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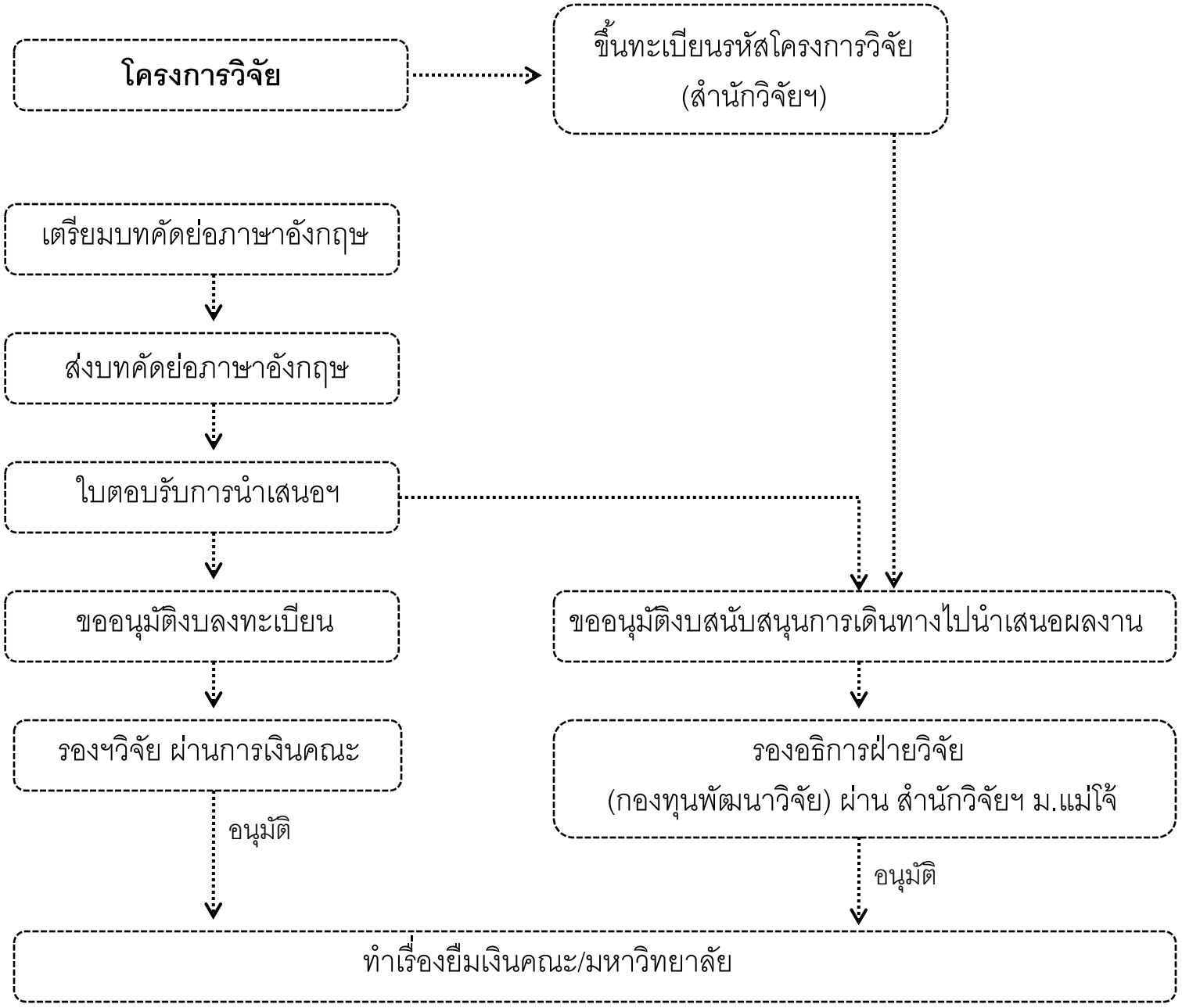
หัวข้อเรื่อง “การนำเสนอผลงานทางวิชาการในระดับนานาชาติ”

เมื่อวันพุธที่ ๒๔ มิถุนายน ๒๕๕๘ เวลา ๑๓.๐๐-๑๔.๓๐ น.

ณ ห้องประชุมคณะสถาปัตยกรรมศาสตร์และการออกแบบสิ่งแวดล้อม

โดย อาจารย์ ดร.วิทยา ดวงธิมา

ขั้นตอนการขออนุมัติงบประมาณในการนำเสนอผลงานระดับนานาชาติ



การนำเสนอผลงานวิชาการระดับนานาชาติ

วิทยา ดวงธิมา
คณะสถาปัตยกรรมศาสตร์และการออกแบบสิ่งแวดล้อม มหาวิทยาลัยแม่โจ้
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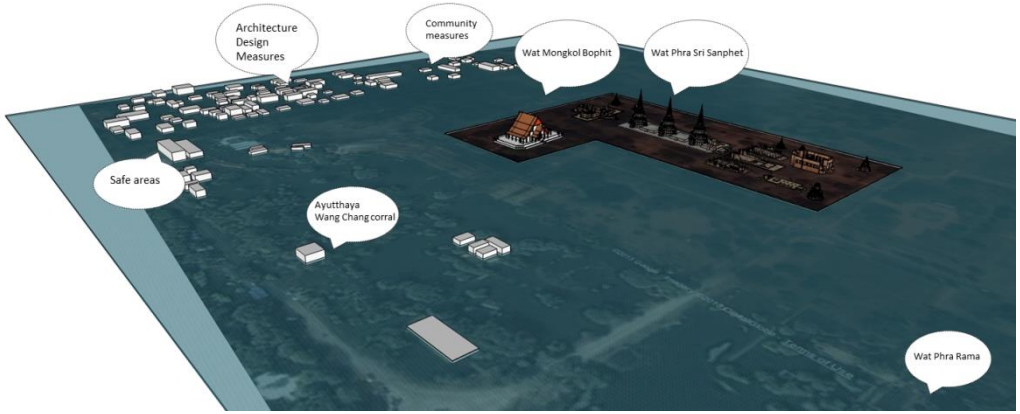
CONCEPT AND PRACTICE OF CULTURAL HERITAGE CONSERVATION UNDER FLOOD DISASTER: A CASE STUDY OF AYUTTHAYA, THAILAND



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Introduction

Methods

Results

Conclusion

Introduction

In the past, catastrophic damage to life and cultural heritage sites are many. Urban floods are increasing worldwide and are likely to become even more damaging in the future due to climate change (Munich, 2009).

Flooding is an important natural risk the basin environments. Thailand has a long history of flood cycles in seasonal variance. The basin area is flat at an average elevation of 1 to 2 m. from the mean sea level with certain spots where the elevation is lowered down to the sea level due to land subsidence.

Fig. Topography of the lower Chao Phraya River basin
Source: *World Bank, 2009.*

Thailand is regarded as highly vulnerable to natural disasters.

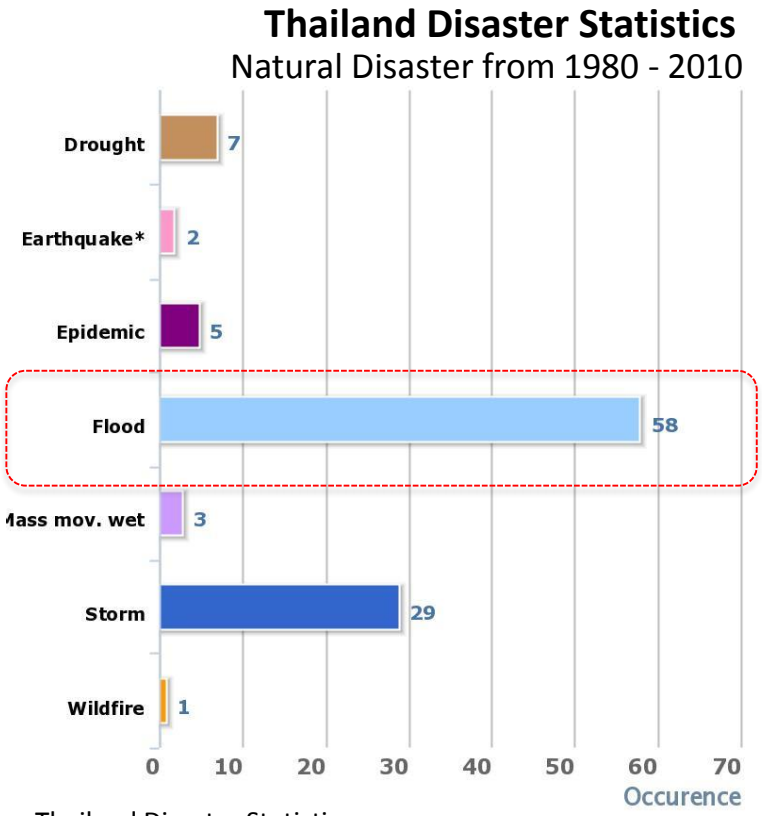
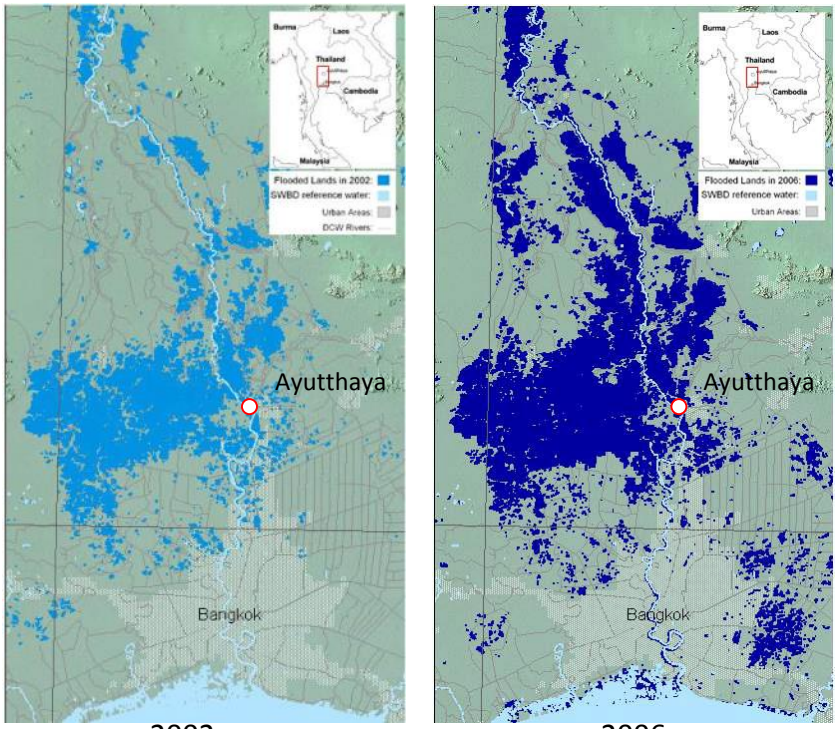


Fig. Thailand Disaster Statistics
sources: by PreventionWeb, 2013

Introduction

The past Flood in 2011, have a result to the physical, economic, social and environment damages. The important cultural heritage sites of Ayutthaya were also affected and damaged by the flood.

Ayutthaya's river flooding problems occurred for such long time ago. In the past, the local people solved this problem by digging canals.



2002 2006

Fig. Inundation maps of flood in the Chao Phraya delta

Distribution of historical sites in Historic City of Ayutthaya

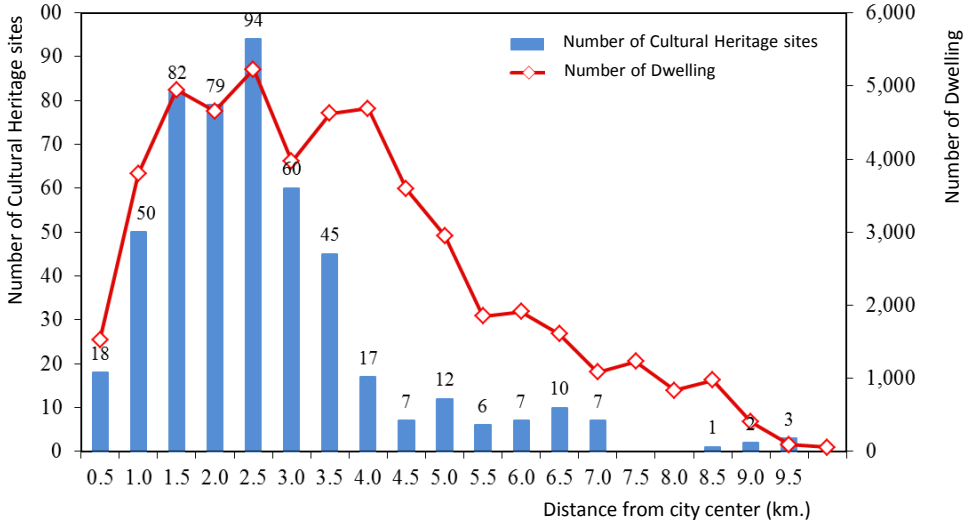


Fig. The relationship between number of cultural heritage sites, number of dwelling and distance from city center.

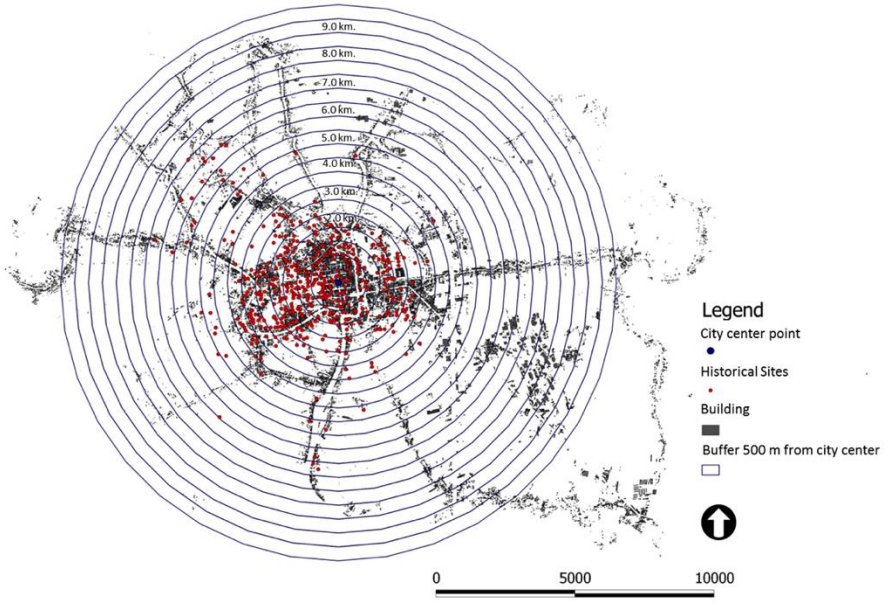
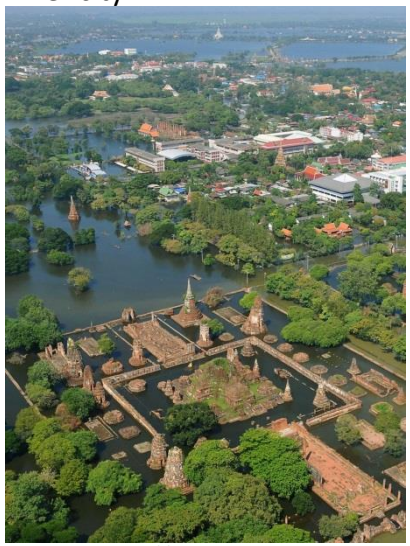


Fig. The Distribution of Cultural heritage sites Around Ayutthaya Historical City.

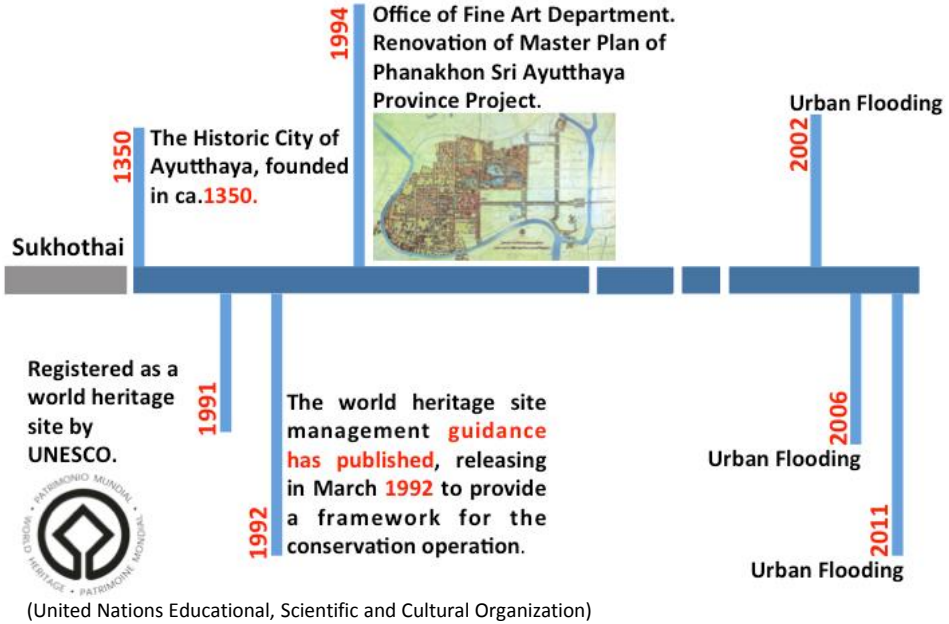
Inner city



Source: http://www.ibtimes.co.uk

Cultural heritage site located in suburb areas

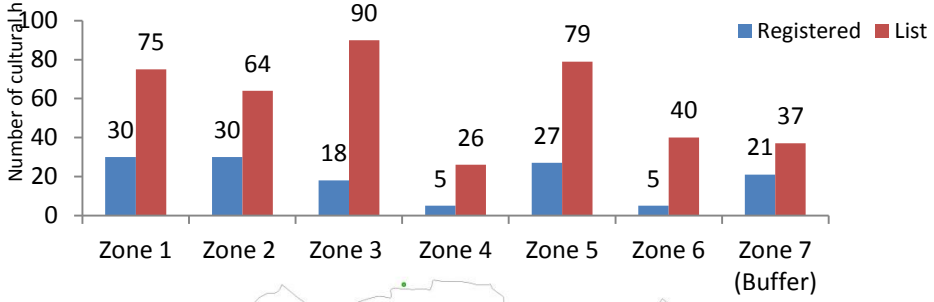
Ayutthaya Historical City



(United Nations Educational, Scientific and Cultural Organization)

Cultural Heritage Sites : The Fine Arts Department has registered 136 sites and listed 411 altogether sites from 1935 until nowadays (Fine Arts Department : 2011).

Distribution of cultural heritage sites in historic city of Ayutthaya



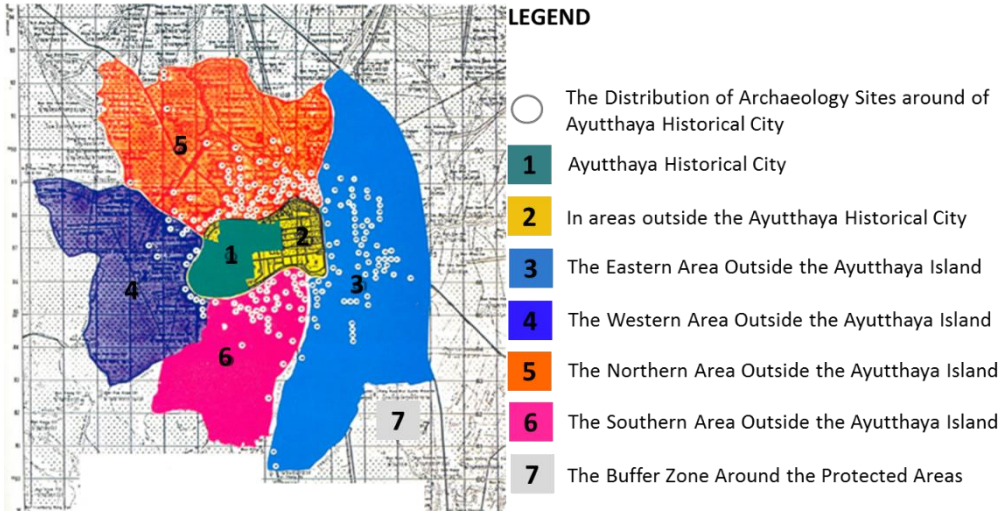


Fig. Zoning and the distribution of Ayutthaya Historical City.

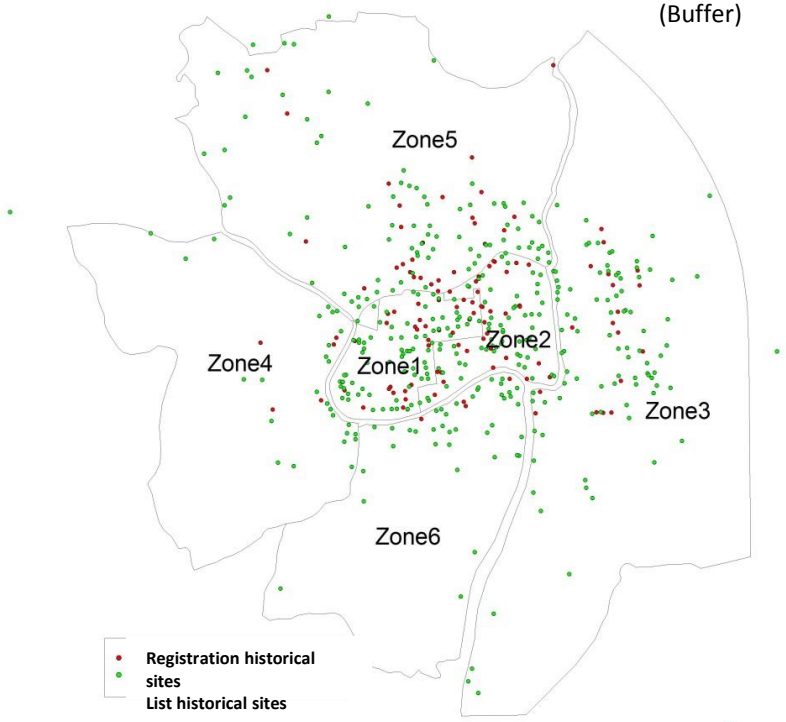


Fig. The Registered cultural heritage sites and the Listed cultural heritage sites.

Ayutthaya historical city has a **large number and value** of cultural heritage.sites

	Cultural Heritage Sites (CHS)	Normal Area
Government	Fine Art Department	Local Government
Flood protection	Registered and Listed CHS.  	Protect urban areas
Participation	Need participation with local people and stakeholder awareness and protect CHS from the flood risk 	Together with local people and need stakeholder group to protect normal area 

the participation by **community-based**

	Cultural Heritage Sites (CHS)	Normal Area
Local People		
Flood protection	Registered and Listed CHS or temple in community/ neighbourhood  (use in daily)	Protect their house
Participation	Local people awareness and protect CHS in community or neighbourhood 	Less participation by local people their neighbourhood

Methods for physical vulnerability assessment

Vulnerability is a human condition or process resulting from physical, social, economic and environmental factors, which determine the possibility and scale of damage from the impact of a given hazard (UNDP, 2004).

Physical vulnerability refers to the potential for physical impact on the built environment and population. (BRGM, RISK-NAT, 2005)

Risk is also depends on the characteristics of a person or group in terms of their capacity to anticipate, cope with, resist and recover from impacts of a hazard. (Blaikie, P., T. Cannon, et al.1994)(Cees van Westen,2009)

The Hazards of place Model of Vulnerability

risk (an objective measure of the likelihood of a hazard event) **interacts with mitigation** (measures to lessen risks or reduce their impact) to produce the hazard potential. (Cutter,2003)

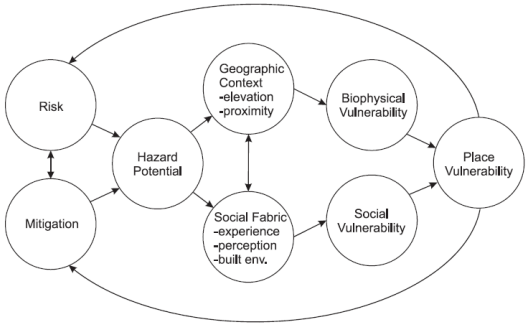


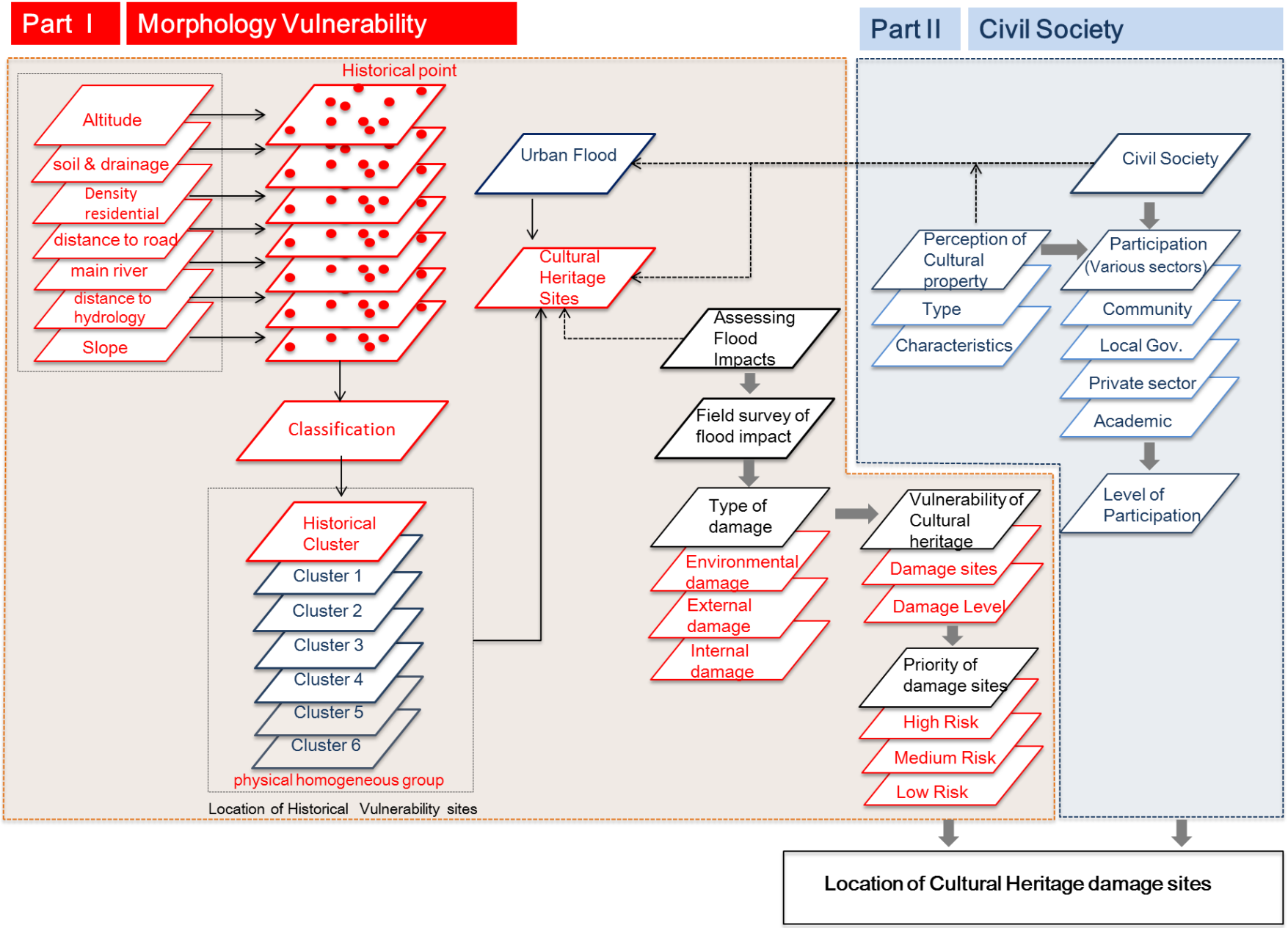
Fig. The Hazards of place Model of Vulnerability (Cutter,2003)

Urban Morphology types

Urban structural type or urban morphology unit and type(UMTs) are the product of past and present human land use activities and can be distinguished by their characteristic pattern of built and open space (Pauleit & Duhme, 2000)

The underlying assumption is that UMTs have characteristic physical features and are distinctive according to the human activities that they accommodate(Gill et al.2008, Jurgen H. Breuste, 2011)

Methodological Framework for urban morphology types



[Source: Author].

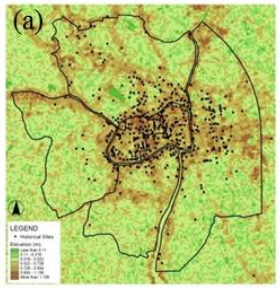
To classify the morphology property of homogeneous group on cultural heritage sites

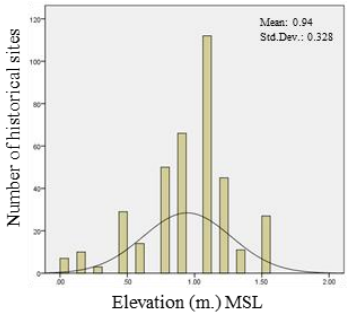
The urban morphology factors

	Factors	Detail of factors	Authors
(a)	Altitude/Elevation	- Current Elevation - Surface water flow paths	(Robert Jelínek et al. 2007, Iain White. 2008, Denpaiboon et al. 2009, Edoardo A.C. Costantini. 2009, C. Kubal et al. 2009)
(b)	Drainage system & Soil	- Vulnerable communities and critical infrastructure - Soil Erodibility - Soil Drainage - Soil Moisture - Soil Scape in fragile environmental balance - Soil Composition	(Robert Jelínek et al. 2007, Iain White. 2008, Denpaiboon et al. 2009, Edoardo A.C. Costantini. 2009, C. Kubal et al. 2009)
(c)	Density of dwelling	- Land value per floor space - Land Use	(Iain White. 2008, Denpaiboon et al. 2009, C. Kubal et al. 2009)
(d)	Main river	- Areas at risk from flooding - The distance to river	(, Robert Jelínek et al. 2007, Denpaiboon et al. 2009)
(e)	Distance to hydrology	- The distance to hydrology	(Robert Jelínek et al. 2007, Denpaiboon et al. 2009,)
(f)	Slope	- The distance of historical site to road - Upstream source of flooding - Flood Susceptibility - Overflow Sensibility	(Iain White. 2008, Denpaiboon et al. 2009)
(g)	Distance to road	- The distance of historical site to road	(Iain White. 2008, Denpaiboon et al. 2009, C. Kubal et al. 2009)

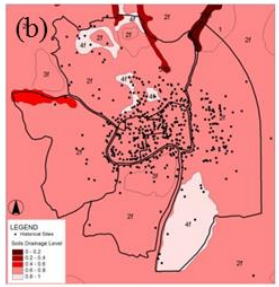
The urban morphology factors

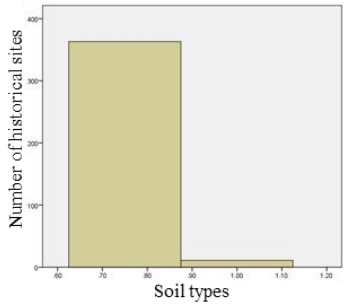
(a) Altitude/ Elevation(m) MSL



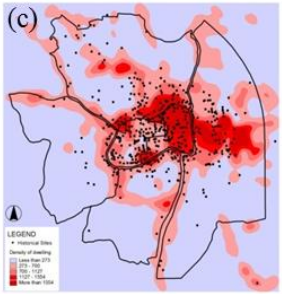


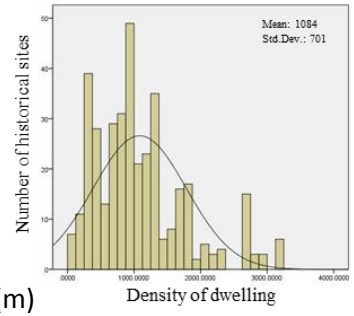
(b)Drainage system & Soil



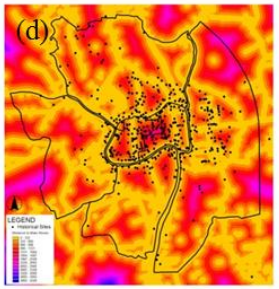


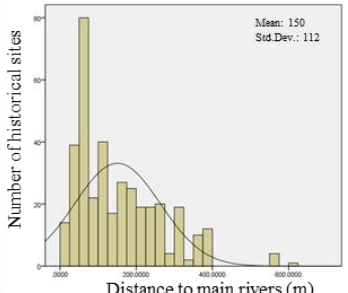
(c)Density of dwelling



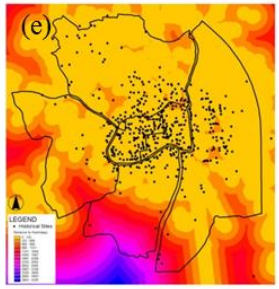


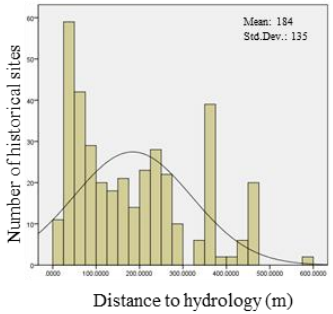
(d) Distance to main river(m)



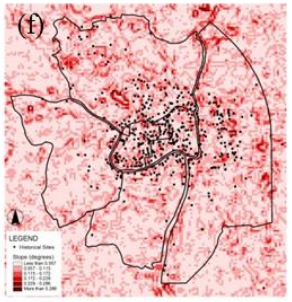


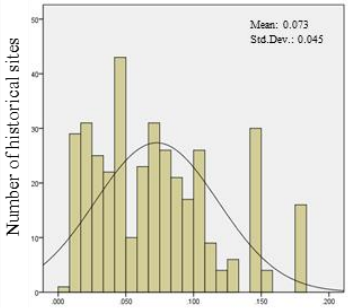
(e) Distance to hydrology(m)



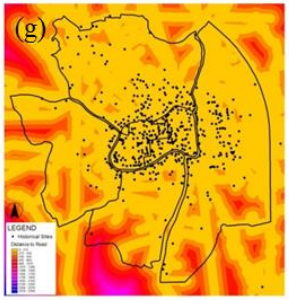


(f) Slope(degrees)





(g) Distance to road(m)



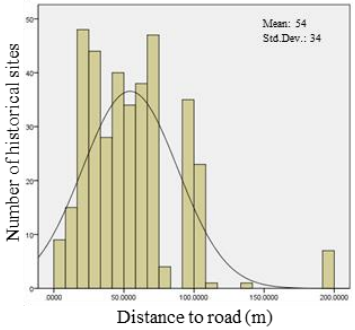


Fig. The morphology vulnerability factors

The urban morphology factors

Table. Final cluster centers of morphology vulnerability types(MVTs).

	Cluster		
	UMT 1	UMT 2	UMT 3
Altitude	.56	.78	.65
Soil drainage	.75	.77	.78
Density residential	.40	.10	.20
Distance to main river	.87	.88	.53
Distance to hydrology	.92	.75	.97
Slope	.65	.75	.60
Distance to road	.95	.85	.91

Table. ANOVA

	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
Altitude	.981	2	.021	490	47.071	.000
Soil drainage	.059	2	.004	490	16.237	.000
Density residential	2.206	2	.028	490	78.005	.000
Distance to main river	6.015	2	0.16	490	387.685	.000
Distance to hydrology	.743	2	.007	490	100.422	.000
Slope	.374	2	.037	490	10.045	.000
Distance to road	.208	2	.005	490	42.002	.000

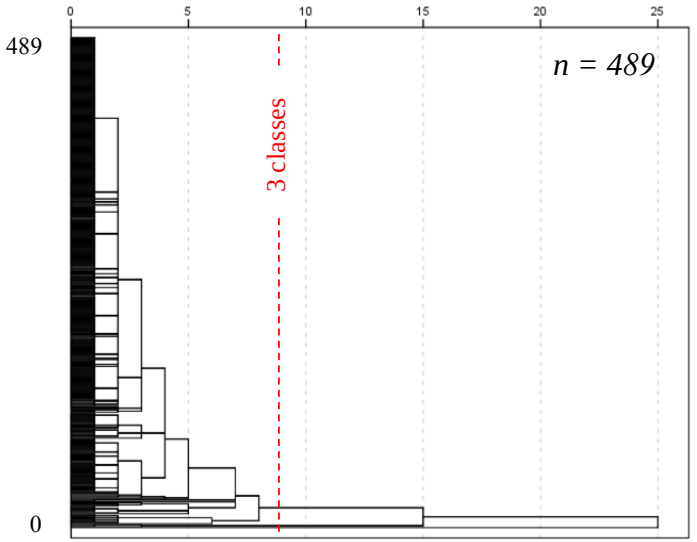
Table. Distances between final cluster centers.

Cluster	1	2	3
UMT 1		.384	.410
UMT 2	.384		.463
UMT3	.410	.463	

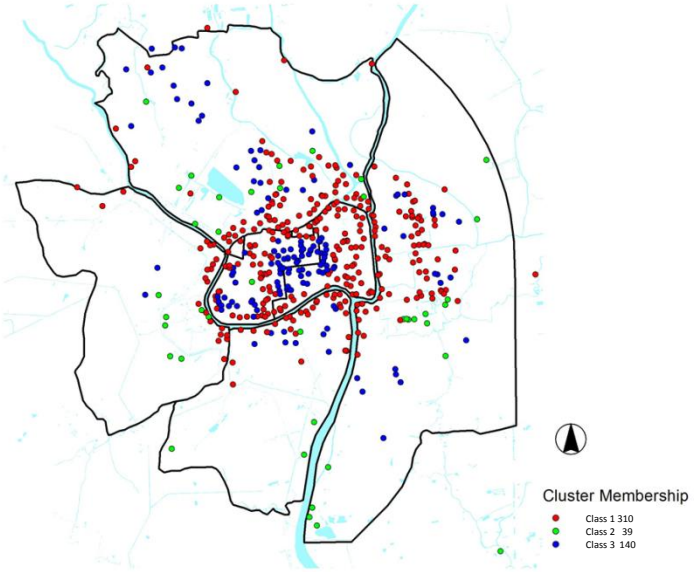
Table. Number of cases in each cluster

Cluster	Total
UMT 1	310
UMT 2	39
UMT 3	140
Valid	489
Missing	.000

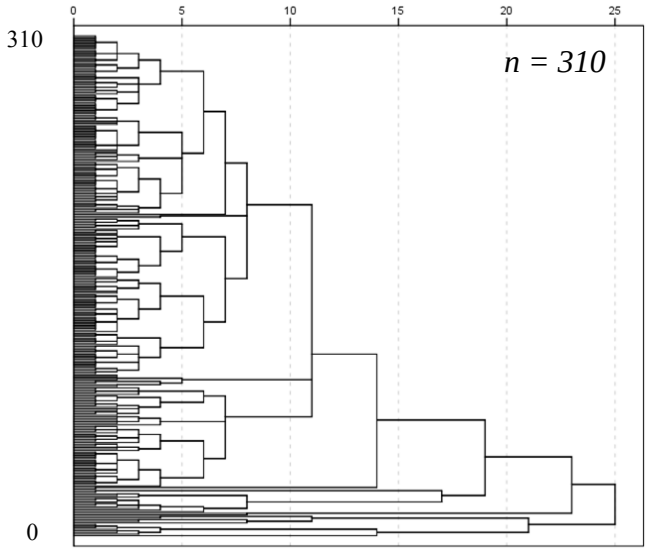
(a) Dendrogram using centroid linkage (all cases)



Average linkage distance between clusters

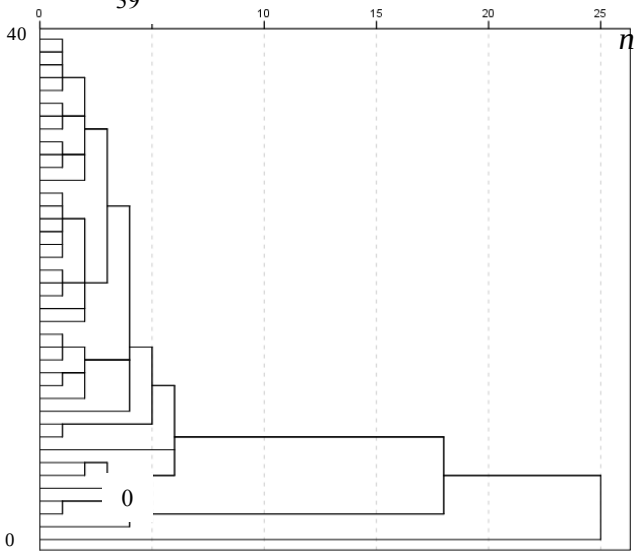


(b) Class 1(UMT 1)



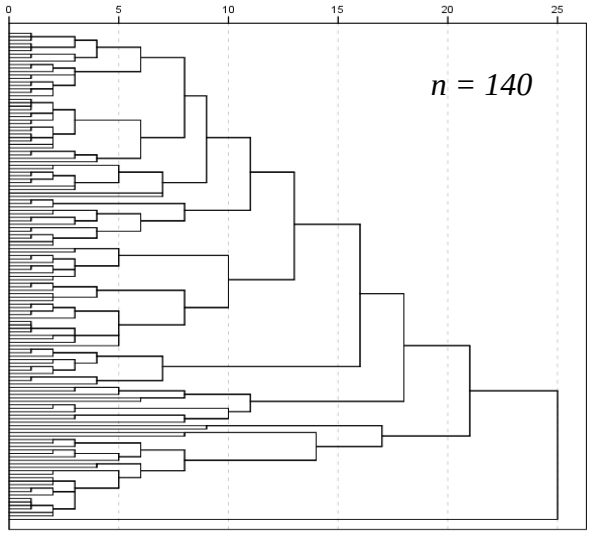
Average linkage distance between clusters

(c) C` `39 ` (UMT 2)



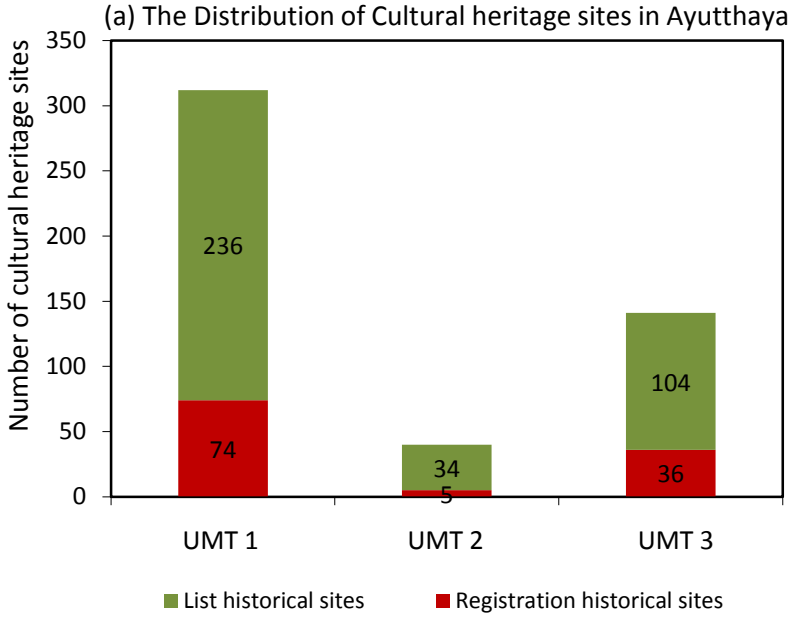
Average linkage distance between clusters

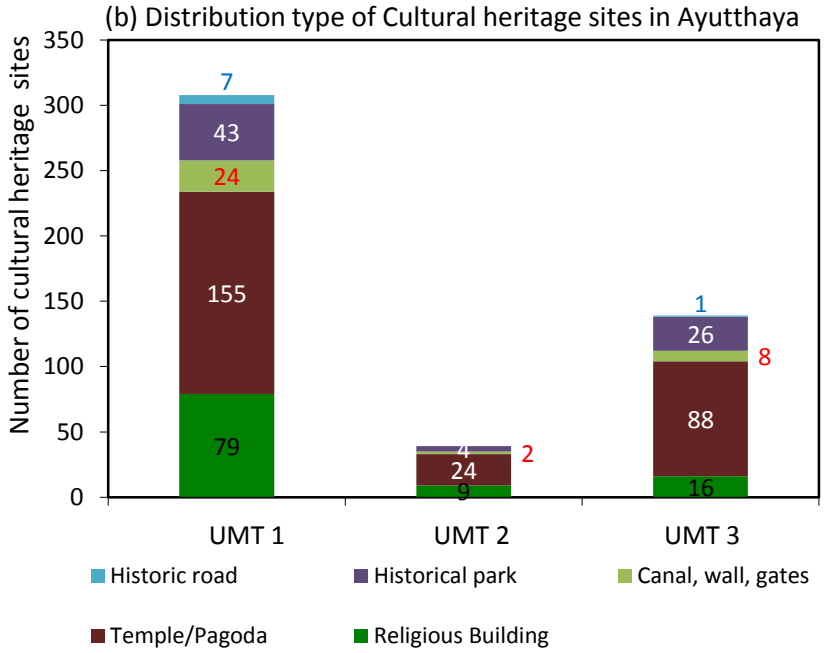
(d) Class 3 (UMT 3)

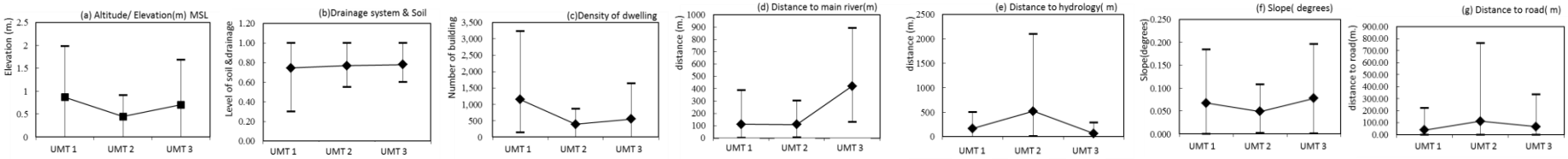


Average linkage distance between clusters

Classification of urban morphology types



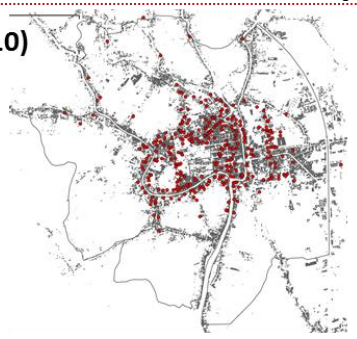




Type	Characteristic						
	Elevation(m.)	Drainage system & Soil	Density of dwellings (total)	Distance to main river(m.)	Distance to hydrology(m.)	Slope(degrees)	Distance to road(m.)
UMT 1	Height above mean sea level 0 - 1.98 m.	0.30-1.00	147- 3,223 (High Density)	0 - 385	0 - 498	0 - 0.184	0 - 221.42
UMT 2	Height above mean sea level 0 - 0.91 m.	0.55-1.00	0 - 851 (Low Density)	5 - 300	0 -2093	0.002- 0.108	0 - 762.27
UMT 3	Height above mean sea level 0 - 1.68 m.	0.60-1.00	0 - 1640 (Medium Density)	129 - 892	0 - 282	0.001 - 0.196	0 - 335.34

Characteristic of urban morphology types

UMT 1 (310)
63%



Religious buildings

Abandoned temple/
Deserted pagoda

Settlement

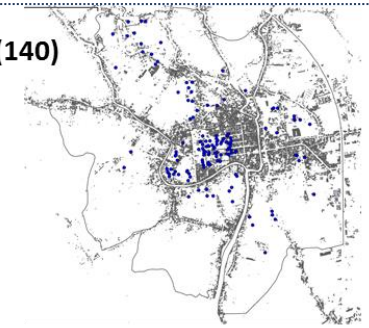
UMT 2 (39)
8%

Religious buildings

Abandoned temple/
Deserted pagoda

Settlement

UMT 3 (140)
29%



Religious buildings

Abandoned temple/
Deserted pagoda

Settlement

UMT 1 High above mean sea level 0-1.98 m. and High density of dwellings

UMT 2 High above mean sea level 0-0.91 m. and low density of dwellings

UMT 3 High above mean sea level 0-1.68 m. and medium density of dwellings

Field survey to assess flood impact of cultural heritage sites

Cultural Heritage Sites

1. Name
2. Type
-Registration
-List
3.Coordinate by GIS
4. Address
5. Zone
6. Description
- Size
- Construction
7. Photo number
8. Date Time

Type of damage

Environmental damage
1. Areas at risk from flood
2.Ground cracks
3. Landscape damage
4. Ground of the pit
or subsidence
5. Surface water flow paths
6. Critical infrastructure

External damage
1. Light damage
(wall, decorative aspects)
2. Structural damage

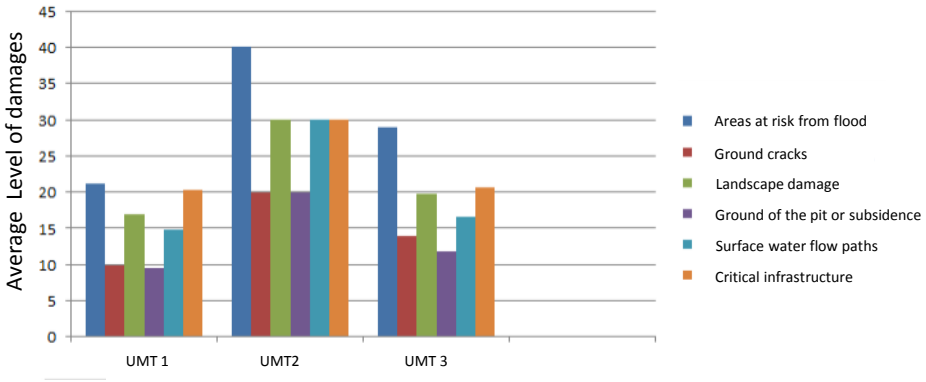
Internal damage
1. Interior of building affected
(wall, decoration, ceiling)

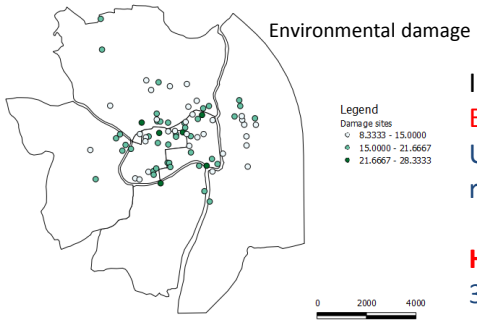
Field survey on **April – May 2012**.

Characteristics and level of the damage sites

Flood impact of cultural heritages vulnerabilities.

Environmental damage

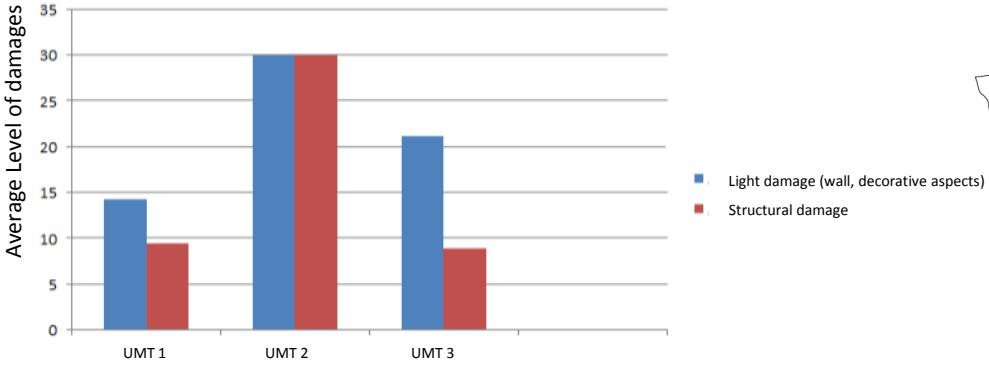


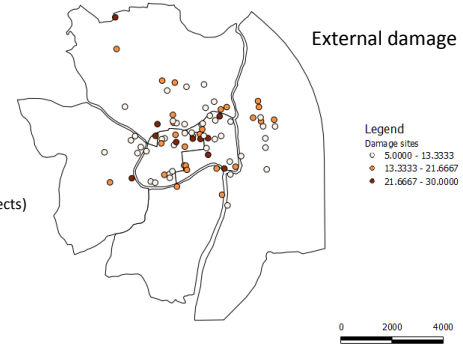


In **UMT 2** the most Environmental damage, UMT 3 and UMT 1 respective.

High Risk 6 sites, Med risk 37 and low risk 41 sites

External damage

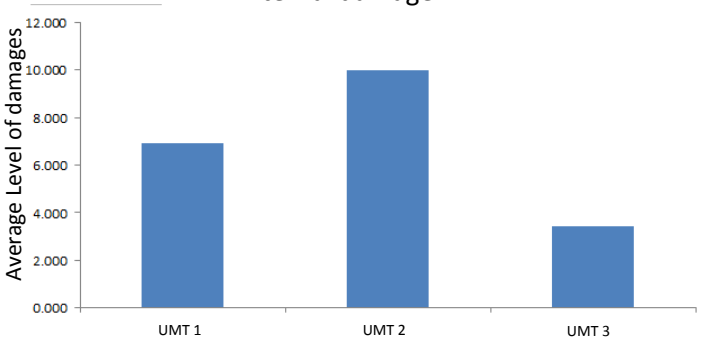


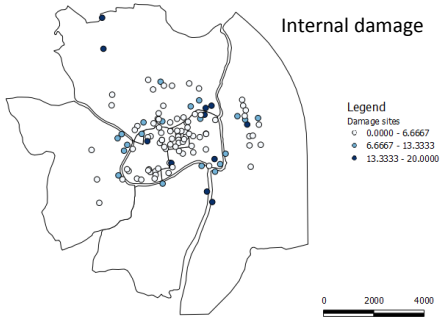


In **UMT 2** the most External damage, UMT 3 and UMT 1 respective.

High Risk 11 sites, Med risk 23 and low risk 50 sites

Internal damage





In **UMT2** the most Internal damage, UMT 1 and UMT 3 respective.

High Risk 10 sites, Med risk 18 and low risk 56 sites

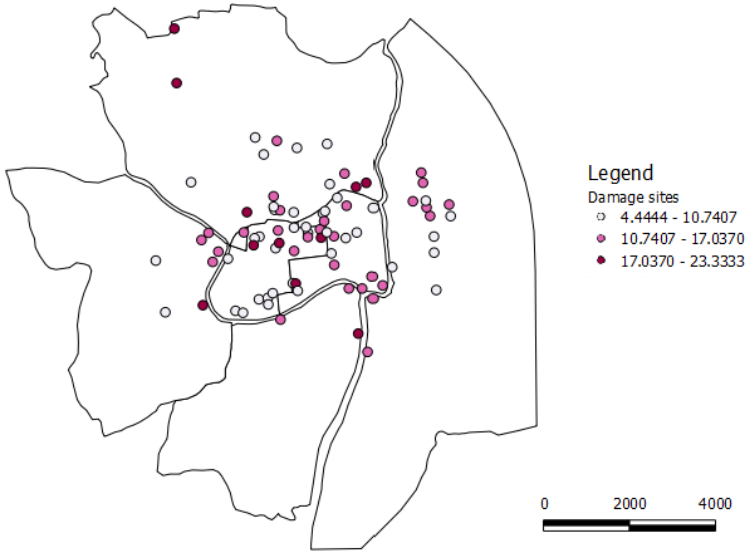
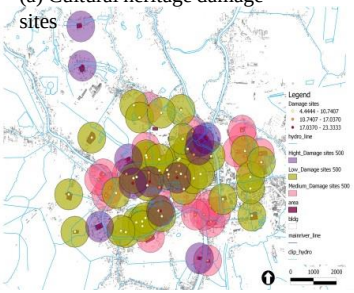


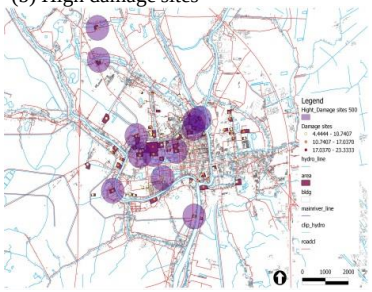
Fig. Flood impact of cultural heritage vulnerabilities.

	High Risk (181-240) 17.04- 23.33(%)	Med Risk(121-180) 10.74 - 17.03 (%)	Low Risk(60-120) 4.44 -10.73(%)	Total
Damage site	12	30	42	84
Average	214.29	146.77	96.74	125
Min	190	130	60	60
Max	240	180	120	240

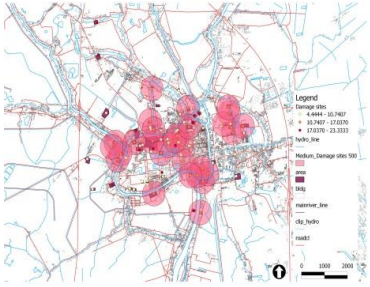
(a) Cultural heritage damage sites



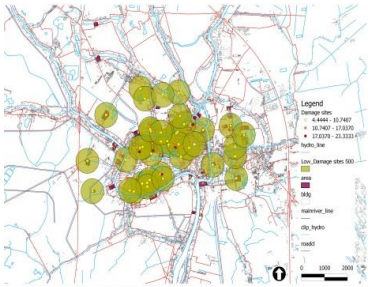
(b) High damage sites



(c) Medium damage sites



(d) Low damage sites



Summary : Flood impact of cultural heritage vulnerabilities.

- **UMT 2** is high vulnerability, UMT 3 is Medium Vulnerability and UMT 1 is low vulnerability.
- Found **3 types of damage**; environmental damage, external damage and internal damage.
- The levels of damage; high risk, medium risk and low risk respectively, are also assigned.
- Found **84 CHS** were assessed as damage; High risk 12 sites, Med Risk 30 sites and low risk 42 sites.

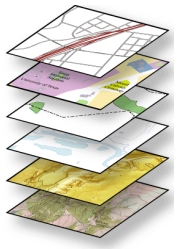
Improve Awareness and Communications by Integrated Assessment to Support Urban and Local Neighbourhood scales for Decision Making

acsee 2015
The Asian Conference on Sustainability, Energy & the Environment

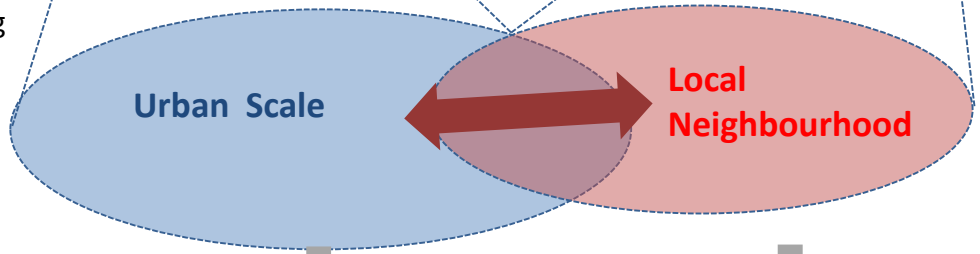
Urban Management

Stakeholder groups:
- Expertise
- Local government
- Local planners

Tool:
- GIS-based Spatial Multi-criteria Supporting Decision Making Process
- Hypothesized Damage level



Integrated assessment to support Urban scale and local neighbourhood scales for decision making



- **Urban morphology types**
- **Cultural Heritage Distributions Damaged**

Contributions
- **Spatial Information for support decision makers on cultural heritage distributions**
- **Hierarchical for cultural heritage conservation and management**

Local Neighbourhood

Stakeholder groups:
- Decision makers
- Urban Planner
- Local people

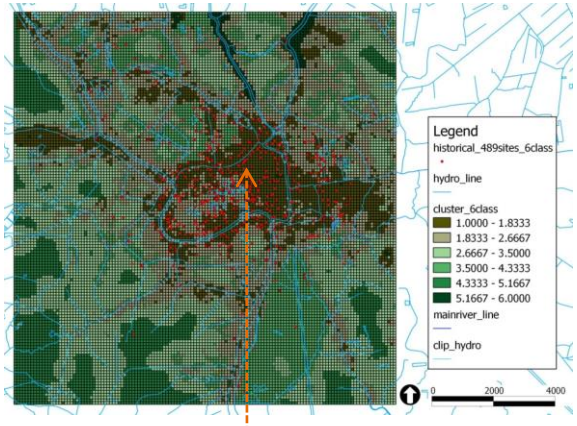
Tool:
- SketchUp
- Protect cultural heritage (PCH) plug in tool.

Neighbourhood areas

Contributions
- **To investigate the safety and security of their local areas.**
- **To encourage greater interest in local safety and security, as well as sharing of information.**

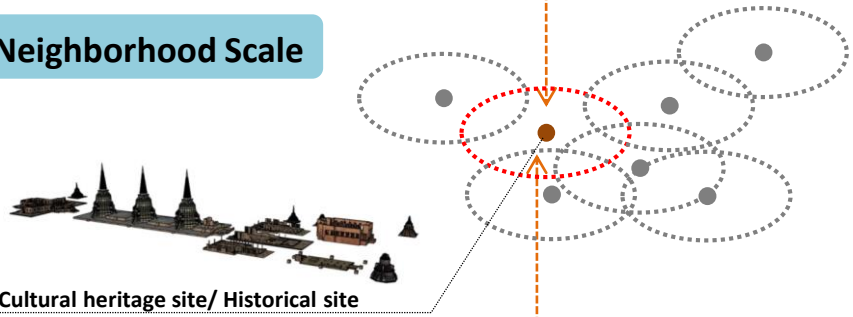
Integrated assessment to support urban and local scale for decision making

Urban Scale



- Altitude or elevation (m) MSL,
- Drainage system & soil,
- Density of resident,
- Distance to main river (m),
- Distance to hydrology (m),
- Slope (degrees) and
- Distance to road (m).

Local Neighborhood Scale



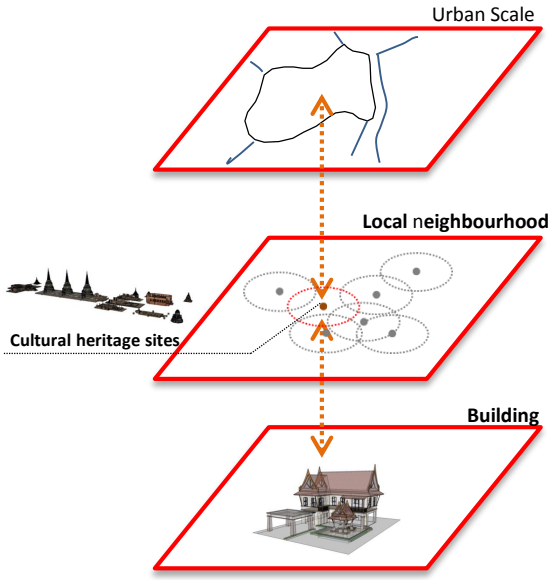
Cultural heritage site/ Historical site

- Characteristics of morphology type
- Safe areas
- Community measures
- Flood conveyance, canal
- Flood Defences: local earth banks
- Wetland and environmental buffers
- Architecture Design Measures

Building Scale

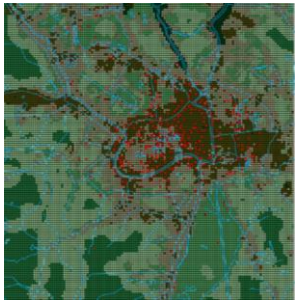
- Architecture Design Measures

Integrated assessment to support urban and local scale for decision making



Urban Scale

urban morphology factors → Classification



Urban Morphology cluster

Type of Urban Morphology

OUTPUT

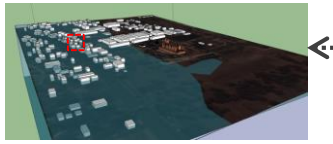
Contribute

- Decision making for urban scale
- Land use plan
- Urban flood zone

GIS based
SketchUp
(PCH) Plug-in tool

Integrated
Based on type of Urban Morphology

Local neighbourhood



Neighbourhood in urban morphology

Building scale in Neighbourhood

OUTPUT

Contribute

- Decision making for neighbourhood scale
- Decision making for building
- Architecture design measures

Characteristic of urban morphology types

Urban Scale

Initial Cluster Centers

	Cluster					
	1	2	3	4	5	6
REGR factor score 1 for analysis 1	1.5613	-1.42349	0.72573	-1.35122	3.7063	2.26678
REGR factor score 2 for analysis 1	2.74114	1.05186	-1.02699	-3.22952	-0.80152	6.28772

Iteration History

Iteration	Change in Cluster Centers					
	1	2	3	4	5	6
1	0.7	0.826	0.666	1.39	1.207	1.251
2	0.658	0.046	0.036	0.368	0.467	0.377
3	0.459	0.052	0.028	0.185	0.22	0.289
4	0.301	0.065	0.007	0.1	0.113	0.288
5	0.195	0.063	0.011	0.053	0.047	0.246
6	0.111	0.055	0.019	0.029	0.016	0.07
7	0.068	0.047	0.021	0.013	0	0.03
8	0.044	0.036	0.022	0.009	0.008	0.026
9	0.038	0.033	0.02	0.008	0.013	0.006
10	0.032	0.029	0.018	0.007	0.014	0.019

a. Iterations stopped because the maximum number of iterations was performed. Iterations failed to converge. The maximum absolute coordinate change for any center is .031. The current iteration is 10. The minimum distance between initial centers is 2.989.

Final Cluster Centers

	Cluster					
	1	2	3	4	5	6
REGR factor score 1 for analysis 1	-0.53583	-0.59799	0.39881	-0.85364	2.02064	1.51776
REGR factor score 2 for analysis 1	1.5159	0.25484	-0.46985	-1.22137	-0.16797	3.84271

ANOVA

	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
REGR factor score 1 for analysis 1	3018.686		0.207	19034	14560	0
REGR factor score 2 for analysis 1	3087.28	5	0.189	19034	16310	0

The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

Number of Cases in each Cluster

Cluster	1	2620
	2	5580
	3	5704
	4	2709
	5	2177
	6	250
Valid		19040
Missing		0

Characteristic of urban morphology types

Characteristic of Urban morphology types	Grid 0.90 x 0.90 (m.)	Cultural Heritage Sites		
		Registered of Cultural Heritage	Listed of Cultural Heritage	Total
Cluster 1	2620	71	191	**270**
Cluster 2	5580	30	149	**179**
Cluster 3	5704	1	11	**12**
Cluster 4	2709	4	20	**24**
Cluster 5	2177	0	1	**1**
Cluster 6	250	1	2	**3**
Grand Total	**19040**	**115**	**374**	**489**

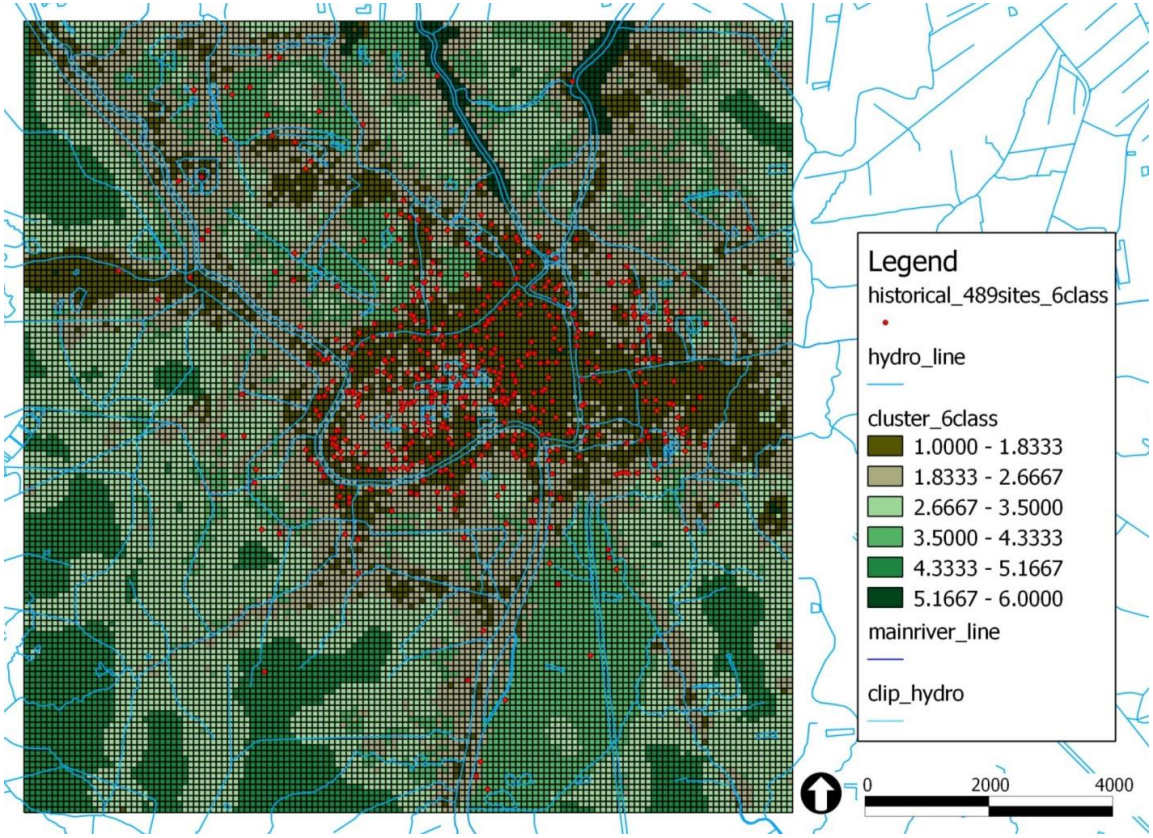


Fig. Characteristic of urban morphology types and cultural heritage sites[Author,2013].

Characteristic of urban morphology factors

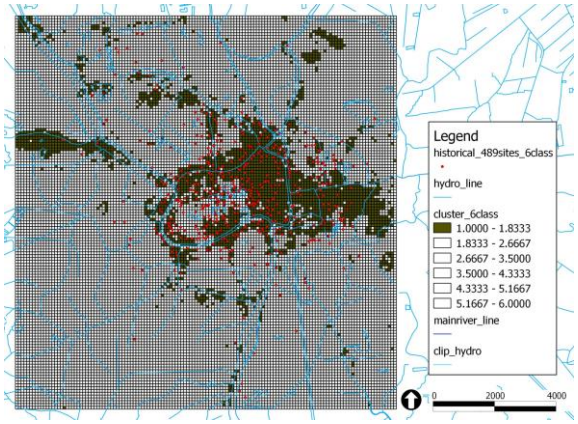
(a) altitude or elevation (m) MSL,
(b) drainage system & soil,
(c) Density of resident,
(d) Distance to main river (m),
(e) Distance to hydrology (m),
(f) Slope (degrees) and
(g) Distance to road (m).

These seven factors are employed as indicators for setting the priorities of vulnerability damage sites.

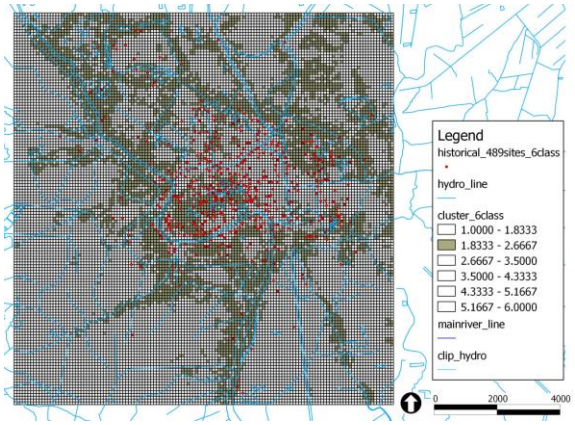
- Found 6 characteristic of UMT

Characteristic of urban morphology types

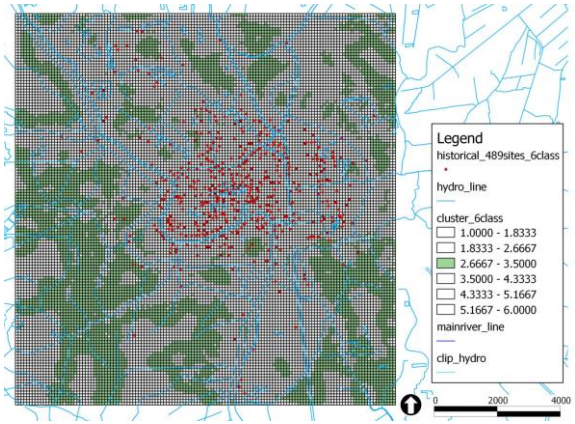
(a) Cluster 1



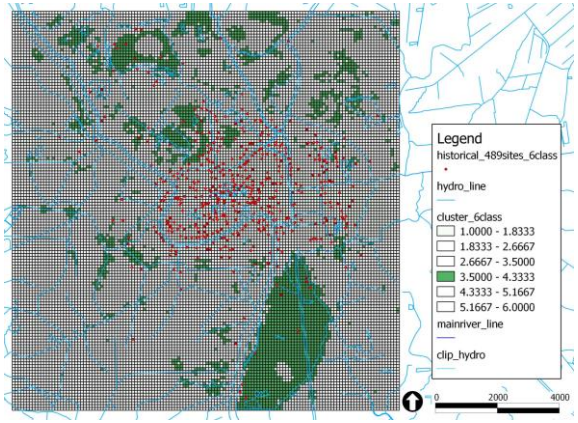
(b) Cluster 2



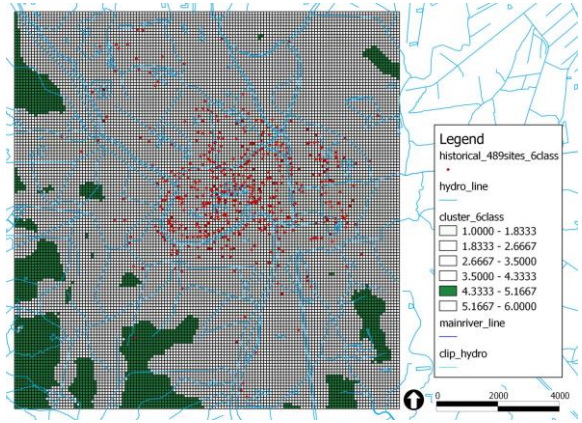
(c) Cluster 3



(d) Cluster 4



(e) Cluster 5



(f) Cluster 6

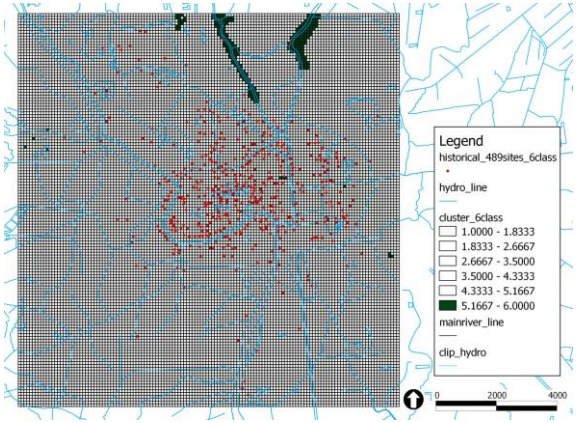
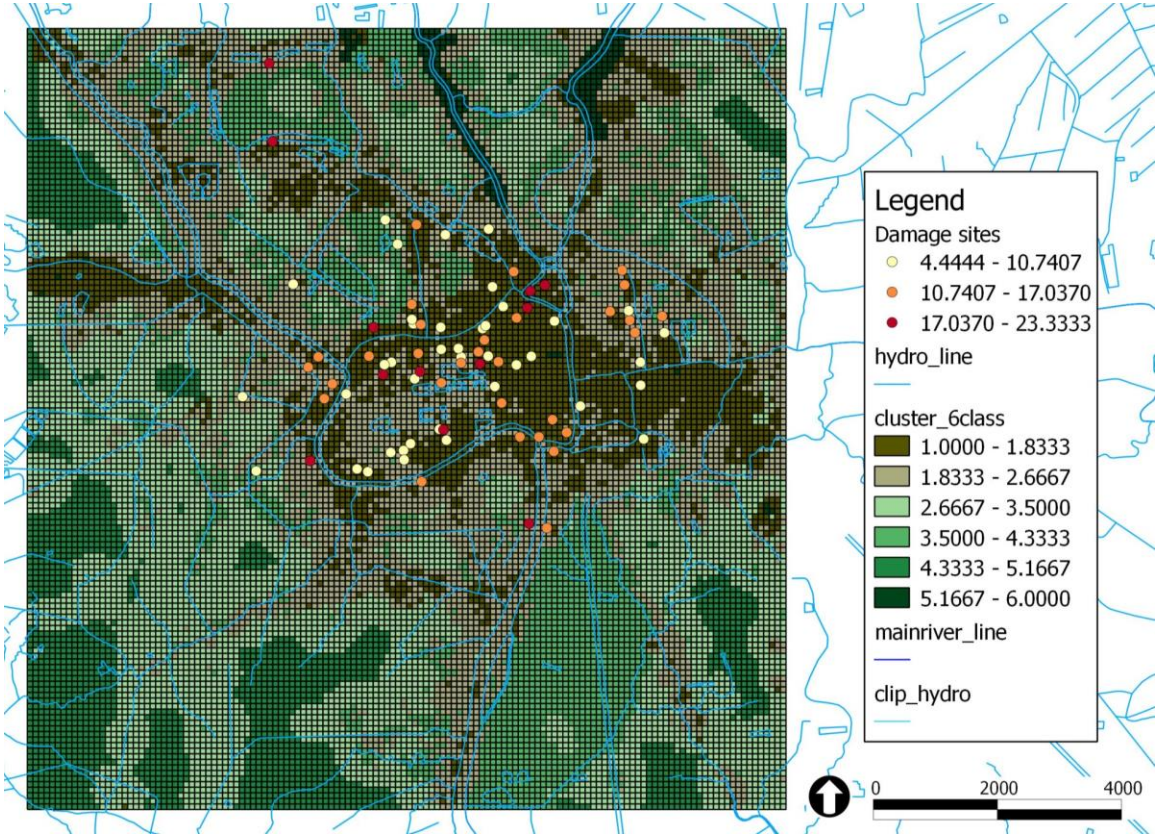


Fig. Characteristic of morphology property types in Ayutthaya. [Author,2013]

Characteristic of urban morphology types and cultural heritage damage sites.

Characteristic of Urban morphology types	Cultural Heritage Damage Sites			
	High damage sites	Medium damage sites	Low damage sites	Total
Cluster 1	9	19	32	**60**
Cluster 2	3	11	8	**22**
Cluster 3	0	0	1	**1**
Cluster 4	0	0	1	**1**
Cluster 5	0	0	0	**0**
Cluster 6	0	0	0	**0**
Grand Total	**12**	**30**	**42**	**84**



- From the previous result found 84 CHS in study area were assessed as damage sites.
- Found **4 cluster of characteristic** of UMT had damage sites

Fig. Characteristic of urban morphology types and cultural heritage damage sites[Author,2013].

Integration with Spatial Information for Support Decision Makers on Cultural Heritage Distributions

Characteristic of urban morphology types

Characteristic of Urban morphology types	Grid (0.90x0.90)	Cultural Heritage Sites			Cultural Heritage Damage Sites			
		Registered of Cultural Heritage	Listed of Cultural Heritage	Total	High damage sites	Medium damage sites	Low damage sites	Total
Cluster 1	2620	71	191	**270**	9	19	32	**60**

Urban Scale

(a) Cluster 1

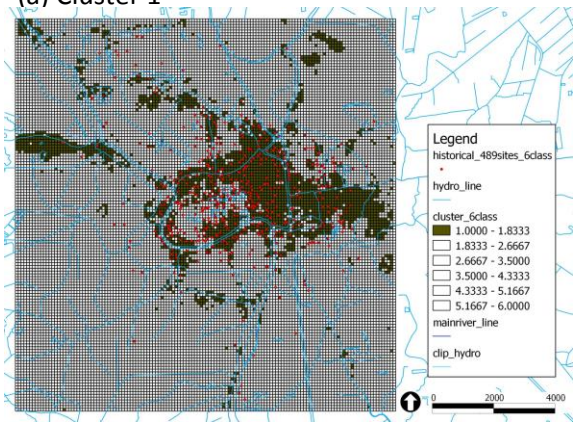


Fig. Characteristic of urban morphology type and damage sites(class 1) [Author,2013].

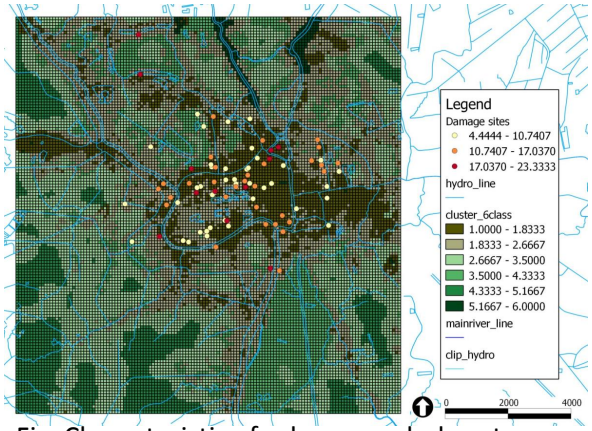


Fig. Characteristic of urban morphology type and damage sites [Author,2013].

Local Neighbourhood Scale

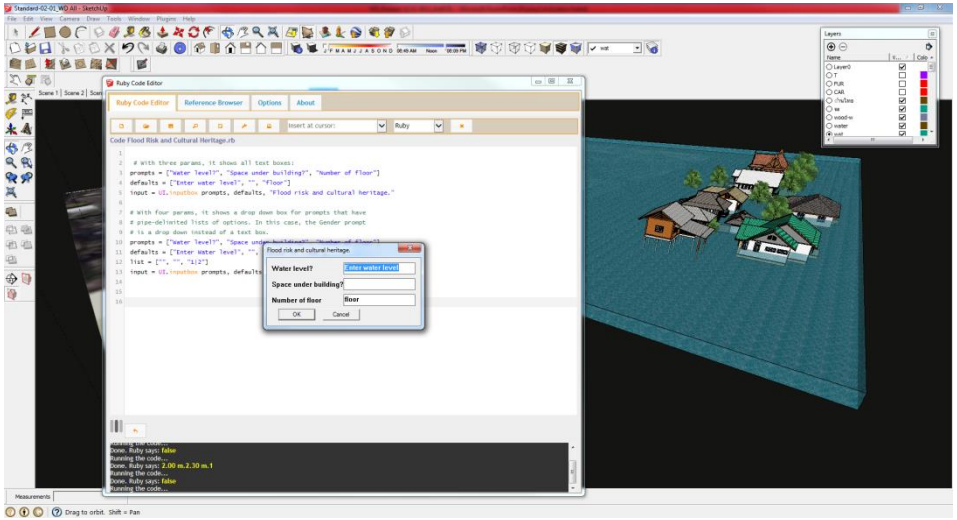
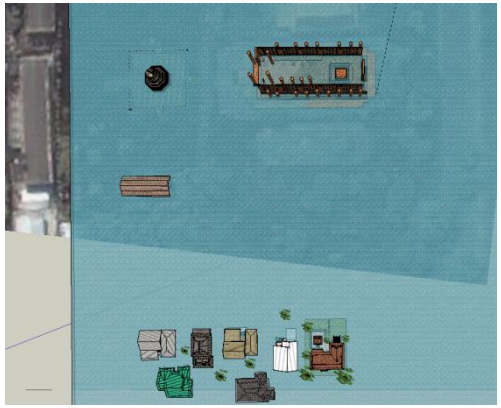
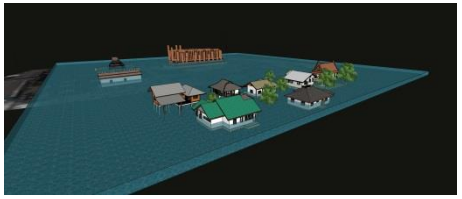


Fig. The support scheme of the PCH tool [Author,2013].





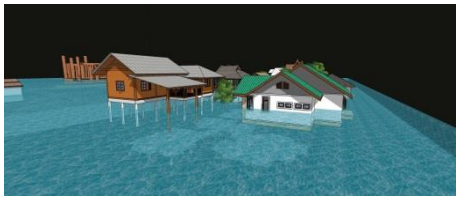


Fig. Characteristic of urban morphology type 1 (cluster 1) [Author,2013].

Integration with Spatial Information for Support Decision Makers on Cultural Heritage Distributions

Characteristic of urban morphology types

Characteristic of Urban morphology types	Grid (0.90x0.90)	Cultural Heritage Sites			Cultural Heritage Damage Sites			
		Registered of Cultural Heritage	Listed of Cultural Heritage	Total	High damage sites	Medium damage sites	Low damage sites	Total
Cluster 2	5580	30	149	**179**	3	11	8	**22**

Urban Scale

(b) Cluster 2

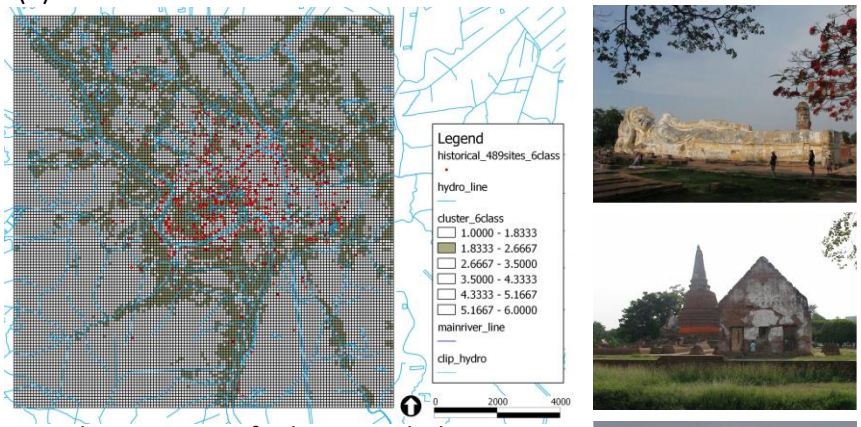


Fig. Characteristic of urban morphology type and damage sites(class 2) [Author,2013].

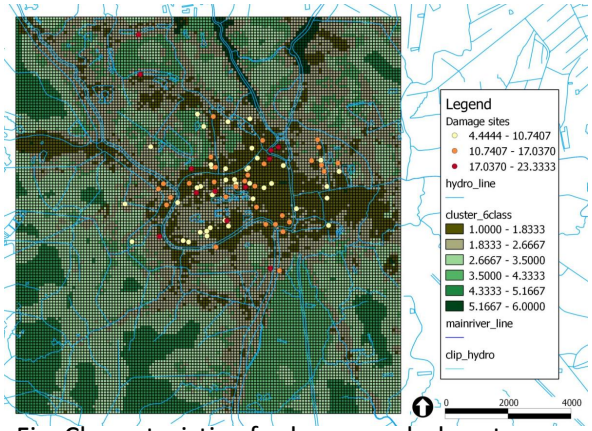


Fig. Characteristic of urban morphology type and damage sites [Author,2013].

Local Neighbourhood Scale

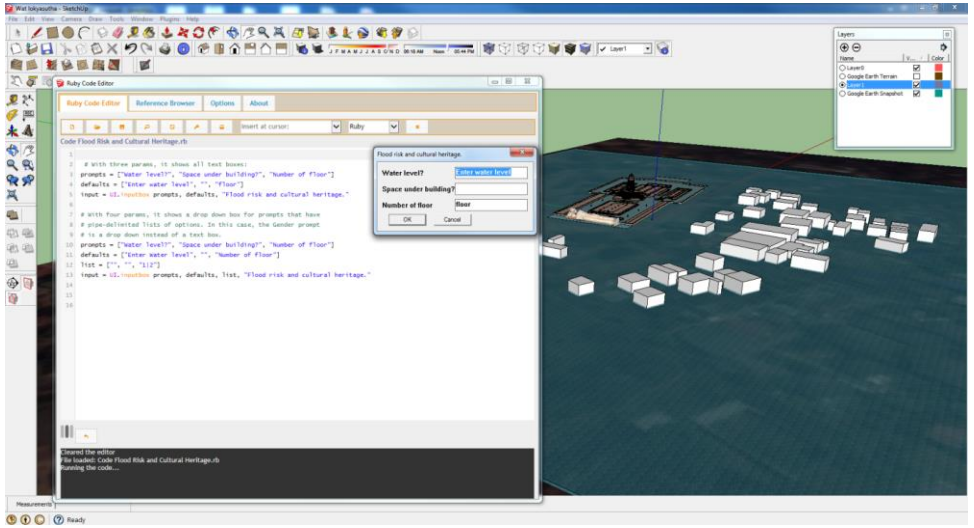
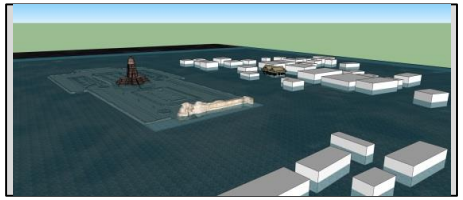


Fig. The support scheme of the PCH tool [Author,2013].



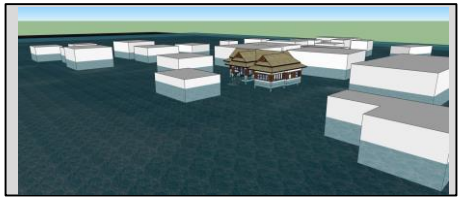


Fig. Characteristic of urban morphology type 2 (cluster 2) [Author,2013].

Integration with Spatial Information for Support Decision Makers on Cultural Heritage Distributions

Characteristic of urban morphology types

Characteristic of Urban morphology types	Grid (0.90x0.90)	Cultural Heritage Sites			Cultural Heritage Damage Sites			
		Registered of Cultural Heritage	Listed of Cultural Heritage	Total	High damage sites	Medium damage sites	Low damage sites	Total
Cluster 3	5704	1	11	**12**	0	0	1	**1**

Urban Scale

(c) Cluster 3

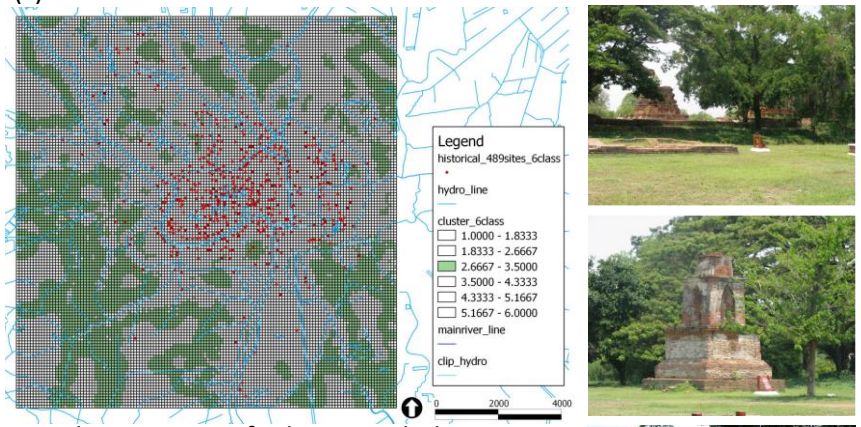


Fig. Characteristic of urban morphology type and damage sites(class 3) [Author,2013].

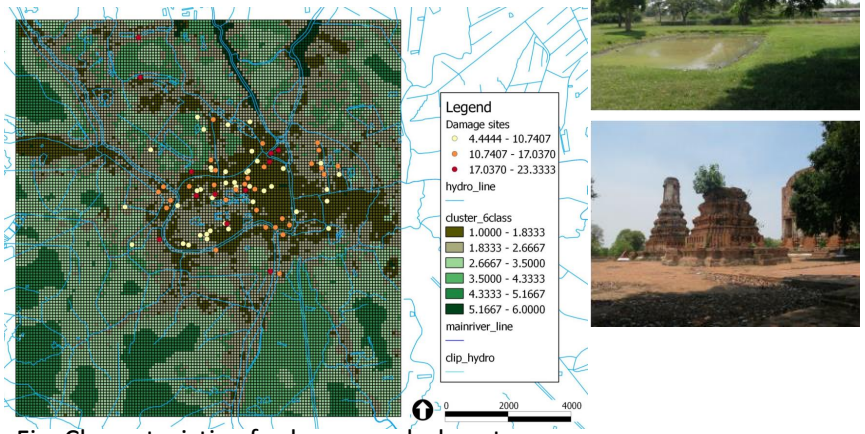


Fig. Characteristic of urban morphology type and damage sites [Author,2013].

Local Neighbourhood Scale

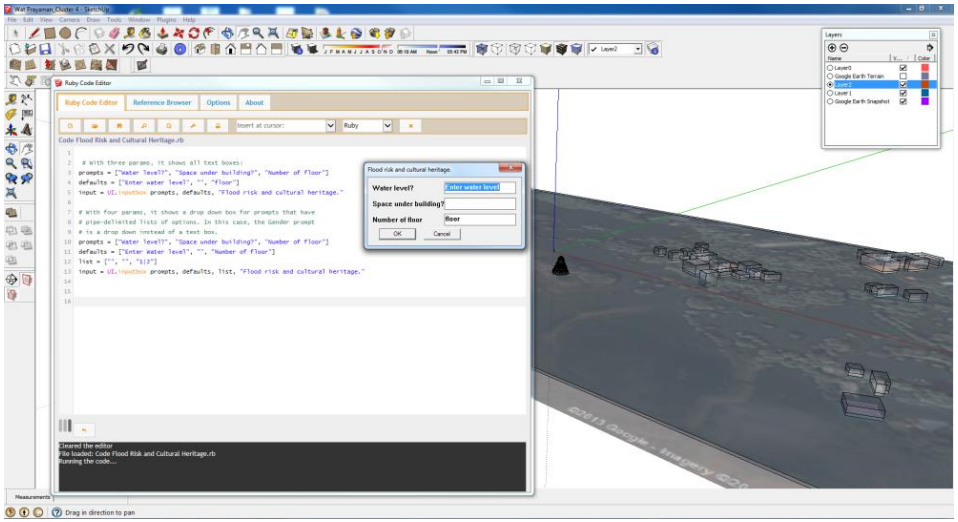
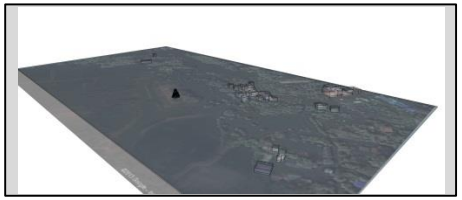


Fig. The support scheme of the PCH tool [Author,2013].



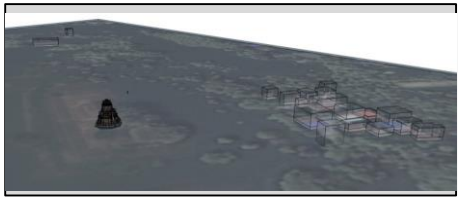


Fig. Characteristic of urban morphology type 3 (cluster 3) [Author,2013].

Integration with Spatial Information for Support Decision Makers on Cultural Heritage Distributions

Characteristic of urban morphology types

Characteristic of Urban morphology types	Grid (0.90x0.90)	Cultural Heritage Sites			Cultural Heritage Damage Sites			
		Registered of Cultural Heritage	Listed of Cultural Heritage	Total	High damage sites	Medium damage sites	Low damage sites	Total
Cluster 4	2709	4	20	**24**	0	0	1	**1**

Urban Scale

(d) Cluster 4

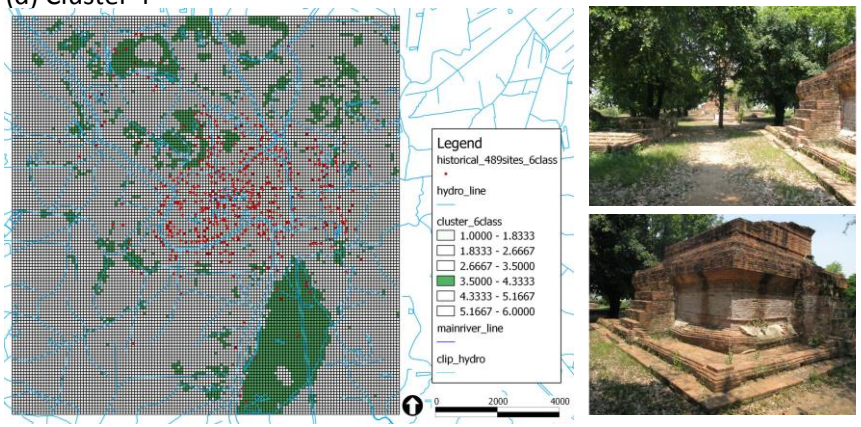


Fig. Characteristic of urban morphology type and damage sites(class 4) [Author,2013].

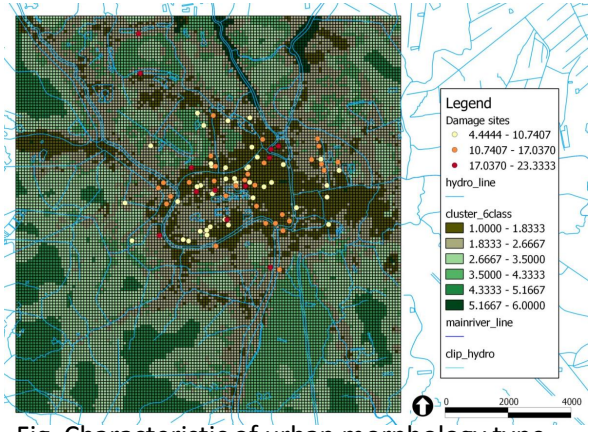


Fig. Characteristic of urban morphology type and damage sites [Author,2013].

Local Neighbourhood Scale

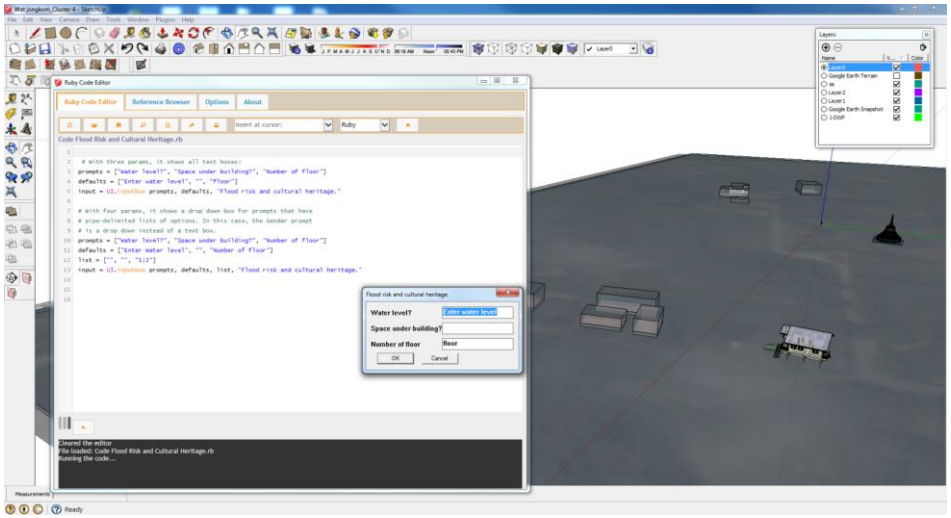


Fig. The support scheme of the PCH tool [Author,2013].

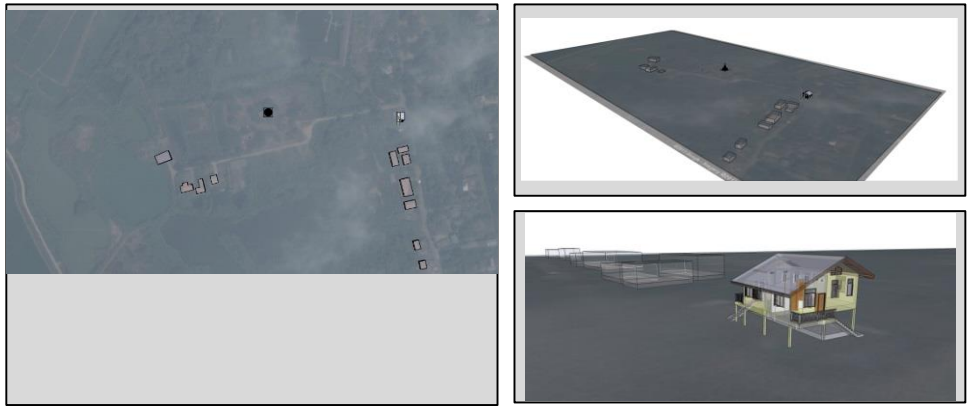


Fig. Characteristic of urban morphology type 4 (cluster 4) [Author,2013].

Hierarchical for Protect Cultural Heritage from Flood Risk.

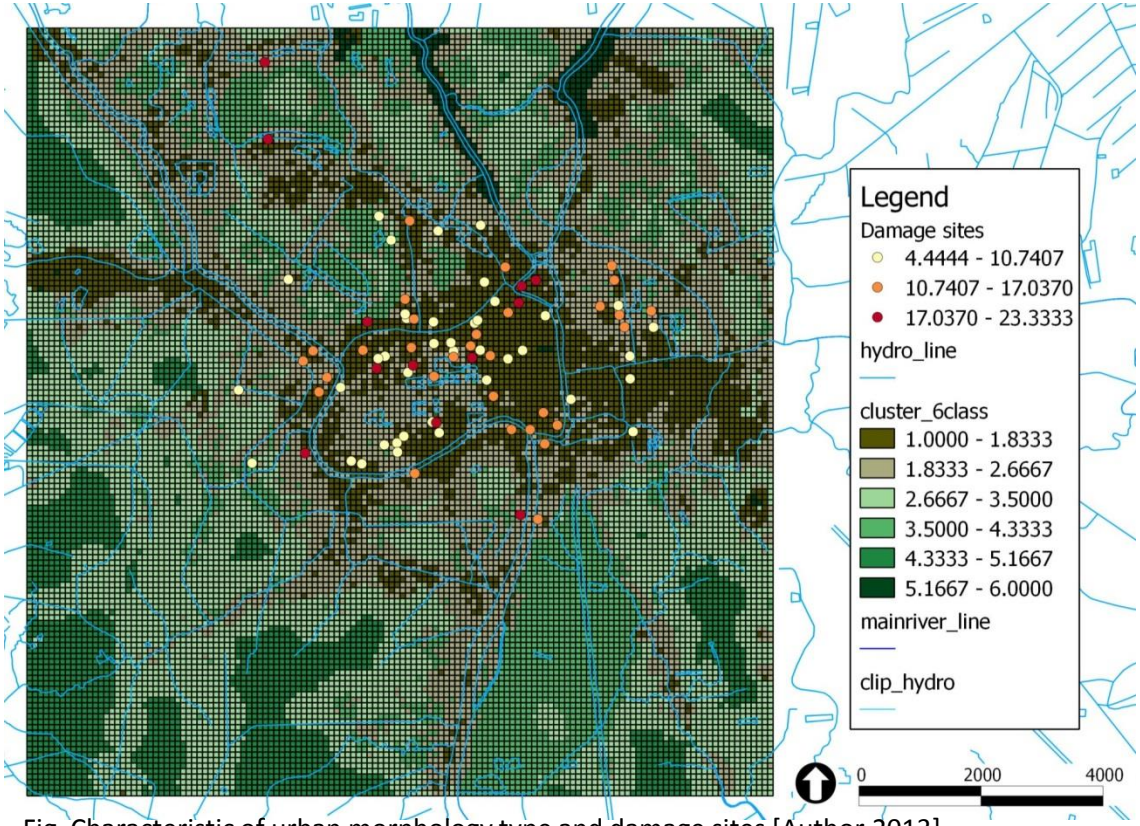


Fig. Characteristic of urban morphology type and damage sites [Author,2013].

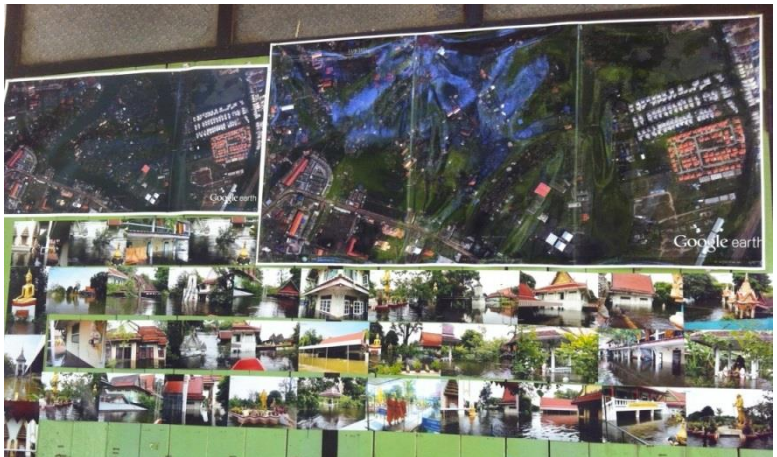
The limitations during the apply plug-in tool for priority of cultural heritage sites from flood protection, hierarchical, have high damage sites, medium damage sites and low damage sites.

The priority of cultural heritage sites from flood protection

Hierarchical 1 = Cluster 1 (60 sites)
High damage sites = 9 sites
Medium damage sites = 19 sites
Low damage sites = 60 sites

Hierarchical 2 = Cluster 2 (22 sites)
High damage sites = 3 sites
Medium damage sites = 11 sites
Low damage sites = 8 sites

Hierarchical 3 = Cluster 3,4 (2 sites)
Low damage sites = 2 sites
respectively.



The Investigate Safety and Security of Their Local Areas

Urban Scale

Scenario for Urban Scale

- Land use plan (Flood zone)
- Land use plan (Historical zone)
- Flood storage: Reservoirs, lakes
- Flood defences: location
- Flood defences: sandbags, etc.

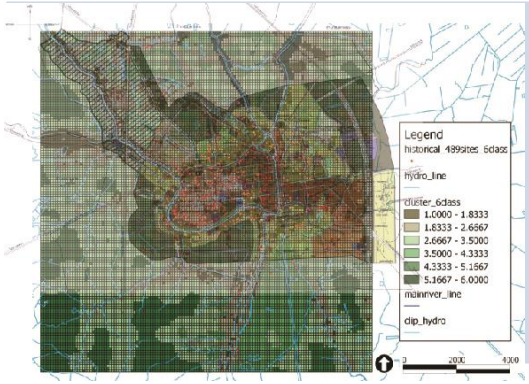


Fig. Land use plan (Flood zone)[Author,2013].

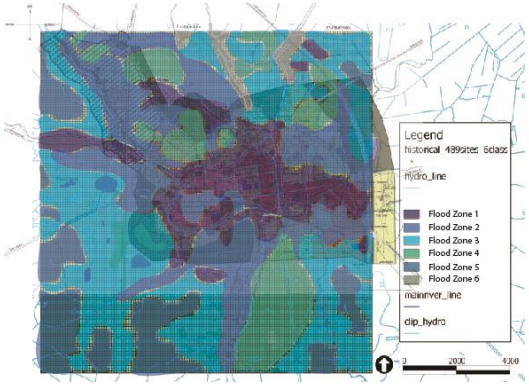


Fig. Land use plan (Flood zone)[Author,2013].

Local Neighbourhood

Scenario for Neighbourhood Scale (Before /After)

- Land use plan (Flood zone)
- Safe areas
- Community measures
- Flood conveyance
- Flood Defences: local earth banks
- Wetland and environmental buffers

Architecture Design Measures
: Elevated construction
: Flood Defence design based on desired safety levels
: Flood guards over doors
: water resistant materials
: Area for preparing the boat during a flood

Safe Havens: Bedroom at upper floor above flood level

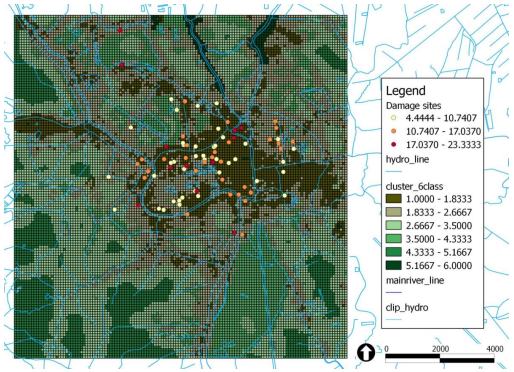
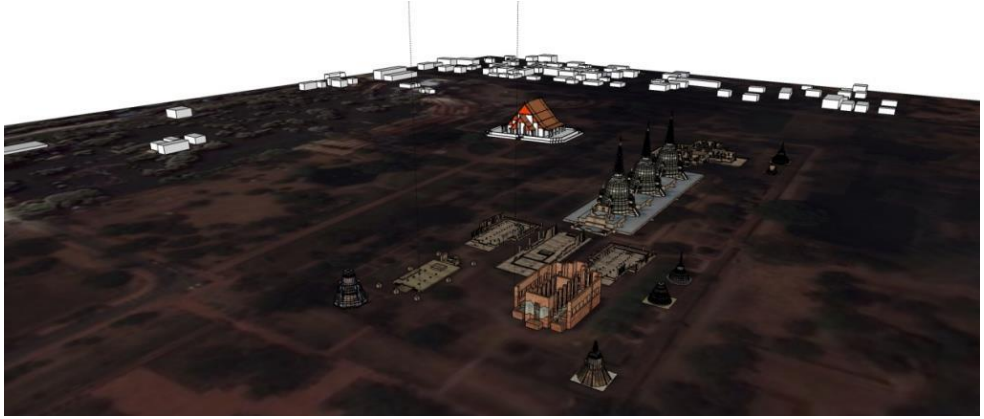


Fig. Characteristic of urban morphology type and damage sites

Master plan



perspective

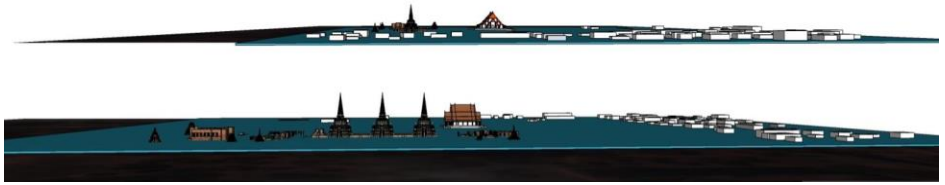
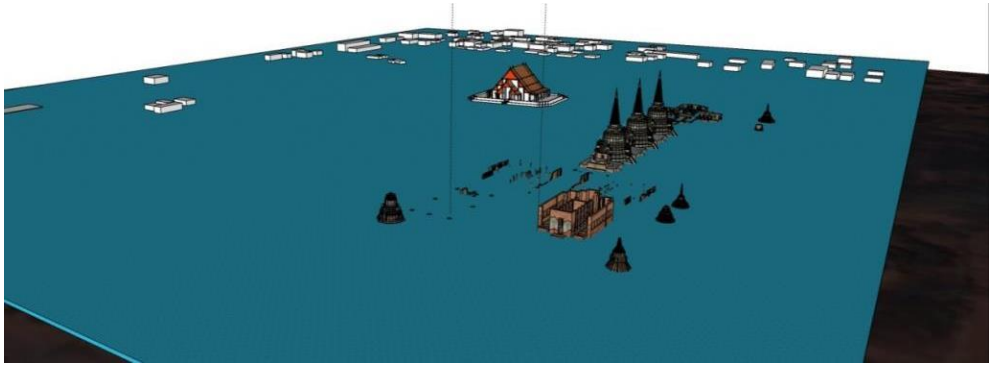


Fig. Elevation of urban morphology type 1 (cluster 1) **after** use PCH plug-in tool [Author,2013].

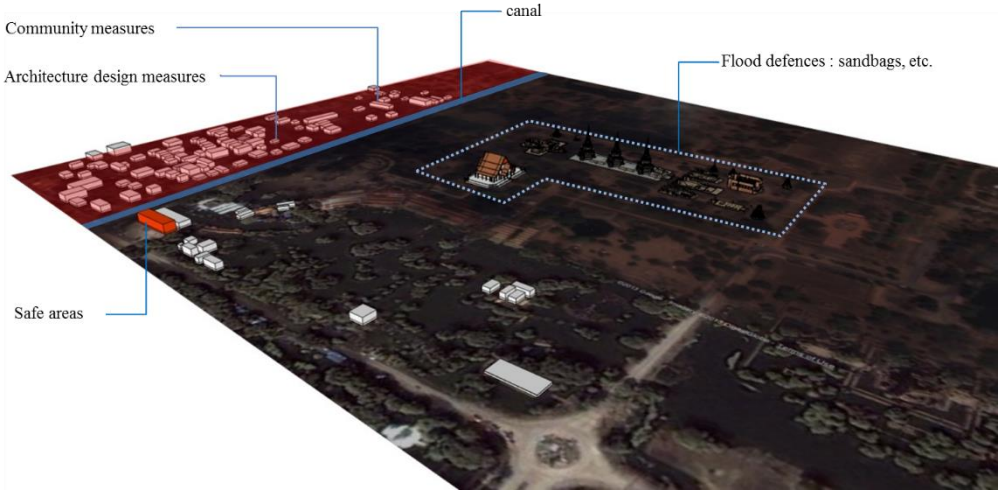
Master plan

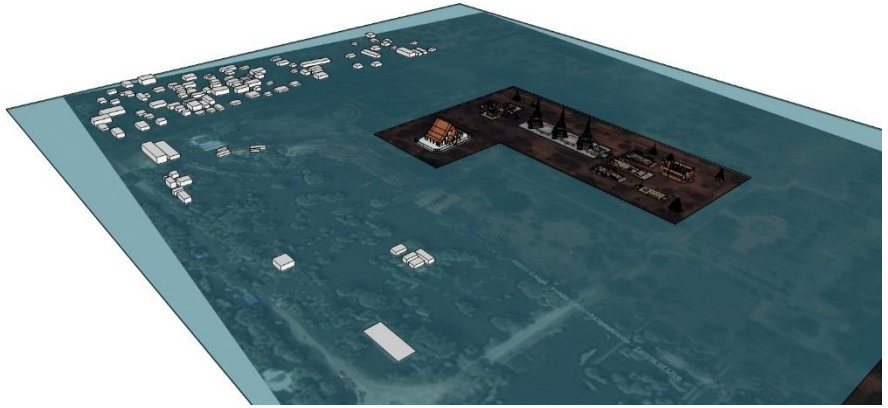


perspective

Fig. Characteristic of urban morphology type 1 (cluster 1) **after** use PCH plug-in tool [Author,2013].

Integration with Spatial Information for Support Decision Makers on Cultural Heritage Distributions

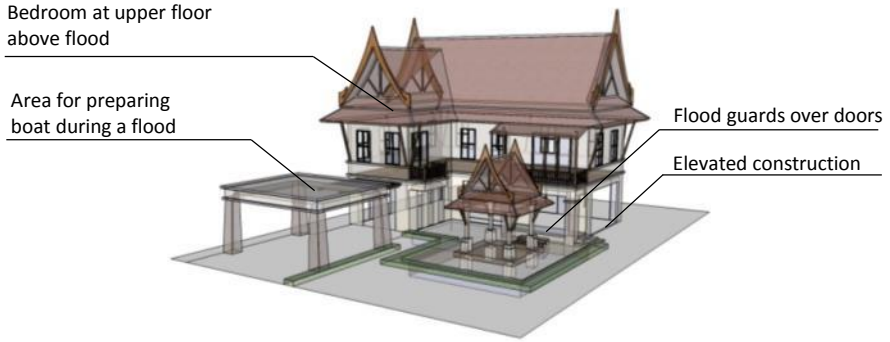




before

Fig. Architecture before Design Measures [Author,2013].

After



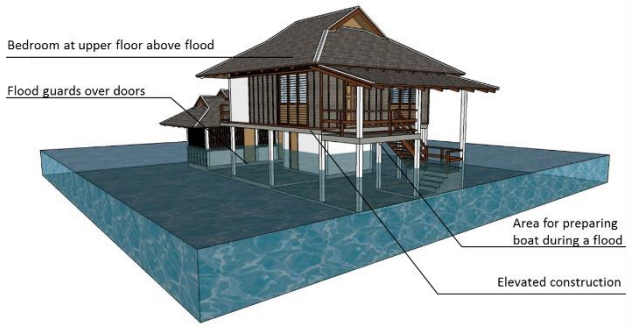


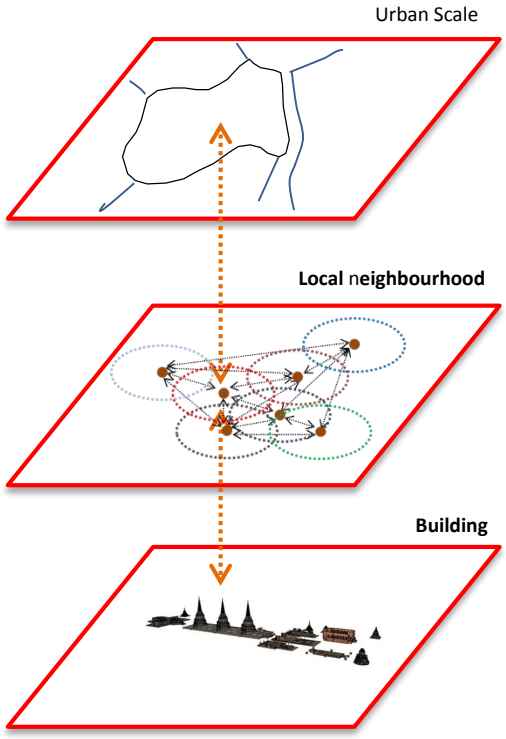
Fig. Architecture Design Measures [Author,2013].

Conclusion

The results of this study indicated that there are importance for both the composition and configuration of possible physical impact of flood disaster and field survey.

This paper expands our scientific understanding of the effects of flood disaster on urban cultural heritage and CHS. The possible physical flood impacts are quite similar to field survey of CHS.

- Characteristic of urban morphology types, it is important to assess the damages of cultural heritage sites, **found environmental damage, external damage and internal damage. The levels of damage; high risk, medium risk and low risk** respectively, are also assigned.
- The priority of cultural heritage sites from flood protection **found : Hierarchical 1 = Cluster 1 (60 sites), Hierarchical 2 = Cluster 2 (22 sites) and Hierarchical 3 = Cluster 3,4 (2 sites) respectively.**
- The investigate safety and security of their local areas **found two scale (urban and local neighbourhood)**
- Found the **difference urban morphology types and neighbourhood is difference for the investigation safety and security** of local areas



These results have important theoretical and management implications. Urban planners and Urban Architects attempting to mitigate the impact of flood disaster on CHS can gain insights into the importance of the priorities of CHS conservation and renovation.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(Maejo University, Thailand, Thailand)

has presented the paper entitled:

Concept and Practice of the Cultural Heritage Conservation after Flood Disaster: A Case Study of Ayutthaya, Thailand.

This is to confirm that Wittaya Daungthima (14024), having presented the above paper, actively participated in The Fifth Annual Asian Conference on Sustainability, Energy and the Environment, and thereby contributed to the academic success of the event.

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Chairman
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Thank you for your attention

ありがとうございます。