

Analysing Climatic and Disaster Pressures on Bagan Heritage Monuments, Myanmar with Heritage Impact Assessment Method

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Abstract: *Bagan is one of the famous heritage cities of Myanmar and famous all over the world due to its numerous pagodas, monuments and natural setting. According to the Bagan inventory (1993), there are over 2230 monuments in Bagan and it can be seen obviously that ancient architectural styles and detailed ornamentations are beautifully decorated which are one of the attractions and values of Bagan. Moreover, Bagan is well known for its tangible cultural properties such as immovable over 2,000 monuments and archaeological sites especially and also some villages which make Bagan as a living city.*

Bagan is located in the central Myanmar and an active earthquake zone in the vast expanse of plains which is on the eastern banks of the Ayeyarwaddy River. Due to its locations, there are several climatic and disaster pressures on Bagan monuments and many historic monuments were deteriorated and collapsed due to earthquakes and flooding. Cracks and deteriorations in monuments were caused and plants and small vegetation on monuments due to rain water erosion led to structural failure also. As consequences, many monuments were conserved by improper conservation techniques and loss of heritage values and authenticity. Therefore, in this research, existing conditions of the area and monuments conditions will be studied first. Then, climatic and disaster impacts on monuments and area will be assessed by Heritage Impact Assessment method. Finally, findings and recommendations will be given and hopefully this study will be useful to some extent for further researches.

Key Words: *Heritage, Tangible culture, Conservation, Authenticity, Integrity, Heritage Impact Assessment.*

1. INTRODUCTION:

Bagan is in the state of contradicting between conservation and development, and restoration and reconstruction. Due to its location, there are different severe climatic and disaster impacts on Bagan which are difficult to mitigate and compatible conservation techniques are required. It was recently affected by severe earthquake and many monuments were deteriorated, some are very outstanding monuments and some had structural deterioration. Therefore, not only for earthquake but also for other climatic impacts, it is required to do Heritage Impact Assessment in Bagan and to define mitigation level.

2. SCOPE:

In this study, different climatic and disaster pressures on monuments will be studied and Heritage Impact Assessment will be processed so that to understand the level of impacts. Then, some recommendations and conclusions will be given.

3. LITERATURE STUDY: In conserving the historic area and assessing the impacts, the following terms and concepts should be studied.

(A) Terms and Definitions

(1) Heritage: "Heritage" has a vast definition and its concepts exceed cultural and natural aspects. It covers diversified entity from physical or tangibles to intangibles.

(2) Culture Heritage: Culture heritage is the legacy of physical artifacts and intangible attributes of a group or society that are inherited from past generations, maintained in the present and bestowed for the benefit of future generations. There are 2 types of cultural heritage: tangible cultural heritage and intangible cultural heritage.

(3) Tangible Culture: Tangible culture is culture that is tangible or touchable, the opposite of intangible culture. Tangible cultural heritage consists of both movable artifacts and immovable monuments. [1].

(4) Conservation: Conservation means all the processes of looking after a place so as to retain its cultural significance. It includes maintenance and according to circumstance includes preservation, restoration, reconstruction, adaption and will be commonly a combination of more than one of these [1].

(5) Authenticity: Authenticity refers to the truthful and credible conveyance of the historic and cultural significance of the site [1].

(6) Integrity: Integrity is a measure of the wholeness and intactness of the natural and/or cultural heritage and its attributes [1].

(7) Heritage Impact Assessment: A Heritage Impact Assessment (HIA) is a study to evaluate the impact the proposed development or site alteration will have on the cultural heritage resources and to recommend an overall approach to the conservation of the resources [1].

(B) The Burra Charter Process: Conservation is an integral part of the management of places of cultural significance and The Burra Charter provides guidance for the conservation and management of places of cultural significance (cultural heritage places) [2].

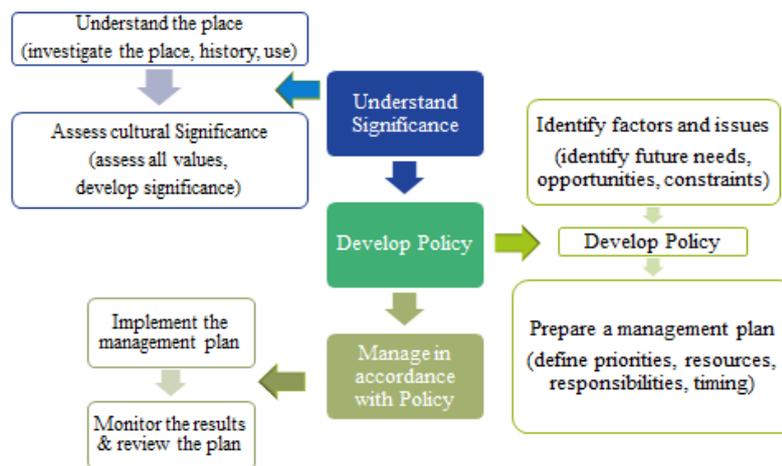


Figure.1 The Burra Charter Process

(C) Criteria for Cultural Heritage: To be nominated in the World Heritage Lists, that property or site should be proved as cultural heritage or natural heritage or both. When considering about cultural heritage, the following criteria should be studied first.

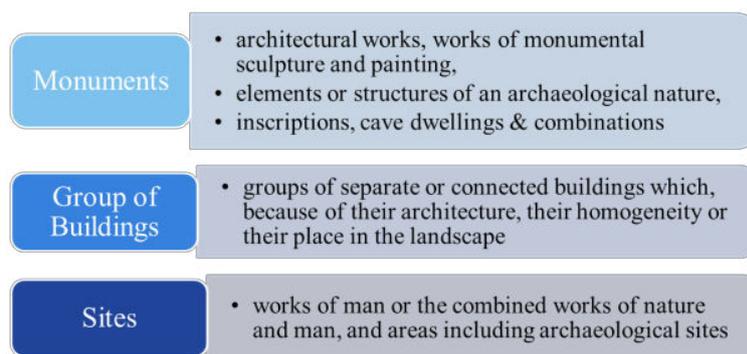


Figure.2 Criteria for Cultural Heritage

(D) Heritage Impact Assessment (HIA): When making an impact assessment, it should be started with the stage of screening, scoping and commissioning of impacts of the projects. To process it, data have to be collected from field survey and important to understand the significance of the place. Then, types of impacts can be identified through 3 detailed stages: planning stage, construction stage and operation stage, according to the evaluation of the heritage significance. Depend on the results, mitigation recommendations have to be provided and these are the essential processes when making impact assessment [3].

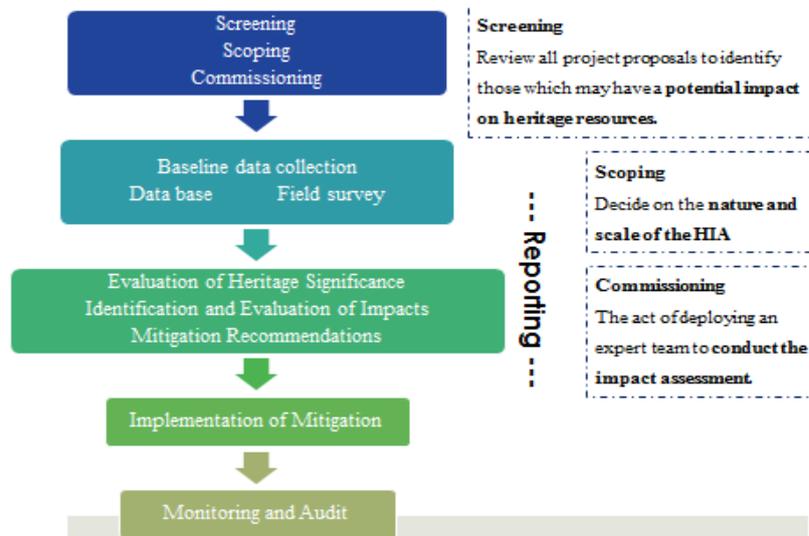


Fig.3 Process of Heritage Impact Assessment

(1) Types of Impacts: There are 4 types of impacts. They are –

- Direct Impacts
- Indirect Impacts
- Cumulative Impacts
- Residual Impacts.

Moreover, Potential impacts should also be considered together.

(2) Sources of Impacts: Basically, there are 2 types of sources of impacts such as natural sources and man-made sources. Natural sources consist of fire, earthquake, flood, tidal wave, wind, insect infestation and vegetation growth. On the other hand, Man-made sources mean war, theft, illegal trade, urban and rural land use plans, tourism and neglect.

4. EXISTING CONDITIONS OF BAGAN: Bagan is one of the most important historical sites in Myanmar and 104 square kilometre wide. The first Bagan ancient city was founded in 1st century AD, near Nyaung-U and Bagan was flourished from 11th century A.D. to 13th century A.D, ruled over by 55 kings.

Agriculture is one of the main industries and in the dry season, temporary cultivation fields appear on the river bank. One of the famous attractions in Bagan is lacquerware which is the local product and only produced from Bagan. And local business mainly depends on tourism.

Bagan can be said as cultural heritage site due to its individual monuments and its historical settings. More than 2,000 monuments and their architecture, the Irrawaddy River and local communities retain religious, social and cultural continuity from the past make the site as a harmonious whole.

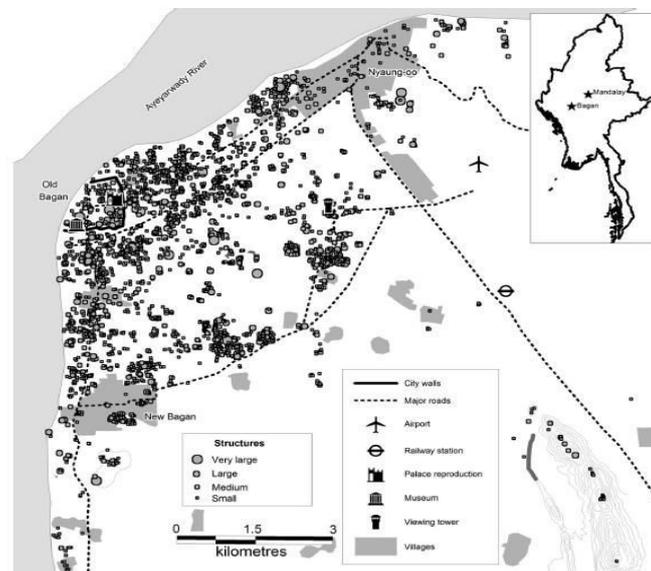


Figure.4 Location within Myanmar and Location of Monuments within Bagan [4]

(A) Climatic Conditions in Bagan: Bagan is located in the central Myanmar and it is an active earthquake zone in the vast expanse of plains which is on the eastern banks of the Ayeyarwaddy River. Bagan is situated within the dry zone and from April to August, there is the highest temperature level. Within December and February, the weather is cold.

No.	Year	Rain Water Level		Temperature (°C)	
		Days	Total level (inch)	Highest	Lowest
1	2008	40	26.34	44.5	10.6
2	2009	38	13.49	44.3	10.2
3	2010	42	32.66	45.2	10.4
4	2011	48	40.34	40.8	11.0
5	2012	34	18.15	44.3	10.6

Table.1 Annual Temperature and Rain Water Level in Bagan [5]

Bagan is situated in an active earthquake zone which is considered as Zone of highly damage. The most severe earthquake with highest intensity in Bagan history was in 1975, July 8 with 6.5 Richter Scale and it caused lots of deterioration and losses in monuments.



Figure.5 Collapsed Monuments



Figure.6 Interior Cracks



Figure.7 Deteriorations



Figure.8 Upper Part Losses

In Consequences, there were many improper restoration and maintenance in heritage monuments. Recently, Bagan was hit by severe earthquake with 6.8 RS in 2016, August 24 and over 400 monuments were damaged.

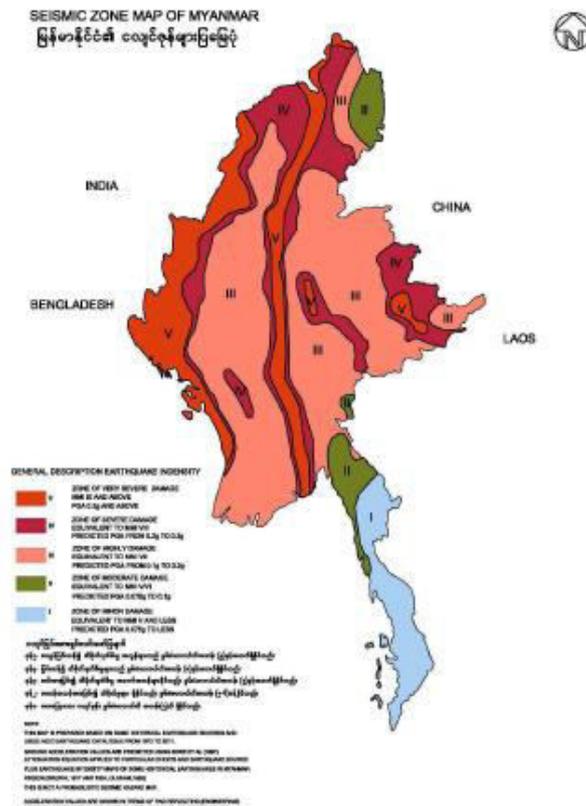


Figure.9 Seismic zone map of Myanmar [5]

(B) Zonings in Bagan: According to the locations of monuments and archaeological sites, there are 3 main zones in Bagan such as:

- Monumental Zone
- Ancient Site Zone
- Preserved Zone.

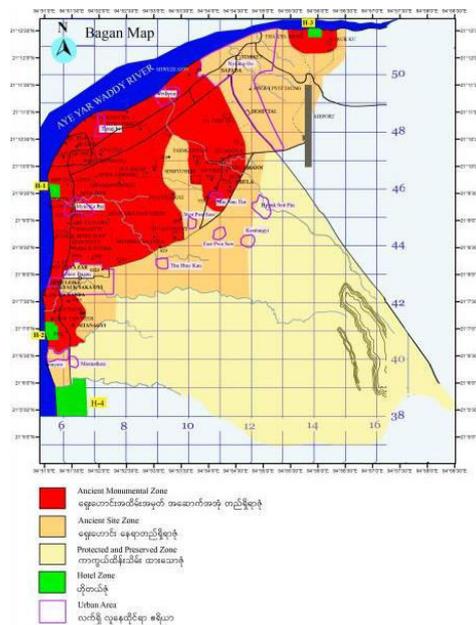


Figure.10 Zonings in Bagan

Existing settlement areas within Monumental Zone are –

- Old Bagan
- Wet Kyi Inn
- West part of New Bagan
- Taung Bi
- Leya
- Myin Ka Par
- Min Nan Thu.

Settlement Areas in Ancient Site Zone are –

- Nyaung Oo
- East part of New Bagan
- Thu Htay Kan
- East Pwa Saw
- West Pwa Saw
- Kontangyi.

Settlement Areas in Preserved Zone are –

- Hpyuk Seit Pin and etc.

(C) Number of Monuments and Grades in Bagan: There were so many verses about the number of monuments in Bagan but according to the inventory in 1993, the total number of monuments in Bagan was 2,230 [6]. According to their architecture value and historical value, monuments are divided into 3 grades [7]. They are-

- Grade 1 – Outstanding monuments, to be systematically inspected and preserved in perfect condition
- Grade 2 - Exceptional monuments, to be regularly inspected, maintained and repaired
- Grade 3 - Important monuments, to be periodically inspected, maintained and repaired when urgently needed.

The monuments grades, values and significance level are some of the key factors when assessing the acceptance level of impacts.

Name	Grade 1 Monuments (Outstanding monuments, to be systematically inspected and preserved in perfect condition)	Grade 2 monuments (Exceptional monuments, to be regularly inspected, maintained and repaired)	Grade 3 monuments (Important monuments, to be periodically inspected, maintained and repaired when urgently needed)	Total Protected Monuments
Bagan	34 Nos -Mahabodhi -Ga Taw Palin -Pa Htoe Thar Myar -Dhamma Yan Gyi -Shwe Gu Gyi -That Byin Nyu -Ma Nu Ha -Ananda Temple -Hti Lo Min Lo -Sula Mu Ni, etc.	100 Nos -Alopyi Gu -South Gu Ni -Eim Ya Kyaung Nga Myat Nar -U Pa Li Thein -Ta Yoat Pyi -Sein Nyet Nyi Ma -Sarabha Gate and City Wall -Soe Min Gyi, etc	288 Nos -Hlan Kya Phaya -Pha Ya Ni -Hsu Taung Pyi -Tu Yin Taung stupa -Shwe Kun Cha -Yin Ma Nar, etc.	422 Nos

Table.2 Number of Monuments and Their Grades

5. MAIN THREATS AND PRESSURES IN BAGAN: The threats and pressures in Bagan can be divided into 8 categories such as:

- Development Pressure
- Tourism Pressure
- Road network and Transportation Pressure
- Disaster Threats
- Climatic Pressure
- Vandalism
- Improper Conservation Techniques, and
- Weakness of knowledge and community involvement

In this research, only climatic and disaster threats and pressures will be studied.

(A) Types of Impacts in Bagan: The existing impacts in Bagan can be divided into 2 types such as Natural impacts and Man-made impacts as shown in the following table [3].

Natural Impacts	Man-made Impacts
Wind Earthquake Rain water erosion River erosion Rain water penetration Vegetation growth on monuments	Roads Cars, express, buses Rubbish Neglect Development of tourism facilities (Hotels, Restaurants, etc.)

Table.3 Existing Impacts in Bagan

(B) Climatic and Disaster Pressure: Bagan monuments are suffered mainly from rain water erosion, penetration and earthquake. Due to these climatic and disaster pressures, there were many deterioration and losses in monuments.

No.	Type	Pressure	Consequences
1.	Wind	-Wind erosion to monuments	-Deterioration of decoration works and motifs on monuments exterior
2.	Earthquake	-Located in earthquake zone	-Lead to structural failure -Damage the archaeological sites

3.	Rain	-Rain water penetration into monuments through cracks -Rain water erosion	-Decrease the structures resistance -Lead to structural failure -Lead to vegetation growth on monuments
4.	River bank	-Erosion along the Ayeyarwaddy river	-Damage the monuments and archaeological remains along the river

Table.4 Climatic Pressure and Consequences

6. HERITAGE IMPACT ASSESSMENT OF BAGAN: Depend on climatic and disaster pressures and threats mentioned above, Heritage Impact Assessment for Bagan will be conducted. Although there are 3 stages in HIA processes (Planning, Construction, Operation Stages), only operation stage will be assessed in this study [3].

No	Impact	Attribute	Significance	Type of Impact	Duration	Spatial Extent	Acceptability
1.	Wind erosion to monuments	-Monuments	-Very High -High	-Direct	Irreversible	-Limited	-Unacceptable
2.	Earthquake zone	-Monuments -Archaeological remains	-Very High - High	-Direct	Irreversible	-Extended	-Unacceptable
3.	Rain water penetration into monuments	-Monuments	Very High	-Direct	Reversible	-Extended	-Unacceptable
4.	Rain water erosion	-Monuments -Archaeological remains	-Very High -High	Direct	Irreversible	-Limited	-Unacceptable
5.	Erosion along the Ayeyarwaddy river	-Monuments -Archaeological remains	-Very High -High	-Direct	Irreversible	-Extended	-Unacceptable

Table.5 Heritage Impact Assessment of Bagan

7. FINDINGS:

To get the results, 3 matrixes are conducted and it is important to consider the acceptability level of impacts. According to the results from HIA table, it can be seen that all the climatic and disaster impacts in Bagan are severe upon monuments and they are unacceptable with mitigation while some are unacceptable at all. Therefore, compatible mitigations for heritage conservation area are required to provide and for unacceptable impacts, the most suitable solutions are essential to consider to change or reduce the impacts.

8. RECOMMENDATIONS:

There are many conservation techniques and methods when conserve and restore the monuments, as International standards and processes guided by UNESCO. However, it is important to define what kind of deterioration should be restored and which monuments should be maintained regularly. It is required to make the priority lists of monuments which need restoration and conservation depending on the deterioration conditions. Not only the possible structural failure problems but also the potential impacts must be considered together. Moreover, it is essential to balance between International criteria and local situations (Intangible Culture, Local people, Living Heritage Area) since our country is a Buddhist country and these are not just the monuments for us but also living pagodas for people.

For a moment, Bagan is in the rehabilitation period since over 400 monuments were affected and hurt in this 2016 earthquake. The most suitable criteria for restoration is essential to define and systematic conservation methods are required to follow for case by case. Since Bagan is situated in the disastrous area, it is impossible to escape the disaster pressures but if all the monuments are maintained by very compatible conservation techniques which can keep its authenticity as much as possible, it will be the best mitigation solution for Bagan heritage monuments.

9. CONCLUSION:

Bagan is our heart and very valuable place for Myanmar people and also for all since there is no other similar place like Bagan in the world. But Bagan is facing with lots of pressures and problems now and some problems have already impacted upon monuments and cannot change anymore. Therefore, for future works, Heritage Impact Assessment should be done before every work so that acceptable level of impacts could be resulted. To conclude, this study is intended to be useful to some extent in conserving Bagan as an ancient living heritage city and in maintaining its authenticity and integrity.

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