywords: Building Resilience, Flood, Hamedan, LISREL Modeling Software, Key City Centers.

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Assessing the risks of developing Kabul settlements towards flood prone areas

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Introduction

Flood is one of the most important environmental hazards. Floods have natural roots, but human activities play an important role in intensifying them. In fact, the development of residential areas towards the river and the destruction of vegetation have increased the likelihood of floods and intensification of damage. One of the areas that have faced an increasing population in recent years is the city of Kabul in Afghanistan. In fact, the political and social situation of Kabul has led to large population growth in recent years, so that the population of Kabul has doubled in the last 20 years. Parallel to the population growth, Kabul encountered significant physical development. The city of Kabul has a high potential of flood hazard due to being surrounded by a mountainous unit from the surrounding area, having a large catchment area upstream, and being located in a flood plain. Nevertheless, the physical development of Kabul city has been progressed during the recent years without regarding the geomorphological characteristics, so that many residential areas are located in high-risk areas, especially those adjacent to the Kabul River. Given the importance of the flood issue, it is necessary to identify the trend of physical development of residential areas in the Kabul urban basin and the increasing trend of these areas towards the flood-prone areas. Therefore, the current study aimed at the preparation of flood potential map of Kabul Basin and spatiotemporal development of the urban city in accordance with the flood-prone areas.

Materials and methods

In this research, in order to achieve the desired goals, Landsat satellite images, a digital model of 12.5 m altitude, geological maps, and climatic information of the region have been used as research data. Many software and models were used in the research include ArcGIS (to prepare maps), and IDRISI (to assess land-use change trends), as well as fuzzy logic-AHP (to identify areas prone of

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flood occurrence), and LCM model (to assess the trend of land-use change and the movement of residential areas towards areas prone to floods). This research has been done in several stages. In the first stage, in order to identify flood-prone areas, 8 parameters including slope, slope direction, height, distance from the river, precipitation, cumulative flow, lithology, and land use have been used. In the second stage, in order to prepare the land use map of the study area during the studied time periods, Landsat satellite images have been used. The Landsat satellite imagery used in the research is from the years 1990, 2000, 2010, and 2020. In the third stage, in order to analyze land-use changes, the LCM model is used, and then using this model, the trend of changes for 2050 is predicted.

Discussion and results

In this study, in order to identify areas prone to floods in the urban area of Kabul, eight parameters have been used. Based on the results, many parts of the Kabul urban area are in the category of very high flood potential. According to the results, 369 square kilometers, equivalent to 26.8% of the area, are in the very low and low potential for floods, these areas mainly include high, steep, and far from the river. Also, 495 square kilometers, equivalent to 35.9% of the area are located on the floor with high and very high potential. These areas mainly include areas with low slope and height, as well as areas close to the river. The increasing population in the urban area of Kabul has caused many parts of the residential areas to move to flood-prone areas in recent years. In order to evaluate the progress made, first the flood-prone areas of the study area have been identified (done in the previous section), after identifying the flood-prone areas, the residential areas located in this area during the study periods have been identified. The results indicate that many parts of the residential areas of the study area are on the floor with a very high potential for floods.

Conclusion

The results show that Kabul city has a high flood potential so that 495 square kilometers of the city limits and suburbs of Kabul have a high flood potential, which mainly includes the western, eastern, and southeastern parts of Kabul. These areas have a high flood potential due to low slope and height, cumulative flow, and proximity to the river. In this study, the trend of land-use change has also been evaluated. According to the results, the use of residential areas in 1990 had an area of 130.3 square kilometers, which in 2020 has increased to 1.205 square kilometers. The results of assessing the progress of residential areas towards flood-prone areas indicate that in 1990, 48.2 square kilometers of Kabul urban area was on the floor with a very high flood potential, which is 2000 to / 9. 58 square kilometers, increased to 80.9 square kilometers in 2010 and 84 square kilometers in 2020. In addition, the results of the assessment of the development trend of residential areas towards flood-prone areas indicate that

the area of these areas will increase to 96.1 square kilometers in 2050. The results show that Kabul city has a high flood potential and the development of residential areas has been done without considering this risk because a large part of the city area has been developed in flood-prone areas and this trend is ongoing.

Keywords: Environmental Hazards, Flood, Residential Development, Kabul.

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Designing Optimal Vision to the aim of Environmental Hazards Reduction (Case Study: Shams-e-Tabrizi Complex)

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Introduction

Site analysis in the architectural design process is investigated in terms of many factors that are obtained through a complete evaluation and accurate understanding of the system. A building cannot be imagined separately from the environment. Each building affects and is influenced by the environment interactively [3]. The location of settlements and other man-made facilities is affected by environmental factors, especially geomorphology and geology. The establishment and growth of cities, while not considering the capabilities of the land and its talents have numerous destructive and harmful effects and severely increases the life and financial losses during a crisis. Therefore, the need for preliminary studies for establishing cities and human settlements is further felt [2]. Among the present urban landscape issues, the issue of landscape and the level of the visual impact of existing or designed buildings on the surrounding texture has been always the concern of many experts in this field such as architects, designers, and even urban planners. The building's visibility factor determines whether the building can be observed at any particular point in the surrounding texture or whether there is a perspective to the surroundings at any point of the site or not. To determine the part and the distances of building to be seen, the factor of visual aristocracy is used, which also determines the power of visual impact and influence of the surrounding building [4].

Material and Method

The main objective of the present research is to evaluate and simulate the parametric component of perspective in the process of site analysis in Khoy and Shams Tabrizi site using the Environmental Impact Assessment Matrix method. The present quantitative research was performed through modeling and simulation techniques. To accurately evaluate the effect of the parameters, valid architectural software was utilized such as Rhino and Grasshopper. This work

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tries to support the designer in designing and not create a plan for the project. Therefore, the studied components in this research are focused on visual components of the design context while the other aspects are not considered.

Discussion and Result

To analyze and evaluate the landscape, factors such as site background, surrounding buildings, green space inside and outside of site, buildings and distant landscapes, topography, and landmark buildings were considered. In the present work, using the environmental impact assessment matrix method, we try to assess the effect of environmental parameters on the perspective component. Matrices can be used to discover direct connections between components in a system. The matrix comprises environmental components that are found in a hypothetical research field [1]. Hence, the relationship and effect of the parameters can be comprehended and expressed. Understanding these effects, an architect can obtain a better comprehension of the subject and obtain more efficient and effective forms. According to the results, topographic factors and surrounding buildings have the greatest effect on calculating the optimal visibility and landscape in a site. Moreover, the perspective from inside to outside of site and vice versa was examined and evaluated separately point by point through coding within the software. According to the calculations of the matrix algorithm for environmental impact assessment, it was indicated that the cells receiving the scores of 5 and higher are appropriate for design and construction.

Conclusion

One of the most important topics in the knowledge of environmental risks is prevention before treatment. Environmental impact assessment can be regarded as an appropriate solution for minimizing negative impacts and environmental hazards. It also provides appropriate solutions and options for decision-making and initial ideas to the designer. Analytical components of the site such as perspective can be used more directly and effectively in the design process through algorithm and parametric methods so that the analysis stage in the design stage can be coordinated, unlike traditional methods. Two simultaneous achievements were obtained in the present research including evaluation of the existing designs and then preparation of a generator for new designs. Indeed, site analysis components can be also both a generator and a tool to assess the final designs (implemented or not).

Keywords: Assessment, Environmental assessment, Perspective, Simulation, Environmental hazards.

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Earthquake Vulnerability and Resilience Assessment of Razan city

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Introduction

Rapid population growth, lack of resources and mismanagement have made natural hazards increasingly a major threat to human societies [1]. Among natural disasters, earthquakes are more frequent and are considered one of the most destructive natural hazards in the world and generally lead to many human and financial losses. Cities have complex and interdependent systems; Hence, they are more vulnerable to various threats, including earthquakes [2]. The main factors in increasing the damage during the earthquake are including increase in urban population, the location of the city next to active faults and also the lack of warning systems [3, 4 and 5], extensive construction, non-implementation of necessary standards in construction and city expansion without urban planning [6 and 7]. Vulnerability is the threshold of a society's response to disasters and environmental hazards [8]. Earthquake risk analysis, estimating its risks for different places and assessing the vulnerability of buildings, urban infrastructure at the time of the earthquake are among the initial measures that are implemented in urban planning [9]. Iran is one of the countries that has a very high vulnerability to earthquakes. Historical data show that every two to three years there is a significant earthquake in Iran. In twentieth century, in more than 20 earthquakes in Iran, between one hundred and forty thousand people have lost their lives, while many villages and towns have been destroyed. This led extensive economic damages. Hamedan province is also one of the provinces has a high seismic potential due to its location in the seismic zones of Iran, especially in the vicinity of active faults such as Avaj fault with a length of 167 km and northwest-southeast direction. The most important earthquake in this region occurred in 2002 with a magnitude of 6.5, which caused damage to rural areas of the city, which left cracks in the old city. Therefore, conducting studies on the vulnerability and resilience of the city and exploiting the results of these studies by land planners and decision makers in planning and preparing the city

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for hazardous events such as earthquakes can effectively and widely address the risks to decrease and increase urban resilience. In addition to the need to investigate the vulnerability of cities to environmental hazards such as earthquakes, the assessment of urban resilience is also a very high priority in urban planning, especially in the crisis management cycle.

Methodology

In this study, 15 sub-criteria and information layers were used to assess the vulnerability of Razan city, which include age of the building, structure of the building, number of floors, quality of the building ,law enforcement centers, width of roads, green space, seismic epicenter, fault, hazardous facilities, river, fire, and population density. The weight of each criteria and sub-criteria of the study area was determined using ANP method using super decision software. The selected layers were weighted and fuzzified using the weights obtained from ANP method in ArcGIS and then combined with each other to prepare a vulnerability map of Razan city. In order to assess the resilience of Razan city against earthquake risk, a questionnaire including 32 questions in social, economic, managerial, and institutional as well as environmental areas was designed. The opinion of city residents was evaluated by random sampling from all six neighborhoods.

Result and Discussion

Razan city vulnerability zoning shows most of Razan neighborhoods are close to 55% in high and very high-risk range, while only 24.2% of Razan neighborhoods are exposed to low and very low vulnerability. This indicates that city is vulnerable to earthquakes. These results confirm that Razan city is in a sensitive situation in terms of earthquake risk. In addition, more codified planning to reduce the vulnerability of this neighborhood seems to be necessary due to the dense population of Razan city, especially in the fifth neighborhood and its higher vulnerability than other urban areas. According to the research questions on measuring the resilience of Razan city, and according to the answers, all neighborhoods of Razan city are in a moderate situation in terms of resilience. It has a kind of downward average situation, except the neighborhood Six, which is moderately better tolerated than other neighborhoods. However, the third neighborhood has less resilience than other neighborhoods in the city and is also at a moderate level in terms of vulnerability. So, this neighborhood needs more attention in urban planning to reduce vulnerability and also increase resilience.

Conclusion

The location of Razan neighborhoods is exposed to earthquakes due to its proximity to several faults, especially Avaj fault. According to the geological

characteristics, if the intensity and magnitude of the earthquake is high, the city is vulnerable. This research used a fuzzy hierarchical process, which presented a suitable classification of the vulnerability of the city to earthquake. In addition, the simultaneous assessment of the city's preparedness and resilience to earthquake risk, which can be extended to some other risks, was able to provide a proper assessment of the city's vulnerability and resilience to this event for decision makers in the field of management. The crisis of this city needs appropriate planning to reduce the effects of this devastating event in the city through well-planned planning and in the context of short-term and long-term plans. However, if all aspects of resilience are taken into account, the severity of these injuries can be reduced and, in other words, residents can be made more flexible in the face of crisis, especially the occurrence of a possible earthquake. According to the analysis of the questionnaire, the most important weaknesses of Razan city is insufficient knowledge by the residents of the city about the risk of earthquakes. Knowledge weaknesses in the relevant organizations about the necessary training in the field of crisis preparedness, and economic problems have reduced the resilience and vulnerability of Razan city to earthquakes.

Keyword: Earthquake Hazard, Resilience, vulnerability, Fuzzy Analytic Hierarchy Analysis, Razan city.

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Self-analysis of temperature trend in drought hazards management (Case study: Chaharmahal and Bakhtiari province)

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Introduction

Changes in climate systems are one of the most challenging environmental phenomena. This phenomenon affects environmental characteristics such as rainfall, drought, high-quality waste movement, etc., and may cause their order to be disrupted [1]. Drought is a recurring climatic phenomenon in the climate system whose effects are not limited to arid and semi-arid regions [2]. There are several factors that contribute to the occurrence of drought. Changing and intervening in these factors in order to prevent drought occurrence is beyond human power and is impossible. On this principle, it is possible for these conditions to occur in any region of the globe in rich and poor, wet and dry, developed and under developing countries, and so on [3]. Due to the fact that drought indicators are valid only for one place and do not have the necessary spatial resolution to assess drought, and also due to the complexity and mechanism of climate, especially in the changes from year to year and decades, it is necessary to study the detection of processes affecting these changes and fluctuations. One of the most important factors affecting climate fluctuations on an annual basis is the role of climate patterns and indicators far from the region [2].

Materials and methods

In this study, the average monthly temperature data of Borujen, Lordegan, Shahrekord, and Koohrang stations were used. Remote link pattern data was also obtained from NASA. In this study, 26 remote linking models were used. In the present study, the results were evaluated seasonally for the years between 1397 to 1399 using Mann Kendall test. Afterward, relationship between temperature and drought of SPEI index has been used. In order to evaluate the trend of change in mean temperature, first, the statistical quality and homogeneity of data of Borujen, Lordegan, Shahrekord, and Koohrang stations

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were evaluated using test run test. Then, the relationship between drought using SPEI drought index and following a series of data from the homogeneous pattern was confirmed. The anomaly and normality of the mean temperature data were then investigated using the Kolmogorov-Smirnov test. According to the results and analyzes of the Kolmogorov-Smirnov test, if it was significant, ie p was less than 0.05, it means that the distribution is not normal. Mann-Kendall test was used to evaluate the significance of the change trend, and 95% and 99% confidence intervals were examined.

Discussion and Results

The results of descriptive statistics show that the highest average temperature in Borujen, Shahrekord, Koohrang and Lordegan stations in July is 22.74, 23.38, 22.21 and 27.80 ° C, respectively, and the lowest average temperature in Borujen, Shahrekord, Koohrang, and Lordegan stations in January are -0.99, -1.20, -3.85 and 3.76 degrees Celsius, respectively. The annual averages in Borujen, Shahrekord, and Koohrang and Lordegan stations are 11.29, 11.48, 9.90, and 15.79 degrees Celsius, respectively. The results showed that Chaharmahal and Bakhtiari province seems that the implantation of drought areas based on teleconnection patterns and its relationship with drought index is a kind of association of the passage of precipitation systems for this. Although there are areas in this province that are not the same in terms of rainfall, but the lack of patterns and systems from a distance will be the absence of rainfall and drought in the whole province. Not only there will be a drought in the rainy areas of the province, but it will also cause a lack of rainfall for the low rainfall areas as well as a drought. In the spring observations, it was found that based on climatic scenarios, there are no changes in the number of events and even drought classes compared to the base aura. However, in the Middle Ages, drought events and drought classes have changed to moderate to severe drought segments relative to the North Atlantic and Arctic linkage patterns for all stations. The fluctuations of drought and wetlands in Chaharmahal and Bakhtiari province are different from other areas. The relationship between droughts in this area and the negative phase pattern has led to drought in this area.

Conclusion

The aim of this study was to identify and zoning the drought of Chaharmahal and Bakhtiari province with the help of SPEI drought index. Then, the relationship between each zone and atmospheric-oceanic connection patterns was analyzed. The results showed that Chaharmahal and Bakhtiari province was divided into four different and distinct zones in terms of the severity of the drought index: southeastern, northwestern, northern, and southern half, which shows the location of the zones. The effect of precipitation systems and their passage on Chaharmahal and Bakhtiari province. Drought and wet season in

each of the areas (Shahr-e Kurd, Borujen, Lordegan, and Koohrang) where drought and wet season are seen consecutively in these areas. The most severe droughts are related to area four (Koohrang). Among the remote connection patterns, the western hemisphere hot pool pattern has the greatest impact on the occurrence of drought in the southwestern regions of the province. The relationship between this index and drought is positive in this area. Due to the drought in the Borujen area, most of the long-distance link patterns, including the Atlantic Index and the Pacific and North Atlantic Decades fluctuation pattern in autumn are significant. Drought in the southern hemisphere (Lordegan) in the warm season (spring and summer) shows a significant relationship with the tropical pattern of the South Atlantic, the tropical index of the North Atlantic and the East Atlantic. Droughts in the northwest (Shahrekord) R show a significant relationship with the multivariate index of Enso and North Atlantic and East.

Kaywords: Self-analysis, temperature trend, drought, hazards management, Chaharmahal and Bakhtiari province.

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Environmental obligations of States in reducing environmental hazards

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Introduction

The corona virus, scientifically named Covid 19, has become a threat to world health and human activities in 2020. Since the virus targets the right to life, it is important to review international legal solutions that address and reduce such risks. The most important human rights obligation of States is to guarantee the right to life, which is the highest human right, without which other rights would be meaningless, so it must be respected in all circumstances and even in emergencies.

Objective

The purpose of this study is to identify the obligations of States in reducing environmental hazards, and also to examine the relationship between corona and environmental hazards, as well as biosafety, in order to examine the fact that despite existing rules and regulations to protect the environment against the developed genetically recombinant organisms that are contagious to viruses, including the corona virus is one of the main objectives of this research

Research Method

The aim of this study is to increase understanding and knowledge in the field of international obligations of States in dealing with environmental hazards and in particular climate change and to present the results in order to promote international cooperation in implementing the principles of international environmental law, and it is practical. In this study, using library research to examine the interaction between climate change and corona as two mutual environmental hazards as well as quarantine and necessary closure of communities to prevent the risk of spreading the corona virus, and the commitments of governments in this regard are described and analyzed. Thus, the present article is divided into two parts. The first part includes the effects of climate change and corona and the second part includes the obligations and duties of governments in the system of international environmental law in relation to climate change and corona virus.

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Results

Occurrence of environmental hazards such as corona virus is one of the most serious threats to human life. The study results show that, as many infectious diseases such as AIDS, SARS and Ebola, which have been transmitted from animals to human beings, it is clear that the corona virus has been transmitted in the same way [20]. The corona virus pandemic is a prime example of the molecular interconnectedness of the universe, and because a transmissible virus mutates between wildlife and humans and is pathogenic, it is reminiscent of a butterfly effect. On the other hand, neglecting the warnings of scholars and not paying attention to climate change and ecosystems has led to the emergence and spread of diseases transmitted from wildlife to humans. Given the increasing trend of climate change and its effects on ecosystems, the prevalence of many known or unknown types of corona virus in the International Committee for the Classification of Viruses as well as similar corona diseases of animal origin is not unexpected. Studies show that the spread of coronavirus is increasing in more infected areas and cities [4]. Also, the coronavirus epidemic is a problem caused by governments' disregard for the environment and environmental commitments before it targets human health. The Stockholm Declaration of Principles includes the commitment of governments to use science and technology to identify, avoid and control environmental hazards and to address environmental issues in the public interest, which has been a biological problem since the outbreak of the coronavirus. Environment highlights this principle as a fundamental obligation for States [36]. Given recent findings and the fact that the corona virus is a living microorganism that exists in the bat body and in some ecosystems, it seems to have been defined in Article 2 of the Convention and in accordance with Article 1 of the Convention for the Protection of Ecosystems and the Preservation of this Microorganism and other similar living organisms in their original place are among the obligations of states. Also, under Article 3 of the Convention, States are committed to using their resources to ensure that activities carried out in the territory or in areas under their control do not cause damages to the environment of other countries or areas outside the territory [37].

Conclusion

To assess the crisis caused by the outbreak of coronavirus in the field of environment, various aspects of the issue should be considered, including environmental hazards and the interaction of these two phenomena with each other. Although with the corona outbreak, according to statistical data collected by NASA, the European Space Agency, and the Global Carbon Project, the weather has temporarily improved during the Corona Pandemic, environmental quality, water quality, and noise pollution in quarantine due to reduced use of transportation, halting or reduction of industrial activities and electricity

demand, emissions of carbon dioxide and nitrogen dioxide have been significantly reduced. On the other hand, the emergence of the corona virus as one of the consequences of not paying attention to the environment and especially climate change, environmental protection in the post-corona period is a serious concern that should be imposed by enforcing international rules for States to ensure sustainable development and prevent environmental hazards and climate change, which can be implemented only through cooperation and solidarity between developed and developing States.

Keywords: corona virus hazards, environment, international environmental law, climate change hazards.

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