

Climate Change Mitigation and Adaptation Strategies and Policies for Cultural Heritage in Egypt

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Abstract

Egypt is highly vulnerable to climate change impacts. According to the Intergovernmental Panel on Climate Change (IPCC), Egypt's Nile Delta is one of the world's three "extreme" vulnerability hotspots, and future projections indicate that Egypt will suffer from the following climate change impacts: sea level rise; water scarcity and deficit; and an increase in the frequency and intensity of extreme weather events such as heat waves, flash floods, heavy rains, sand and dust storms. This will lead to major impacts on infrastructure, beaches and fertile land in the Nile Delta as they are subject to erosion, salt water intrusion and inundation. Consequently, food security, human health, economy and ecosystems in Egypt are at risk. Moreover, the cultural heritage and archaeological sites will be under risk of sea level rise and increasing the temperature and humidity. Egypt is making a great effort to adapt and mitigate the impacts of climate change in many vulnerable sectors like agriculture, water resources, ecosystems, etc., as well, established national council for climate change to draw up the strategies and policies and action plans for adaptation and mitigation the impacts of climate change. This research is filling the gap and investigates the adaptation and mitigation strategies and action plans related to cultural heritage sites and what are the actions that are needed for that, the capacity building in this context. The research depends on analyzing national reports, UNFCCC reports, national plans and action plans and presidential and governmental decrees that related to climate change in addition we developed a questionnaire that targeted the specialists in the field of cultural heritage and archaeology especially from ministry of tourism and antiquities. Analysis of these data will be presented in this article to provide more understanding and develop policies for cultural heritage mitigation from climate changes.

Keywords: Mitigation and adaptation, Cultural heritage, climate change, Vulnerability & Ministry of Tourism and Antiquities

1. Introduction

The Intergovernmental Panel on Climate Change's fifth Assessment Report (IPCC AR5) ¹ cautioned that warming of the climate system is unmistakable, as shown by increasing global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.

¹ IPCC, Climate Change 2014: Synthesis Report. 2014.

To address global warming, there are two basic countermeasures: mitigation and adaptation (Table 1). Mitigation is an intervention to reduce the emissions sources or enhance the sinks of greenhouse gases. Adaptation is an ‘adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities’ (IPCC 2001).² To protect our communities, economies, and the world in which we live from the effects of climate change, we must change our attitudes, processes, and—in certain cases—ways of life.

Table (1): differences between adaptation and mitigation

	Mitigation	Adaptation
Spatial scale	Mitigation has global benefits, so it is mostly an international concern.	Adaptation offers most advantages at the local scale, so it is mostly a local concern.
Time scale	As a result of the climatic system's inertia, mitigation has a long-term impact.	Adaptation has the potential to reduce vulnerability in the short term.
Sectors	The oil, transportation, manufacturing, and waste management industries, mitigation is a top priority.	Water and health industries, as well as coastal and low-lying regions, all prioritize adaptation
	Both mitigation and adaptation are relevant to the Cultural Heritage and Archeological sites.	

So far, many efforts have been made for mitigation and adaptation, in the face of the emerging impacts of climate change in many countries, people now recognize the necessity and importance of adaptation.

Egypt is highly vulnerable to climate change impacts. According to the Intergovernmental Panel on Climate Change (IPCC), Egypt’s Nile Delta is one of the world’s three “extreme” vulnerability hotspots.³ It is known that deltaic regions are highly vulnerable due to its physical characteristics of low topography with high flood probability, significant land erosion and high sensitivity to climatic changes.⁴

² IPCC, Climate change 2001. Synthesis report. Cambridge University Press. 2001

³ Nicholls, R.J.et al, Coastal systems and low-lying areas. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 2007.PP 327.

⁴ Elham M. Ali, Islam A. El-Magd, Impact of human interventions and coastal processes along the Nile Delta coast, Egypt during the past twenty-five years, *The Egyptian Journal of Aquatic Research*, Volume 42, Issue 1, 2016. PP.2

The future projections indicate that Egypt will suffer from the following climate change impacts: sea level rise; water scarcity and deficit; and an increase in the frequency and intensity of extreme weather events such as heat waves, flash floods, heavy rains, sand and dust storms. This will lead to major impacts on infrastructure, beaches and fertile land in the Nile Delta as they are subject to erosion, salt water intrusion and inundation. Consequently, food security, human health, economy and ecosystems in Egypt are at risk.⁵

The most vulnerable parts in Egypt will be the governorates on the coastline including Alexandria, Port Said, Beheera, Kafr el Sheikh as well as other wetlands of Al-Burullus and Manzala. In this context Ali & Abou El-Magd (2016) used remote sensing techniques to determine and found the lost area of each lake with the highest rate at Lake Idku (73% in 40 years), followed by Lake Manzala (42% in 60 years), and Lake Burullus (38% in 60 years).⁶

There are indications that the coastal cities of Damietta, Ras el-Barr, Gamasa, the areas around AlBurullus Lake, Al-Manzala Lake and Bardaweel Lake will be inundated between 2040 and 2050. Due to the uneven topographical nature of the coastal area between Damietta and Rosetta, this area is predicted to become separate islands surrounded by water from all directions. It is estimated that a sea level rise of up to 100cm is expected until year 2100.⁷

2. Institutional Framework for Climate Change in Egypt

Egypt paid a great attention to climate change issues, it was one of the first countries that signed United Nations Framework Convention on Climate Change (UNFCCC) in June 1994 and Kyoto protocol in march 1999 and finally Paris agreement was ratified by Egypt June 29, 2016.⁸

Egypt established many authorities that working in climate change issues, strategies and action plans started by establishing the unit of climate changes – ministry of environment in 1996, then establishment of the national committee on climate change.

As a result of the increased scientific evidence of the dangerous of Climate Change phenomenon and its impacts on Egypt, the National Committee on Climate Change has been established in 2007 (Prime Minister Decree 272). The committee includes representatives from the Ministries of Foreign Affairs, Water Resources & Irrigation, Agriculture & Land Reclamation, Electricity & Energy, Petroleum, Trade & Industry, Economic Development and Defense, besides experts from national and relevant agencies.

⁵ Nicholls, R.J.et al, 2007: Coastal systems and low-lying areas., PP 327.

⁶ Islam Abou El-Magd and Elham, Ali Earth Observations for Egyptian Coastal Lakes Monitoring and Management, In book: *Egyptian Coastal Lakes and Wetlands: Part II*. 2017.

⁷ Egyptian Environmental Affairs Agency (EEAA), Egypt third national communication under the united nations framework convention on climate change. 2013.PP 43

⁸ <http://www.eeaa.gov.eg/en-us/topics/air/climatechange.aspx>. Visited in 3-4-2021

The National Committee is concerned with developing mitigation and adaptation strategies to address phenomenon of climate change. Reviewing and activating the National Strategy for Climate Change with the preparation of plans and programs required in the near term and long term and integrated into national action plans for development in Egypt.

The National Committee on Climate Change was replaced by National Council for Climate Change, which was established by Prime Minister decree No. 1912 for 2015, and consists of three bodies:

- The Supreme Committee.
- The Executive Office.
- Technical Working Groups.

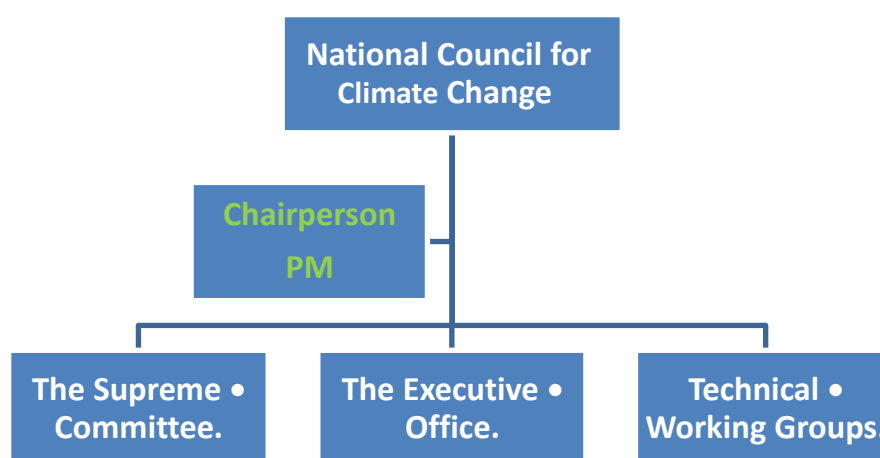


Figure 1:Organizational Structure of the National Council for Climate Change formulation

The Prime Minister shall be the chairperson of the National Council for Climate Change and convene the council at least once a year or whenever the need arises. The Supreme Committee of the National Council for Climate Change shall be formed with the membership of:⁹

1. Minister of Foreign Affairs.
2. Minister of Investment and International Cooperation.
3. Minister of Water Resources and Irrigation.
4. Minister of Planning, Follow-up, and Administrative Reform.
5. Minister of Finance.
6. Minister of Environment - Rapporteur.
7. Minister of Agriculture and Land Reclamation.
8. representatives of the Ministry of Defense.
9. Rapporteur of the Ministerial Group for Services.

And the executive office consists of representative of the ministries of supreme committee.

⁹ Translated from PM Decree no.1129 for 2019.

3. Strategies, Policies and Reports

Egypt has a clear policy structure, which is supported by the 2011 National Adaptation Strategy (NAS) and high-level government agencies, including line ministries, that are responsible for putting it into action. The aim of the strategy is to give Egypt more flexibility in dealing with the threats and negative effects of climate change in various sectors. Furthermore, Egypt has developed a ‘Sustainable Development Strategy (SDS) — Egypt’s Vision 2030.’¹⁰ UNFCCC secretariat follows up the situation of climate change and GHG emissions for each country through a set of reports such as national communication report (NC), National Inventory Report (NIR), Biennial Update Report (BUR) and Intended Nationally Determined Contributions (INDC) are non-binding national plans highlighting climate actions, including climate related targets, policies and measures governments aim to implement in response to climate change and as a contribution to achieve the global targets set out in the Paris Agreement.

Egypt has submitted the Initial National Communication in 1999, the Second National Communication in 2010, and the Third National Communication in 2016. The Government of Egypt has prepared this first Biennial Update Report (BUR) for submission to the UNFCCC in 2018.¹¹ Table (2) shows the timeseries communication reports, the first communication report 1999 as shown in table 2 the National Communication "NC" reports and its submission dates.

Table (2):¹² National Communication "NC" reports to UNFCCC

Report	Submission Date
NC1	19 Jul 1999
NC2	7 Jun 2010
NC3 & NIR	8 Nov 2016
Biennial Update Report	2018

4. Evaluation of cultural heritage and tourism adaptation and mitigation actions in Egypt

Cultural heritage plays an important role in economic development and growth through tourism and recreation industries, including urban and rural revitalization.¹³ Climate change, on the other hand, has a proven effective impact on climate change tourism in general, affecting operators, destinations, and visitors.

¹⁰ Egyptian Environmental Affairs Agency (EEAA), *Egypt third national communication*.

¹¹ NAP-SGP, *National Adaptation Plans in focus: Lessons from Egypt*. 2018. Accessed on March 2021 <https://www.adaptation-undp.org/resources/project-brief-fact-sheet/national-adaptation-plan-process-focus-lessons-egypt>

¹² <https://unfccc.int/non-annex-I-NCs> Accessed on March 2021.

¹³ Alexandrakis G, Manasakis C, Kampanis NA, Economic and societal impacts on cultural heritage sites, resulting from natural effects and climate change. *Heritage 2(1)*:279–305. (2019); Licciardi G, Amirtahmasebi R, *the economics of uniqueness: investing in historic city cores and cultural heritage assets for sustainable development*. World Bank, Washington, DC. 2012

Climate change is already becoming a threat for cultural heritage management around the world, hastening the degradation and deterioration of various aspects of cultural heritage.¹⁴ To make cultural heritage more resilient to climate change, proactive climate adaptation is needed¹⁵, which can minimize degradation and possible loss while optimizing heritage benefits for current and future generations.¹⁶

A coalition of concerned organizations and individuals brought the impact of climate change on World Heritage natural and cultural resources to the notice of the World Heritage Committee's 29th session in 2005. The UNESCO World Heritage Centre, in partnership with its Advisory Bodies (ICCROM, ICOMOS, and IUCN), had brought this issue to the Committee's attention and requested that a large working group of experts on the impact of climate change on World Heritage be convened and a plan and report be prepared to address the issue. The Committee approved these documents at its 30th session in July 2006.

Climate change adaptation of cultural heritage is a mechanism that aims to reduce the harm or exploit opportunities associated with current or potential future climate change impacts. Climate change adaptation science, practices, and policy have primarily centered on numerous vulnerable sectors over the last three decades, however research on adaptation of various cultural heritage types is still relatively weak.¹⁷

The majority of research to date has concentrated on developing mechanisms, instruments, or methods for assessing climate threats and vulnerabilities of various cultural heritage types.¹⁸ Although these studies are important in understanding climate change risks and raising awareness, there have been limited efforts to understand the design of feasible adaptation measures, as well as the governance challenges encountered in implementation to increase cultural heritage resilience.¹⁹

¹⁴ Boshier L, Kim D, Okubo T, Chmutina K, Jigyasu R, *Dealing with multiple hazards and threats on cultural heritage sites: an assessment of 80 case studies*. Disaster Prev Management 29(1) (2019). P115; Hollesen J, Callanan M, et al, *Climate change and the deteriorating archaeological and environmental archives of the Arctic*. *Antiquity* 92(363). 2018.P580; Rockman M et al, *Cultural resources climate change strategy*. National Park Service, Washington, DC. 2016.

¹⁵ Chmutina K, Jigyasu R, Boshier LS, *Understanding the impacts of climate change on cultural heritage buildings: a case of York, UK*. *CIB World Building Congress: intelligent built environment for life, Tampere*, Finland, 2016. PP 192; Sesana E, Gagnon AS, Bertolin C, Hughes J, *Adapting cultural heritage to climate change risks: perspectives of cultural heritage experts in Europe*. Geosciences. 2018

¹⁶ International Council on Monuments and Sites, *ICOMOS Future of our pasts: engaging cultural heritage in climate action*. ICOMOS, Paris. 2019.PP30

¹⁷ Heathcote J, Fluck H, Wiggins M, *Predicting and adapting to climate change: challenges for the historic environment*. *Hist Environ Policy* 8(2). 2017. PP 94; Tansey E, *Archival adaptation to climate change*. *Sustainability: Science, Practice and Policy* 11(2). 2015. P50

¹⁸ Fatorić S, Seekamp E, *are cultural heritage and resources threatened by climate change? A systematic literature reviews*. *Clim Chang* 142(1). 2017.237

¹⁹ Fatorić S, Seekamp E, *Knowledge co-production in climate adaptation planning of archaeological sites*. *J Coast Conserv* 23(3). 2019. P695

In order to bridge the gap between climate change science and climate change adaptation preparation and implementation for cultural heritage, it is critical to recognize the various types of obstacles that emerge during the adaptation process.²⁰ For Egypt, according to governmental decrees in this issue, there is no any formal representation for ministry of tourism and antiquities in national committee, national council of climate change respectively in any part. This is one of the main gaps that reflect no direct policies and strategies related to the cultural heritages and the impact of climate changes on it.

Also, according to literature review, the cultural heritage was mentioned a part of tourism sector in a few lines in the third communication report. As well as Egypt's Intended Nationally Determined Contribution (INDC) submitted to the UNFCCC in 2015, as shown in the in table (3) that identifies adaptation action areas.

Table (3): Major adaptation thematic areas identified in Egypt's INDC

Water resources — including water storage, improving irrigation and raining systems, awareness
Agricultural security — changing crop pattern, livestock, and improving the current low productivity of cattle
Integrated coastal zones management and providing job in safe areas
Health sector
Rural areas, population, and roads
Tourism
Energy
Adaptation policies — including building institutional capacities, environmental regulations; monitoring systems and increase awareness.

5. Cultural Heritage and Tourism Sector

5.1. Vulnerability

In general, Tourism in Egypt is one of the important sources of national income. The number of tourists visiting the country in the year 2010 reached more than 14 million spending about 140 million tourist nights in the country.²¹ Egyptian tourism revenues in 2008 amounted to US\$10.9 billion, compared with US\$9.5 billion in 2007; a 14.7% increase. Egyptian tourism contributed about 19.3% of the country's foreign exchange proceeds. It accounted for 11.3% of the GDP, directly and indirectly, and represented 40% of total services export.²²

²⁰ Xiao X et al, *Optimizing historic preservation under climate change: decision support for cultural resource adaptation planning in National Parks*. Land Use Policy. 2019.P 83,380.

²¹ Ministry of Tourism, Tourism Satellite Account Unit, 2014

²² Ibid,55.

According to third communication report, the vulnerability of tourism sector due to potential impacts of climate change includes as shown in the following Table (4):

Vulnerability Aspects on Cultural Heritage and Tourism	Risk
<ul style="list-style-type: none"> • Climate change and sea level rise are associated with direct impacts, which include the erosion and inundation of sandy beaches, and thus, the gradual regression of shorelines. • Another impact is the possible increased frequency of recurrence of storms and hurricanes, which would have a negative impact on multiple sectors of the coastal zone. 	<ul style="list-style-type: none"> ➤ Erosion and inundation of sandy beaches. ➤ Increasing frequency of recurrence of storms and hurricanes.
<ul style="list-style-type: none"> • Increased erosion rates in the low-lying coastal zone can be a result of steady sea level rise. This could result in beach erosion at the narrow and low-level sand barrier that divides the sea from the northern lakes, resulting in the gradual convergence of those lakes with the sea, as is foreseen for Lake Manzala. 	<ul style="list-style-type: none"> ➤ Erosion rates of the coastline ➤ Flooding of the low-lying coastal zone
<ul style="list-style-type: none"> • Sea level rise can have an impact on coral reefs, especially if the rate of rise exceeds the rate of coral growth. As a result of environmental pressures, the rate of coral bleaching may accelerate. However, the Red Sea's unique rock structure, which is 2 to 5 meters above sea level, is seen as a natural shield against rising sea levels in these regions. 	<ul style="list-style-type: none"> ➤ Coral reefs bleaching
<ul style="list-style-type: none"> • All low-lying beaches with water levels ranging from 0 to 1 m are likely to be flooded.²³ According to the topographic characteristics of each individual region, beaches along the Mediterranean and Red Seas with levels higher than the expected sea level will remain protected. Lowlands would be exposed to inundation to varying degrees depending on the precise existence of these areas if no adequate and successful steps are taken to protect the coastal zone. 	<ul style="list-style-type: none"> ➤ Inundation of low-lying beaches (below 1.0 m).
<ul style="list-style-type: none"> • There would be a clear negative impact on the coastal zones' socioeconomic aspects. Depending on the steps taken to mitigate the harmful effects of climate change and the projected rate of sea level rise, the severity of this impact could be reduced. 	<ul style="list-style-type: none"> ➤ Socioeconomic aspects on the coastal zones.
<ul style="list-style-type: none"> • The negative impacts of increasing temperature on the colors and lifetimes of monuments are expected to affect its quality and hence the number of visitors. 	<ul style="list-style-type: none"> ➤ Negative impact of increasing temperature on the colors and lifetimes of monuments.
<ul style="list-style-type: none"> • Salt water intrusion in low land coastal areas is expected to affect buried monuments in the coastal areas leading to enhancing deterioration rates. 	<ul style="list-style-type: none"> ➤ Salt water intrusion on buried monuments.

²³ UNDP, *Climate Change Adaptation in the Arab States Best practices and lessons learned*. 2018. P24

5.2. Adaptation

For adaptation actions for cultural heritage and tourism sector, the third communication report mentioned that Touristic development in particular, as well as on the tourism sector in general, includes a combination of protective and precautionary measures, and other direct and positive defense measures.

Preventive and precautionary measures include:

- Proclamation of marine and wildlife protectorates: This is one of the most important adaptation steps for environmentally sensitive areas within tourist destinations that are most vulnerable to threats according to the criteria regulating protectorate selection.
- Implementation of integrated environmental management systems in touristic sites: The Tourism Development Authority has already submitted a proposal to the Global Environment Facility (GEF) for an integrated environmental management system for the Red Sea coasts, which included several recommendations that are considered efficient adaptation means.
- Assessing the degree of fragility and risk exposure of touristic and archaeological sites: As a means of responding to climate change impacts, this assessment should be carried out in compliance with effective standards.
- Shifting tourism development away from environmentally sensitive and vulnerable areas toward less sensitive and vulnerable areas: The aim is to approach climate change adaptation on a planning level in a protective and precautionary manner, by directing projected tourism growth away from environmentally sensitive areas and climate-vulnerable areas. The outcome should be that tourism will be directed towards areas that are less sensitive and less vulnerable to these risks, by adapting to the expected changes before they actually occur.
- Developing a monitoring framework for expected climate change impacts in touristic sites: This involves determining basic observable measures and parameters that measure the different effects of climate change observed in touristic locations. The evaluation of outcomes and various metrics must be shared in order to ensure a quick and efficient response and, ultimately, to recommend appropriate strategy changes. The requested database will be created as a result of this command.
- Examining the success of environmental law enforcement and its evolution through the years, beginning with the passage of the protectorates law in the early 1980s and ending with the enactment of environmental laws and regulations in 1994: Since then, a plethora of new concepts and innovations have emerged. Others are linked to the degree to which these laws are enforced, and others are linked to the potential of using these laws as one of the climate change adaptation measures, such as identifying the shoreline, storm water spillways, and their limits, as well as all other measures that help the adaptation measures.

- Encouraging and assisting civil society groups in the implementation of strategic organisational policies: The implementation of any suggested methods for climate change adaptation would be dependent on various organisational processes and policies. The reliance on the involvement and patronage of the local civil society and its numerous organisations in touristic areas is at the forefront. Local, regional, and national tourism investor groups, as well as civil society organizations, local universities, and others, are among those involved.

As noticed all adaption activities related to the coastal tourism establishment, with poor and weak attention to the cultural heritage sites or archaeological sites. For the ministry of Tourism and Antiquities, there is a unit called risk and crisis management that concerned with managing the risks, crises and disasters on antiquities in Egypt. This unit don't purplish or lead any studies in this filed and don't organize any capacity building activities in the area of adaption and mitigation of climate change.

5.3. Questionnaire

5.3.1. Methodology

The study depended on the quantitative method. The quantitative method is a scientific method that explains social phenomena through numerical data using a set of statistical methods. The quantitative method is used in measuring social phenomena to evaluate, describe, and analyze them, in addition to making predictions about this phenomenon.²⁴

5.3.2. The measurement instruments

Potential questionnaire form is developed based on the identified themes from the literature review. An electronic copy of potential questions is forwarded to the researcher's advisor who provided advice on the structure and content of the proposed questions.

The questionnaire is distributed in Arabic and it was target to the specialists in the field of conservation of archaeological sites and, cultural heritage. It is divided into three parts:

1. First part is an Introduction about the study and its objectives
2. The second part is a sample profile: This part concerned with the demographic data of the sample, it consisted of four questions about gender, age, educational level, and experience.
3. The third part; is the main part, it contains 12 questions, 7 Likert scale questions rated from strongly disagree to strongly agree and 5 yes or no questions, that investigate the knowledge of participants about climate change issues and its impacts on cultural heritage and institutional capability to deal and mitigate the impacts of climate change.

Part one: Data analyses

Statistical model using SPSS V.16.0 is used to analyze the collected data. The statistical methods used are Frequencies, percentages, means and standard deviations: To describe sample's attitudes towards study questions and phrase.

²⁴ (Muijs, 2004; Cheia, 2010).

The agreeing degrees for the Likert scale were determined based on the weighted mean, as follows:

- 1-1.79 = Strongly disagree
- 1.80-2.59 = Disagree
- 2.60-3.39 = Neutral
- 3.40-4.19 = Agree
- 4.20-5 = Strongly agree

6. Results

Sample profile

The analysis of the questionnaire is a major part of understanding the position of cultural heritage and the people working in this sector of their believe and preparedness to climate changes, Table (5) shows that there is no big difference in participant's gender. The percentage of male reached 48.6 compared to 51.4% of females which refers to gender equality for the workers in the field of cultural heritage.

Regarding the age, the highest age slice came under 35 years with a percentage of 48.6% and 45.9% ranging from 36 to 50 years and 5.4 % More than 50 years. For education, most of the participants have a master's degree by 45 %, followed by a bachelor's degree with a percentage of 33.3% while 16.2% have doctoral degree which indicates to the high scientific degrees for the participants in this questionnaire.

Concerning the experience, the table shows that most of the respondents have from -06 to 20 years of experience by 75.7%, followed by whom have from More than 20 years' experience (15.3%). While 9% of the respondents have less than 5 years of experience.

Table (5): Sample profile

No.	Items	Freq.	%	
1	Gender	Male	54	48.6
		Female	57	51.4
2	Age	21-35 years	54	48.6
		36- 50 years	51	45.9
		More than 50 years	6	5.4
3	Education	Bachelor	37	33.3
		Master's degree	50	45
		Doctoral degree	18	16.2
		Others	6	5.4
4	Experience	5 years and less	10	9
		6-20 years	84	75.7
		More than 20 years	17	15.3

Regrading the jobs of respondents' fig. (2) showing variety of respondents, the highest number by job was inspectors, curators, and conservators.

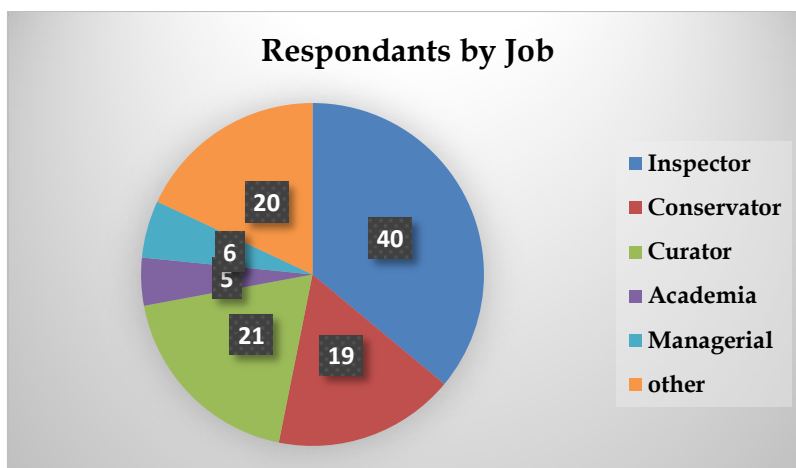


Figure 2: Respondents by their Job

For question of “Which of the following terms do you know or have heard about before” Table (6) shows that climate change is chosen by 110 respondents however the other terms like Adaptation and mitigation, Climate models, SSPs and RCPs were chosen just by not more than 28 respondents

Table (6) climate change terms knowledge

No.	Terms	Frequencies
1	Climate change	110
2	Adaptation and mitigation	28
3	Climate models	19
4	IPCC Reports	23
5	Shared Socioeconomic Pathways (SSPs)	7
6	Representative Concentration Pathway (RCPs)	7

For the question of “As a specialist in the archeology and cultural heritage field, to what extent do you agree on the following phrases?”

Table (7): general knowledge about climate change and its impacts

Items		Frequencies*					Mean	SD	
		1	2	3	4	5			
1	Climate change could affect your future work or lifestyle.	Freq.	3	2	11	69	26	4.02	0.80
		%	2.7	1.8	9.9	62.2	23.4		
2	You have the information and know-how needed to combating the impacts of climate change	Freq.	6	31	41	30	3	2.94	0.93
		%	5.4	27.9	36.9	27	2.7		
3	Climate change will have negative impacts in the near future on cultural heritage sites.	Freq.	4	4	9	65	29	4.00	0.90
		%	3.6	3.6	8.1	58.6	26.1		

4	Geographic information systems and remote sensing play an important role in managing the impacts of climate change on cultural heritage sites.	Freq.	4	2	12	54	39	4.10	0.92
		%	3.6	1.8	10.8	48.6	35.1		
Total mean								3.76	0.62

* 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree.

As shown in table (7), respondents agreed with the statement “Climate change could affect your future work or lifestyle.” with 62.2% and strongly agreed with this statement with 23.4%. The value mean was 4.02 (SD = 0.80) which is located in the agreeing level. This means that the majority of the study sample agrees with this statement.

Regarding the statement “You have the information and know-how needed to combating the impacts of climate change”, 36.9% reported as neutral and 27.9 % disagree while 27% area agree with this statement. The mean value was 2.94 (SD = 0.93) which is located in the neutral level. This means that the majority of the study sample don’t sure about their knowledge for adapting or mitigating climate change.

According to the results shown in table (7), respondents agreed on the phrase "Climate change will have negative impacts in the near future on cultural heritage sites." 58.6% of respondents agreed with this phrase and 26.1% strongly agreed. The mean value for this phrase was 4 .00 (SD = 0.90) which is located in the agreeing level. This means that the majority of the study sample agrees with this statement. This indicates that respondents according their experience realize the negative impacts of climate change on cultural heritage sites.

Concerning the statement “Geographic information systems and remote sensing play an important role in managing the impacts of climate change on cultural heritage sites.”, the percentage of acceptance was 83.7% as 48.6% of the respondents agreed and 35.1% reported strongly agree. The mean value was 4.10 (SD = 0.92) which is located in the agreeing level. This means that the majority of the study sample agrees with this statement and reflects their awareness of the importance of remote sensing and GIS in the field of cultural heritage management.

For question “through your experience, any of the following climate parameters and events has a negative impact on the archaeological and cultural heritage sites.”

Table (8): climate parameters with negative impact CH sites

No.	Terms	Frequencies
1	Moisture	98
2	Rising temperatures	59
3	Sea level rise	45
4	Heavy rainfall	71
5	Extreme weather events	25

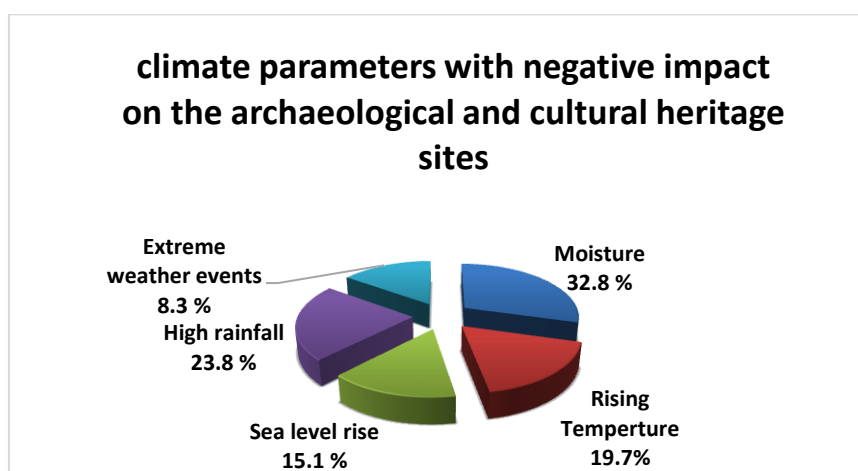


Figure 3: climate parameters with negative impact on the archaeological and cultural heritage sites

According to your experience, which of the following climate elements is more harmful to the archaeological and cultural heritage sites.

Table (9): Most harmful climate elements for CH sites.

No.	Terms	Frequencies
1	Moisture	84
2	Rising temperatures	31
3	Sea level rise	29
4	There was a lot of rain (Heavy rain)	62
5	Extreme weather events	36

According to Table (10) that investigates the institutional current status of mitigation and adaptation in Ministry of tourism and Antiquities through two actions:(1) capacity building for this issue (2) integrating mitigation and adaptation to policies, strategies and action plans of the ministry.

There is 85.6 % have not taken any courses related to climate change regarding the field of archaeology and cultural heritage. While 87.4% didn't get any trainings on implementing adaptation and mitigation policies, and reducing the effects of climate change on archaeological sites. So, 91.9% of respondents showed their willingness and desire to participate in any training related to this topic. 64% said that there are no any studies have been conducted in their archaeological area on the impact of climate change on cultural heritage sites on near or far future.

For integrating and implementation of adaptation and mitigation policies into ministry strategies to reduce the impacts of climate change on cultural heritage sites 74.8% said that adaptation and mitigation don't involve in ministry strategies or policies

Table (10): Adaptation and mitigation capacity building for CH sector.

Items		Frequencies		
			Yes	No
1	Have you taken any training courses related to climate change regarding the field of archaeology and cultural heritage?	Freq.	16	95
		%	14.4	85.6
2	Did you get any training on implementing adaptation and mitigation policies, and reducing the effects of climate change on archaeological sites?	Freq.	14	97
		%	12.6	87.4
3	Have any studies been conducted in your archaeological area on the impact of climate change on cultural heritage sites on near or far future?	Freq.	40	71
		%	36	64
4	Is your institution incorporating adaptation and mitigation policies into its strategies to reduce the impacts of climate change on cultural heritage sites?	Freq.	28	83
		%	25.2	74.8
5	Would you like to participate in trainings on managing the impacts of climate change on cultural heritage sites?	Freq.	102	9
		%	91.9	8.1

7. Conclusion

In conclusion, Egypt has numerous cultural heritage assets that exposed to climate change impacts in different degrees. So, mitigation and adaptation action must be involved in all levels of planning in the cultural heritage sector not just for current time but for near and far future to be able to provide the resources for competing these impacts on cultural heritage. It is recommended to develop a separate national strategy for the impact of the climate change on culture heritage, which engage all players in this sector. It is not only a socio-economic sector that contribute to the national GDP and create jobs and opportunities to local community but it is more than that of our historical culture and history that requires to be sustained and maintained. So, it is recommended to organize capacity building activities to enhance the human capital of the Ministry of Antiquities and specialists in cultural heritage management to deal with the climate change impacts in short and medium future terms. It is highly recommended to go beyond restoration efforts to be more oriented to the future planning and designing of early warning systems that support decision making in the field of cultural heritage management.

Finally, it is recommended to foster research and development in this type of studies that would improve our understanding and solutions to manipulate the impact of climate change on the culture heritage sites.

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إستراتيجيات وسياسات التكيف والتخفيف مع تغير المناخ المتعلقة بالتراث الثقافي في مصر

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الملخص

تعد مصر واحده من البلدان شديدة التأثر بالتغير المناخي. ووفقاً للهيئة الحكومية الدولية المعنية بتغير المناخ (IPCC)، تعد دلتا النيل في مصر واحدة من أكثر ثلاث اماكن تأثراً في العالم، ونشير التوقعات المستقبلية إلى أن مصر ستعاني من تأثيرات تغير المناخ التالية: ارتفاع مستوى سطح البحر؛ ندرة المياه وعجزها؛ وزيادة تواتر وشدة الظواهر الجوية المتطرفة مثل موجات الحر والفيضانات والأمطار الغزيرة والعواصف الرملية والترابية. سيؤدي ذلك إلى تأثيرات كبيرة على البنية التحتية والشواطئ والأراضي الخصبة في دلتا النيل لأنها معرضة للتعرية وتسرب المياه المالحة والفيضان. وبالتالي، فإن الأمن الغذائي وصحة الإنسان والاقتصاد والنظم البيئية في مصر في خطر. علاوة على ذلك، سيتعرض التراث الثقافي والمواقع الأثرية لخطر ارتفاع مستوى سطح البحر وزيادة درجة الحرارة والرطوبة. تبذل مصر جهداً كبيراً للتكيف والتخفيف من آثار تغير المناخ في العديد من القطاعات المعرضة للخطر مثل الزراعة والموارد المائية والنظم البيئية، وما إلى ذلك، وكذلك، تم إنشاء المجلس الوطني لتغير المناخ لوضع الاستراتيجيات والسياسات وخطط العمل من أجل التكيف والتخفيف من آثار تغير المناخ. ويسعى هذا البحث لسد الفجوة والتحقيق في استراتيجيات التكيف والتخفيف وخطط العمل المتعلقة بمواقع التراث الثقافي وما هي الإجراءات اللازمة لذلك، وبناء القدرات في هذا السياق. يعتمد البحث على تحليل التقارير الوطنية وتقارير اتفاقية الأمم المتحدة الإطارية بشأن تغير المناخ وخطط العمل الوطنية والقرارات الرئاسية والحكومية المتعلقة بتغير المناخ، كما قمنا بتطوير استبيان استهدف المتخصصين في مجال التراث الثقافي والآثار وخاصة من وزارة السياحة والآثار لمعرفة مدى معرفتهم بأبعاد القضية ومدى الإستعداد المعرفي والمؤسسي لها. وسيتم تقديم تحليل لهذه البيانات في البحث لتوفير مزيد من الفهم وتطوير سياسات للتخفيف من آثار التغير المناخي على التراث الثقافي في مصر.

الكلمات المفتاحية: التكيف والتخفيف، التراث الثقافي، تغير المناخ، الحساسية للتغيرات المناخية، وزارة السياحة والآثار.