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CICLE XXIV

THE AUTHENTICITY IN THE EARTHEN ARCHITECTURE: A CHALLENGE FOR THE CONSERVATION

CRITICAL FACTORS, PRESERVATION TREATMENTS AND CASE STUDIES

PHD CANDIDATE
Désirée De Antoni

SUPERVISOR
Prof. Arch. Mauro Bertagnin

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To my Grandmother

"Authenticity means the sum of substantial, historically ascertained characteristics: from the original up to the current state, as an outcome of the various transformations that have occurred over time"

Cracow Charter

"The availability and economic quality of the material mean it bears great potential to contribute to poverty alleviation and sustainable development"

The WHEAP Programme

"The standard of living and culture among the world's desperately poor peasants can be raised through cooperative building, which involves a new approach to rural mass housing. There is much more in this approach than the purely technical matters that concern the architect"

Hassan Fathy, Architecture for the Poor

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Chapter One: Research Background

1.1. Preface

The dealt arguments were and are objects of debates in several studies and international conferences since many decades. In particular the thesis examines the strategies carried out by the World Heritage Earthen Architecture Programme (WHEAP), project of the World Heritage Centre of UNESCO, which is focused on the conservation of the earthen architecture.
The thesis intends to give a contribution to this varied debate. The work, in fact, wants to provide a critical synthesis of the wide theoretical measurements of the WH Centre, concerning the conservation of the earthen architecture and, contemporary, presents the results of some missions on the field, carried out by the PhD candidate.

In the past, the inadequate knowledge of the architectural earthen heritage as well as the perishability of the material, often related to poverty conditions, took to a series of misunderstandings. For these reasons the earthen architecture has been subjected to a low consideration worldwide for a long time.
Nowadays the implementation of the raw earth as construction material is still subjected to several prejudices, which consider it as a "poor" building material.
On the contrary, the earthen heritage is very wide and characterized by properties realized only with the traditional building technologies, implementing the local material, available on the site. Due to these features, the earthen architecture can be considered a great interesting heritage, born from a particular relationship between man and nature. The adaptability and the spirit of survival belongs to the man who tries to find building materials, easily available on the area, suitable for the construction of his own house, mosques or entire villages.

In the beginning of the 80ties, at the Centre Pompidou, a big exhibition called "Des Architectures De Terre" really gives its contributes to promote and ignite the interest towards a world heritage, characterized by great quality, form the architectural as well as technical point of view. The earthen heritage, in fact, presents a great variety of shapes, styles and building technologies.
Anyway, the structures in earth, as others built with different materials, are considered to be easily subjected to decay, if not realized with right building technologies, protected by appropriate solutions and cyclically maintained.
For these reasons, often, in some contexts, the local populations implement some "modern" materials as the concrete, both in new constructions as well as in the conservation treatments carried out in the existing buildings. This process can cause a lose of the local know-how as well as the traditional building technologies. In addition, an inappropriate use of these exogenous materials on the earthen structures, can decrease the durability of the buildings as well as their resistance, instead of improving these features.

Nowadays the survival of the earthen architecture is threatened by external factors, which can vary depending on the geographical areas and the climatic events.

The affecting factors are the disasters, like earthquakes and floods, the conflicts, the impact of an aggressive and unsustainable tourism etc.
These conditions determine the different approaches to the conservation of the earthen heritage carried out worldwide.
Therefore, the thesis intends hopefully to provide a clear framework, concerning several methodologies to implement in order to safeguard the earthen architecture.

1.2. Objectives

The thesis, as said above, intends to analyze the evolution of the meaning of the term "authenticity", paying particular attention to the earthen architecture and the technologies as well as the methodologies to safeguard this heritage.
Before analyzing methodologies and techniques implemented, during the conservation activities worldwide, the thesis proposes as first general objective, a critical framework of the theoretical measurements supported by the WH Centre actions, in order to safeguard all the World Heritage site and especially the earthen ones.

Other objectives concern the draft of a complex framework, regarding the technical maintenance as well as the conservation treatments carried out in the earthen architecture. These objectives are proposed, also taking inspiration from the experiences held abroad by the PhD candidate and presented in the case studies.

1.3. Methodology

The thesis follows different themes related to each other by connected arguments.
In the fist part we deeply analyze the concept of "heritage" and "conservation", which is considered the main instrument to safeguard the cultural values represented by the monuments and hold them on to the future generations.
Further the thesis focuses on the evolution of the theoretical instruments, which support the safeguarding activities, carried out for the conservation of the architectural heritage.

For this reason, we analyze the Restoration Charters and the concept of the authenticity of the heritage, presented for the first time in the Venice Charter in 1964.
After studying the Restoration Charters, we examine the new theoretical instruments, adopted in order to preserve the heritage like the Operational Guidelines of the WH Centre of UNESCO–United Nations Educational, Scientific and Cultural Organisation.
Referring to the OGs, the thesis analyzes the term "World Heritage" and subsequently the concept of "Outstanding Universal Value" which characterizes a site inscribed on the World Heritage List.
Further the analysis focuses on the criteria adopted for the inscription of a site, taking into account some earthen properties already listed on the WHL.

After studying the criteria, we concentrate on the tests of authenticity and integrity, which a monument should satisfy. We also analyze the WH Centre management and protection requirements necessary to sustain OUV of a property, also for long term too.
For what the tests of authenticity concerns, a complex study is carried out in order to investigate the meaning of the attributes, which an inscribed monument should preserve and safeguard to maintain the OUV. These attributes are well-known: form and design, materials and substance, use and function, traditions, techniques and management systems, location and setting, language, and other forms of intangible heritage, spirit and feeling and other internal and external factors.
The OGs demand that the authenticity attributes and the integrity conditions of a site are safeguarded during the time, against any kind of external threat.
For this reason, the thesis takes into account the OUV affecting factors like human actions (tourism and economic activities) and geo-climatic events (landslide, earthquakes, floods).

Further the work focuses on the test of the authenticity in the earthen sites, presenting the WHEAP Programme of the WH Centre. This programme promotes the conservation of the earthen architecture as well as the improvement of the living conditions of the populations, which live in those sites.
The term authenticity is then analyzed again but referring it to the different cultural contexts, which foresee the implementation of several conservation treatments, tied up to the local traditions.
Subsequently the thesis investigates the OUV affecting factors in relation to some earthen sites inscribed on the WHL (conflicts, urban development, pollution, climate change etc.)

At this point the attention is focused on a wider scale, considering the earthen heritage, inscribed or not present on the WHL.
The thesis investigates the OUV affecting factors related to the human actions like the construction activities and the lack of maintenance of the buildings, and the natural events (rain, snow, wind etc.).
Before analyzing and comparing different conservation methods of the earthen architecture, the work studies the general pathological framework, which attack these structures. The principal pathologies analyzed are those related to the dampness, while others concern structural defects, which characterize the earthen buildings. After defining the pathological framework, the thesis focuses on several conservation technologies as well as structural consolidation treatments.

We describe some traditional conservation methodologies and others more innovative, comparing and dividing them in three categories. The treatments concern: maintenance interventions on foundations, maintenance interventions on vertical elements (load-bearing walls and partition wall) and maintenance interventions on horizontal elements (floors and roof).

The conservation methodologies are referred to technologies, carried out by the PhD candidate in her abroad missions on the field, and to interventions found in other case studies reported in the bibliography or investigated during the stage held at the WH Centre-UNESCO, in the Africa Unit.

We provide a brief judgement for each technique, exposing some observations regarding the implementation of the treatment, which is also evaluated, considering the principles of the authenticity of material, techniques and form of a building.

In the final part of the thesis, we also propose some recommendations in order to support an appropriate maintenance and conservation of the earthen architecture, promoting the valorisation and the improvement of the traditional technologies.

The last objective of the work is therefore, to contribute to create an operational framework, able to provide a support for the technicians and the local communities, guaranteeing a long tem conservation of the traditional earthen architecture with its related values.

1.1. Premessa

Gli argomenti esaminati nella tesi sono da molti decenni oggetto di innumerevoli studi e di convegni internazionali. In particolare la ricerca prende in esame la strategia maturata dal World Heritage Earthen Architecture Programme (WHEAP), programma del Centro del Patrimonio Mondiale dell'UNESCO, deputato alla conservazione dell'architettura di terra.
La tesi intende dare un contributo a tale vasto dibattito, operando da un lato una sintesi critica sull'ampio spazio teorico promosso dal Centro del Patrimonio Mondiale, nell'ambito della conservazione del patrimonio in terra, e dall'altro presentando i risultati delle esperienze maturate dalla dottoranda in alcuni lavori svolti sul campo.

In passato, la scarsa conoscenza del patrimonio architettonico in terra cruda, la deperibilità percepita del materiale e la sua associazione a condizioni di povertà, hanno condotto ad una serie di fraintendimenti. Questi ultimi, a loro volta, hanno causato, per lungo tempo, a livello mondiale, la scarsa considerazione per l'architettura di terra.
Per tali ragioni, l'utilizzo della terra cruda come materiale da costruzione è ancora oggi soggetto ad alcuni preconcetti, che in taluni ambienti e in diversi strati sociali inducono a considerarlo come un materiale "povero".
In realtà il patrimonio in terra cruda è molto vasto e caratterizzato da opere realizzate con le sole tecniche tradizionali che sfruttano il materiale locale disponibile in loco. Queste caratteristiche lo rendono un patrimonio di grande interesse, perché frutto di un particolare rapporto dell'uomo con la natura, del suo spirito di adattamento e di sopravvivenza con la ricerca di materiali facilmente reperibili con cui costruire la propria casa, oppure una moschea o interi villaggi.

Una mostra come quella dal centro Pompidou all'inizio degli anni ottanta, ha contribuito in modo determinante a promuovere una conoscenza approfondita di un patrimonio mondiale di grande qualità, sia dal punto di vista architettonico che tecnologico. Il patrimonio in terra cruda è, infatti, caratterizzato da notevoli varietà di forme, stili e tecniche costruttive.
D'altro canto, le strutture in terra cruda, come altre concepite con diversi materiali, sono ritenute degradabili se non realizzate con corrette tecniche costruttive, protette in modo appropriato e soggette a manutenzione ciclica.
Per queste ragioni, spesso, in alcuni contesti, le popolazioni locali adottano in modo inappropriato materiali ritenuti "moderni", come ad esempio il calcestruzzo, sia nelle nuove costruzioni, sia negli interventi di conservazione di edifici esistenti. Questo meccanismo può condurre ad una perdita del saper fare locale e delle tecniche costruttive tradizionali. Inoltre un errato utilizzo di questi materiali esogeni su edifici in terra, può concorrere a diminuirne la durabilità e la resistenza, anziché aumentarle.

La sopravvivenza dell'architettura in terra è oggi minacciata da fattori esterni, che possono variare a seconda delle aree geografiche e del succedersi degli eventi. Questi fattori vanno dal cambiamento climatico, ai disastri, come i terremoti e le alluvioni,

dai conflitti all'impatto di un turismo aggressivo e non sostenibile.
Tali condizioni determinano i diversi approcci alla conservazione del patrimonio in terra a livello mondiale.
La presente tesi intende pertanto offrire auspicabilmente un chiaro panorama delle varie metodologie finalizzate alla salvaguardia dell'architettura in terra.

1.2. Obiettivi

Coerentemente con quanto sopra ricordato, questo lavoro intende analizzare l'evoluzione del significato del termine "autenticità", con particolare attenzione all'architettura in terra, alle tecniche e metodologie di salvaguardia nel tempo del patrimonio esistente e alla conservazione dell'architettura in terra a livello mondiale.
La tesi vuole proporre in prima istanza, come obiettivo di carattere generale, un quadro critico dell'apparato teorico, che supporta l'azione del Centro del Patrimonio Mondiale nella salvaguardia dei siti in generale ed in terra cruda.

Come obiettivo ulteriore, la tesi si propone di offrire un quadro complessivo sulle tecniche di intervento, sia sul piano della manutenzione, che della conservazione dell'architettura di terra. Le finalità riportate vengono perseguite anche grazie al concreto arricchimento maturato nelle esperienze effettuate all'estero, cui fanno riferimento i casi di studio che hanno visto la dottoranda protagonista di interventi sul campo.

1.3. Metodo

La tesi nella sua evoluzione procede per filoni tematici legati da argomenti interrelati tra loro.
Nella parte iniziale ci si concentra sui concetti di "patrimonio" e di "conservazione", quest'ultima considerata lo strumento principale per salvaguardare e tramandare alle generazioni future i valori culturali di cui i monumenti sono i portatori.
Successivamente la tesi effettua una disamina approfondita dell'evoluzione degli strumenti teorici che supportano l'azione di salvaguardia dei patrimoni architettonici.

Inizialmente ci si concentra sull'analisi delle Carte del Restauro e sul concetto di autenticità del patrimonio, presentato per la prima volta con la Carta di Venezia del 1964. Successivamente, vengono presi in esame nuovi strumenti teorici per preservare il patrimonio, quali le Operational Guidelines for the Implementation of the World Heritage Convention the redatte dal Centro del Patrimonio Mondiale dell'UNESCO, l'Organizzazione delle Nazioni Unite per l'Educazione, la Scienza e la Cultura.
Con riferimento alle OGs, si prende poi in considerazione la definizione del termine "Patrimonio Mondiale" per arrivare al concetto dell'"Outstanding Universal Value" (OUV), cioè il Valore Universale Eccezionale che caratterizza un sito inscritto nella Lista del Patrimonio Mondiale.

L'analisi si concentra altresì sui criteri adottati per l'iscrizione di un sito, prendendo come riferimento, alcune architetture in terra già presenti nella Lista del Patrimonio Mondiale.

Nel passo ulteriore, si pone l'attenzione al superamento dei test di autenticità e di integrità che un monumento deve soddisfare. Inoltre si indagano le richieste avanzate dal Centro del Patrimonio Mondiale riguardo alla protezione ed al mantenimento dell'OUV nel tempo.
All'inquadramento di tale valore, si accompagna l'approfondimento sugli attributi dell'autenticità che un sito deve presentare e salvaguardare per il mantenimento dell'OUV. Come noto tali attributi sono costituiti da binomi fra loro interagenti quali: concezione e forma, materiali e sostanza, uso e funzione, tradizioni, tecniche e sistemi di gestione, ambiente e contesto, linguaggio e altre forme di patrimonio immateriale, spirito ed espressione e altri fattori interni ed esterni.
Le OGs richiedono che gli attributi dell'autenticità e le condizioni d'integrità nel sito siano mantenuti nel tempo, a dispetto di ogni fattore di rischio.
La tesi pertanto prende in considerazione i fattori in grado potenzialmente di minacciare la protezione dell'OUV, quali azioni antropiche (turismo e attività economiche varie) ed eventi geo-climatici (frane, terremoti, alluvioni).

L'analisi si incentra poi sul rispetto del test dell'autenticità nei siti in terra, presentando il progetto WHEAP del Centro del Patrimonio Mondiale, che promuove la conservazione dell'architettura in terra e il miglioramento delle condizioni abitative delle popolazioni che vivono in quei siti.
In particolare, il termine autenticità viene ripreso e analizzato nuovamente, con riferimento ai diversi contesti culturali che prevedono l'utilizzo di svariate tecniche di conservazione, legate alla tradizione locale.
Vengono poi indagati i fattori di rischio che possono minacciare l'OUV, con riferimento ad alcuni siti in terra inscritti nella Lista del Patrimonio Mondiale (conflitti, sviluppo urbanistico, inquinamento, cambiamento climatico etc.).

Dopo aver analizzato il termine autenticità, riferito ai siti in terra e le cause che possono minacciarne la salvaguardia, l'attenzione si sposta su una scala più ampia, considerando il patrimonio in terra, iscritto o non presente nella Lista del Patrimonio Mondiale.
Si indagano ancora più approfonditamente i fattori che minacciano la conservazione dell'autenticità di un edificio o di un monumento in terra, in relazione alle attività dell'uomo, legate alla costruzione e alla mancanza di manutenzione degli edifici, e gli eventi naturali (pioggia, neve, vento etc.).
Successivamente, per analizzare e comparare vari metodi di conservazione dell'architettura di terra, si studia il quadro patologico generale che interessa queste strutture. L'analisi si incentra sulle patologie dovute alla presenza di umidità e ai difetti di natura strutturale che caratterizzano gli edifici in terra cruda.
In presenza dei potenziali quadri patologici evidenziati, si indagano varie tecniche di consolidamento strutturale e di conservazione.

Il metodo seguito si articola nella descrizione degli interventi legati alla tradizione e di altri più innovativi, comparati fra loro e suddivisi in tre categorie principali, che sono: tecniche per la manutenzione delle fondazioni, tecniche per la manutenzione degli elementi verticali, quali murature in terra portanti e partizioni interne e tecniche per la manutenzione degli elementi orizzontali, come solai e coperture piane o a falde. I trattamenti conservativi presentati si riferiscono sia a tecniche sperimentate concretamente dalla dottoranda durante le sue missioni sul campo svolte all'estero, che a metodologie in parte ricavate dall'analisi di altri casi di studio (i cui riferimenti sono riportati in bibliografia), in parte indagati durante il periodo di stage compiuto al Centro del Patrimonio Mondiale, nell'Unità Africa.
Per ciascun trattamento conservativo, la tesi propone riflessioni circa gli interventi indagati, presentando alcune osservazioni che riguardano la realizzazione della tecnica in se stessa ed una sua valutazione in termini di mantenimento dell'autenticità del materiale, della tecnica e della forma.

Nella parte finale, la tesi, oltre a inquadrare i vari trattamenti, commentandoli attraverso osservazioni mirate, propone alcune raccomandazioni, tese a favorire una adeguata manutenzione e una valida conservazione dell'architettura in terra, promuovendo al contempo la valorizzazione ed il miglioramento delle tecniche tradizionali.

L'obiettivo ultimo perseguito dalla tesi è perciò quello di concorrere alla costruzione di un quadro di riferimento operativo in grado di offrire supporto ai tecnici e alle comunità locali, al fine di garantire una conservazione a lungo termine sia dell'architettura di terra tradizionale che dei valori ad essa connaturati.

Chapter Two: General Theory of Restoration and New Theoretical Instruments for Preserving the Heritage

2.1. An Overview on the History of Conservation[1]

"Heritage is our legacy from the past, what we live today, and what pass on to future generations"(World Heritage Centre UNESCO).

The natural or cultural heritage belongs to the populations, of which it represents the history, the traditions and the identity.
The heritage can be considered intangible, if we speak, for example, of a typical dance playing in a particular area, or tangible, like a monument site.
In this chapter the work will focus on the heritage considered as tangible property, and in particular on the birth of the contemporary concept of conservation, considered as the main activity to carry out in order to pass on to the future, the meaningfulness of the monument and the cultural values, which represents.

2.1.1. Conserving the Heritage: A Challenge Born in the Past

During the XIXth century the restoration activities became more and more works of total, often well documented, reconstruction of the buildings.
These interventions risked making the monument lose its authenticity and consequently, its significance and value for the community.
Contemporary, on the other side, a new awareness was growing up, due to the necessity to make the restoration, a more scientific and less theoretical activity.

The necessity to safeguard the heritage and its authenticity was born in ancient time but, in the beginning, it was not really supported by public institutions or groups of specialized technicians. For this reason, the heritage conservation concept was related to the sensibility and the awareness belonging to individual subjects.
There were several opinions concerning the term of restoration.

Eugene Viollet-le-Duc[2] (1814-1879), French architect, proposed a restoration activity, which could destroy and cancel all the incoherent parts of the building, which did not belong to its original aspect. This thought was called "Stylistic Restoration".
He wrote that restoration "means to re-establish [a building] to a finished state, which may in fact never have actually existed at any given time" (Eugene Viollet-le-Duc, 1854). The lost parts should have been built in the original style of the monument. The risk to create an architectural falsification was very high.

John Ruskin[3] (1819-1900), English intellectual scholar, proposed a strictly opposite thought respect to the French one. The new position was called "Romantic Restoration". He thought that every kind of restoration activities always created an "architectural falsification". For this reason, he suggested to maintain as much as possible the monuments and not do any kind of activities on buildings, which were almost ruins. He wrote about restoration: "it means the most total destruction which a

building can suffer: a destruction out of which no remnants can be gathered: a destruction accompanied with false description of the thing destroyed" (John Ruskin, 1849).

Luca Beltrami[4] (1854-1933), Italian architect, proposed a restoration very similar to the Viollet-le-Duc one but with some additions. The new movement was called "Historical Restoration".
The construction of the integrations in the buildings should not have followed only a coherent stylistic criterion. A deep archive and a historical documentation of the monuments should have been carried out before the introduction of the lost parts.

Camillo Boito[5] (1836-1914), Italian architect, at the Third Conference of Architects and Civil Engineers of Rome in 1883, defined others criteria to explain the concept of restoration. His position, called "Philological Restoration", can be posed between the French thought of Viollet-le-Duc and the English one of John Ruskin. The new concept was seen as a kind of reconciliation between the two opposite opinions, regarding the meaning of restoration.
Boito said: "it is better to consolidate [the monuments] than repair, better to repair than restore, better to restore than to rebuild, better to rebuild than to embellish; in no case must anything be added, and above all, nothing should be removed" (Camillo Boito, 1883)
It was necessary to respect all the "transformations" carried out on the building during the time.
Every subsequent new integration should have been very distinguished to the original monument aspect, without distorting the entire complex of the property.

2.1.2. Cultural Heritage Charters and Recommendations

During the end of XIXth century and the XXth century, Charters of Restoration and several recommendations, concerning the monuments conservation, were drafted.

- The Manifesto of the Society for the Protection of Ancient Building (1877)
The first document, which took into account the importance to safeguard the monuments, can be considered **the Manifesto of The Society For The Protection Of Ancient Building** (SPAB) in 1877.
The Manifesto supported the protection of the buildings rather than their restoration. This brief message was the starting point for all the following policy statements, which adopted this cause.

- The Athens Charter (1931)
The first Charter of Restoration was the Athens Charter, drafted during **the International Conference**, organized by the International Museums Office in 1931.
The document proposed some principles in order to draft an international code of practices for the heritage restoration.
Among the principles, presented in the Charter, we can cite the proposal to avoid the complete restoration of the buildings in favour of a regular maintenance and conservation of them with all their historical integrations, implemented during the

time. For this reason the document seemed to follow the idea of restoration supported by Camillo Boito.
The Charter proposed together with the conservation of a building, the analysis and preservation of the context in which the monument sited.
It was possible to change the function of a building but only if this "transformation" would not have damaged the heritage.
The document permitted the use of modern construction materials, like concrete for the consolidation of the monuments, while for archaeological restoration, only the *anastylosis* should have been adopted.

- The Italian Charter of Restoration (1932)
In 1932 the Italian Charter of Restoration was published. The document resumed the conclusions of the Athens Charter and, at the same time, following the principles proposed by Gustavo Giovannoni[6] (1873-1947), supported the creation of a common methodology for the interventions on the monuments that meant the adoption of an official code. The position was called "Scientific Restoration".
Giovannoni was the first scholar and architect, who suggested to use every kind of modern technologies during the restoration activities. He thought that the restoration activities should have been carried out only if they were strictly necessary. The integrations of the buildings should have been easily distinguished by an external scholar. Following the Athens Charter, the document supported the theory that the preservation of a monument should have been tied to the conservation of its context.

- The Venice Charter (1964): International Charter for the Conservation and Restoration of Monuments and Sites
The Athens Charter was further superseded by the Venice Charter.
This International Charter for the Conservation of Monuments and Sites was approved during the Second International Congress of Architects and Technicians of Historic Monuments, held in Venice, from May 25th to 31st 1964. This meeting also recommended the creation of **the International Council on Monuments and Sites** (ICOMOS) (see Paragraph 2.3.1.1.), which was formed in 1965. ICOMOS is an international non-governmental organisation that promotes the preservation of the heritage.
A great contribution for the drafting of the Venice Charter was given by Italian scholars like Roberto Pane, Pietro Gazzola and Cesare Brandi[7].
Further ICOMOS adopted the standards of conservation practice of the Venice Charter and published them in 1966.
Till nowadays the Venice Charter is considered to be the most important international conservation document and represents "in all the world the official code in the field of the conservation of cultural properties" (Pietro Gazzola, 1971).

The Charter made a distinction between the concepts of **restoration** and **conservation**. The conservation activities should have been strictly related to a systematic maintenance of the heritage and its historical and physical context. A change of the function of the property was possible, trying to respect and maintain the original form of the building.
For what the concept of restoration concerns, it should have been considered as an exceptional process, implemented only when it was really indispensable.

The reconstruction activities should have been avoided, instead the *anastylosis* was approved.
For the first time the concept of **"authenticity"** of the heritage was presented. The attributes to satisfy during the preservation activities, in order to meet the authenticity of the property, were not deeply specified but the concepts of authenticity of **form**, **materials** and **setting** were shortly presented.
With the concept of authenticity of the building, conserving the heritage became an activity to carry out in order to safeguard a property, without distorting the original aspect and passing it on to the future generations.
The Venice Charter promoted the theory that the monuments should have been conserved not only as works of art but also as historical evidence.

The full text of the Venice Charter is now exposed:

"DEFINITIONS

Article 1.
The concept of a historic monument embraces not only the single architectural work but also the urban or rural setting in which is found the evidence of a particular civilization, a significant development or a historic event. This applies not only to great works of art but also to more modest works of the past which have acquired cultural significance with the passing of time.

Article 2.
The conservation and restoration of monuments must have recourse to all the sciences and techniques which can contribute to the study and safeguarding of the architectural heritage.

Article 3.
The intention in conserving and restoring monuments is to safeguard them no less as works of art than as historical evidence.

CONSERVATION

Article 4.
It is essential to the conservation of monuments that they be maintained on a permanent basis.

Article 5.
The conservation of monuments is always facilitated by making use of them for some socially useful purpose. Such use is therefore desirable but it must not change the lay-out or decoration of the building. It is within these limits only that modifications demanded by a change of function should be envisaged and may be permitted.

Article 6.
The conservation of a monument implies preserving a setting which is not out of scale. Wherever the traditional setting exists, it must be kept. No new construction, demolition or modification which would alter the relations of mass and colour must be allowed.

Article 7.
A monument is inseparable from the history to which it bears witness and from the setting in which it occurs. The moving of all or part of a monument cannot be allowed except where the safeguarding of that monument demands it or where it is justified by national or international interest of paramount importance.

Article 8.
Items of sculpture, painting or decoration which form an integral part of a monument may only be removed from it if this is the sole means of ensuring their preservation.

RESTORATION

Article 9.
The process of restoration is a highly specialized operation. Its aim is to preserve and reveal the aesthetic and historic value of the monument and is based on respect for original material and authentic documents. It must stop at the point where conjecture begins, and in this case moreover any extra work which is indispensable must be distinct from the architectural composition and must bear a contemporary stamp. The restoration in any case must be preceded and followed by an archaeological and historical study of the monument.

Article 10.
Where traditional techniques prove inadequate, the consolidation of a monument can be achieved by the use of any modern technique for conservation and construction, the efficacy of which has been shown by scientific data and proved by experience.

Article 11.
The valid contributions of all periods to the building of a monument must be respected, since unity of style is not the aim of a restoration. When a building includes the superimposed work of different periods, the revealing of the underlying state can only be justified in exceptional circumstances and when what is removed is of little interest and the material which is brought to light is of great historical, archaeological or aesthetic value, and its state of preservation good enough to justify the action. Evaluation of the importance of the elements involved and the decision as to what may be destroyed cannot rest solely on the individual in charge of the work.

Article 12.
Replacements of missing parts must integrate harmoniously with the whole, but at the same time must be distinguishable from the original so that restoration does not falsify the artistic or historic evidence.

Article 13.
Additions cannot be allowed except in so far as they do not detract from the interesting parts of the building, its traditional setting, the balance of its composition and its relation with its surroundings.

HISTORIC SITES

Article 14.

The sites of monuments must be the object of special care in order to safeguard their integrity and ensure that they are cleared and presented in a seemly manner. The work of conservation and restoration carried out in such places should be inspired by the principles set forth in the foregoing articles.

EXCAVATIONS

Article 15.

Excavations should be carried out in accordance with scientific standards and the recommendation defining international principles to be applied in the case of archaeological excavation adopted by UNESCO in 1956.
Ruins must be maintained and measures necessary for the permanent conservation and protection of architectural features and of objects discovered must be taken. Furthermore, every means must be taken to facilitate the understanding of the monument and to reveal it without ever distorting its meaning.
All reconstruction work should however be ruled out "a priori". Only anastylosis, that is to say, the reassembling of existing but dismembered parts can be permitted. The material used for integration should always be recognizable and its use should be the least that will ensure the conservation of a monument and the reinstatement of its form.

PUBLICATION

Article 16.

In all works of preservation, restoration or excavation, there should always be precise documentation in the form of analytical and critical reports, illustrated with drawings and photographs. Every stage of the work of clearing, consolidation, rearrangement and integration, as well as technical and formal features identified during the course of the work, should be included. This record should be placed in the archives of a public institution and made available to research workers. It is recommended that the report should be published.

The following persons took part in the work of the Committee for drafting the International Charter for the Conservation and Restoration of Monuments:

Piero Gazzola (Italy), Chairman Raymond Lemaire (Belgium), Reporter José Bassegoda-Nonell (Spain), Luis Benavente (Portugal), Djurdje Boskovic (Yugoslavia), Hiroshi Daifuku (UNESCO), P.L. de Vrieze (Netherlands), Harald Langberg (Denmark), Mario Matteucci (Italy), Jean Merlet (France), Carlos Flores Marini (Mexico), Roberto Pane (Italy), S.C.J. Pavel (Czechoslovakia), Paul Philippot (ICCROM), Victor Pimentel (Peru), Harold Plenderleith (ICCROM), Deoclecio Redig de Campos (Vatican), Jean Sonnier (France), Francois Sorlin (France), Eustathios Stikas (Greece), Gertrud Tripp (Austria), Jan Zachwatovicz (Poland), Mustafa S. Zbiss (Tunisia)".

The concept of the **authenticity of the setting** is often underlined in the Document. The text says that the monuments are strictly related to the urban or rural context, where they are sited. For this reason the conservation of a property "*implies*

preserving a setting which is not out of scale. Wherever the traditional setting exists, it must be kept"(art. 6).
The article 7 then specifies that the moving of parts of a monument have to be avoided in general. This methodology is allowed only in specific cases, when "*the safeguarding of the monuments demands it or where it is justified by national or international interest of paramount importance"(art. 7).*
For what the **authenticity of the form** of the heritage concerns, the Venice Charter focuses on the preservation of the relations of mass and colour of the property in its setting. New constructions, demolitions or other modifications can alter the original aspect of the heritage and its context.
If the restoration of a monument foresees the replacements of missing parts, this intervention *"must integrate harmoniously with the whole, but at the same time must be distinguishable from the original so that restoration does not falsify the artistic or historic evidence" (art. 12).*
The **authenticity of the material** is mentioned in the article 9, which underlines that a process of restoration has to be based on respect for original material, which was implemented to build the monument.

- The Italian Charter of Restoration (1972)
The Italian Charter of Restoration, drafted by Pietro Romanelli, Alfredo Barbacci e Cesare Brandi, was adopted in Italy in 1972.
The document was deeply inspired by the volume "Restoration Theory" written by Cesare Brandi in 1963. The book contained lessons and papers written by Brandi during his work at the Central Institute for Restoration, funded by himself in Rome in 1939.
The Italian Charter underlined the distinction between the safeguard of the buildings and their restoration. The first concept was related to the conservation activities, which did not concern a direct intervention on the built properties, but a kind of preventive maintenance. The second concept, instead, concerned the activities carried out directly on the building in order to maintain its efficiency.
The document underlined again the distinction between authentic parts and integrations of a building, remembering to conserve most possible the original state of the property. The Charter, always following the focal points of the precedent documents, focused on a division among different kind of restoration, providing instructions for their implementations. The four kinds of restorations were: archaeological, architectural, pictorial and sculptural.

- Declaration of Amsterdam (1975)
In 1975, during **the Congress on the European Architectural Heritage**, the Declaration of Amsterdam was drafted.
The document underlined the importance to safeguard the European architectural heritage, conserving it, developing a wide cooperation with the populations.
Another focal point of the Declaration supported the integration of the conservation activities into the urban and regional planning process.

- The Nara Document on Authenticity (1994)
The Nara Conference on Authenticity in Relation to the World Heritage Convention was held at Nara in Japan, in 1994. During the conference, the Nara Document on Authenticity was drafted.

The Document followed the principles of the Venice Charter but it provided a review of the definition of "authenticity", which is nowadays internationally adopted.
This theme will be subsequently developed in Chapter three.

- The Charter of Cracow (2000)
This Charter of Restoration was drafted in Cracow, during **the International Conference on Conservation "Krakow 2000"**, by the members of the Plenary Session "Cultural Heritage as the Foundation of the Development of Civilisation".
This Charter was deeply tied to the Venice Charter and followed all its principles for the conservation and restoration of the buildings.
The document deeply exposed the concept of architectural **"heritage"**, referring it to the monuments as well as to the whole historic centres.
The Charter of Cracow distinguished the conservation interventions on the architectural, urban and landscape heritage in: **environmental control, maintenance, repair, restoration, renovation and rehabilitation**.
In relation to that, the paragraph "Aims and Methods" of the Charter of Cracow is exposed below.

*"**1.** The architectural, urban and landscape heritage, as well as artefacts, are the result of an identification with various associated moments in history and social-cultural contexts. The conservation of this heritage is our aim. **Conservation** can be realised by different types of interventions such as environmental control, maintenance, repair, restoration, renovation and rehabilitation. Any intervention implies decisions, selections and responsibilities related to the complete heritage, also to those parts that may not have a specific meaning today, but might have one in the future.*

***2. Maintenance and repairs** are a fundamental part of the process of heritage conservation. These actions have to be organised with systematic research, inspection, control, monitoring and testing. Possible decay has to be foreseen and reported on, and appropriate preventive measures have to be taken.*

***3.** The **conservation of built heritage** is implemented by **the project of restoration**, including the strategy to conserve in the long term. This `restoration project` should be based on a range of appropriate technical options and prepared in a cognitive process of gathering knowledge and understanding of the building or site. This may include traditional and subsequent new materials, structural investigations, graphical and dimensional analysis and the identification of historical, artistic and socio-cultural significance. All pertinent disciplines have to participate in the restoration project and the co-ordination should be carried out by a person qualified and well trained in conservation and restoration.*

***4.** The **reconstruction** of entire parts 'in the style of the building' should be avoided. Reconstruction of very small parts having architectural significance can be acceptable as an exception on condition that it is based on precise and indisputable documentation.*
If necessary, for a proper use of the building, completion of more extensive spatial and functional parts should reflect contemporary architecture. Reconstruction of an

entire building, destroyed by armed conflict or natural disaster, is only acceptable if there are exceptional social or cultural motives that are related to the identity of the entire community".

2.2. From the Concept of Restoration to the Concept of Conservation

After the study of the Charters of Restoration, we can say that the concept of restoration has been changed during the time.
The discussion about restoration between Viollet-le-Duc with its "Stylistic Restoration" and John Ruskin with its "Romantic Restoration", seemed to make the interest grow about the concept and the safeguard of authenticity of the heritage.
The first proposed to build the monument integrations following the original style of the property, in order to bring it back to its original and pure aspect.
On the contrary, the second thought that "Stylistic Restoration" risked to create architectural falsification.

Camillo Boito tried to find a reconciliation between these opposite positions, proposing a "Philological Restoration". This idea of restoration was further the base of the Athens Charter, which promoted the preventive conservation of the monuments, rather than their complete restoration.
In 1932 Giovannoni with the Italian Charter of Restoration finally supported the drafting of a standard code of the interventions on the monuments and analyzed the problem related to the concepts "original" and "copy". Following the Camillo's idea of restoration, Giovannoni promoted the maintenance activities to be carried out with all modern building technologies and materials.

In 1964 the Venice Charter made a distinction between conservation and restoration: the first, concerned cyclical protection activities of the monuments and their contexts, while the second was considered like an exceptional event to carry out only for "emergency cases", such as all those totally destroyed properties (see Appendix 1 for definitions of conservation, maintenance, preservation, restoration, reconstruction).
The term of authenticity was expressed for the first time in the Venice Charter. The text did not provide a deep explanation or some guidelines to respect, during the interventions, in order to safeguard the authenticity of a monument. On the other side, it is important to underline that the concepts of authenticity of form, materials and setting were there mentioned.

2.3. New Recommendations for Safeguarding the Heritage

2.3.1. The UNESCO: World Heritage Centre and the Operational Guidelines

The United Nations Educational, Scientific and Cultural Organisation (UNESCO) was founded in 1947. UNESCO has now 193 **Member States** and 7 **Associate Members**. Most of the Member States have Permanent Delegation to

UNESCO.
Italy, together with Afghanistan, Austria, Argentina, El Salvador, Islamic Republic of Iran, Iraq and Hungary, became Member in 1948.

UNESCO is a specialized agency of the United Nations, which promotes the building of pace, the respect of the human rights, the fight against poverty, the sustainable development and the intercultural dialogue among the different civilizations. In order to sustain the realization of these goals, UNESCO supports several objectives concerning five major programs: education, natural sciences, social and human sciences, culture, and communication and information.

United Nations
Educational, Scientific and
Cultural Organization

Fig. 2.1. The UNESCO logo

The responsible for the preservation of the movable and immovable heritage, is the **Culture Sector** of UNESCO.
We can highlight the main objectives of the Culture Sector in five lines of action:

- *"Protecting and conserving immovable, cultural and natural properties;*
- *Safeguarding living heritage;*
- *Enhancing the protection of cultural objects, the fight against their illicit traffic and the development of museums;*
- *Protecting and promoting the diversity of cultural expressions and the development of cultural and creative industries;*
- *Integrating intercultural dialogue and cultural diversity into national policies"* (Culture Sector, UNESCO).

In this work we focus on the first line of action of Culture Sector, the protection of immovable cultural heritage, which is carried out through the effective implementation of the **Convention Concerning the Protection of the World Cultural and Natural Heritage**, adopted by UNESCO in 1972.
Since 1992 a specialized part of the Culture Sector, called the **World Heritage Centre** (WH Centre), is in charge to the management of the Convention among all the **States Parties**, which adhere.

2.3.1.1. The World Heritage Centre at UNESCO

The WH Centre is internationally considered the focal Agency for the "identification, protection and preservation of cultural and natural heritage around the World considered to be of outstanding value to humanity"[8] (WH Centre-UNESCO, 2008).

PATRIMONIO MUNDIAL · WORLD HERITAGE · PATRIMOINE MONDIAL

Fig. 2.2. The WH Centre logo

The WH Centre carries out lots of activities.
The Centre supports the countries to sign **the World Heritage Convention** (WH Convention). In November 2011,

188 States Parties have ratified the WH Convention.
The WH Centre provides technical assistance to the States Parties for the conservation of the sites, holding also professional training for the local populations in order to involve the inhabitants in the preserving activities and to improve their awareness of the heritage that they own.
The assistance concerns also the sites **in immediate danger caused by conflicts, climatic events etc.**
The Agency provides its assistance to the States Parties, organizing every two years the **General Assembly** and each year the **World Heritage Committee** (WH Committee). During the General Assembly, which includes all States Parties to the Convention, the members of the WH Committee are elected.
The WH Committee is composed by 21 States Parties, which can stay in charge for six years. It is important to underline that most of the States Parties choose to reduce their period of term of office, to four years, in order to give the opportunity to other States Parties to become Members of the Committee.
The 21 States Parties of the current WH Committee are: Algeria, Cambodia, Colombia, Estonia, Ethiopia, France, Germany, India, Iraq, Japan, Malaysia, Mali, Mexico, Qatar, Russian Federation, Senegal, Serbia, South Africa, Switzerland, Thailand, United Arab Emirates.
The last ordinary sessions of the WH Committee took place in Paris (France), from June 19th to 29th 2011. It was the 35th session.
The WH Committee decides about these main activities:

- the implementation of the WH Convention,
- the use and allocation of the World Heritage Fund, analysing the requests of the States Parties,
- the inscription of a cultural, natural or mixed (cultural and natural) sites on the **World Heritage List** (WHL) or on the **List of World Heritage in Danger** (WHLD) or even the definitive deletion of those properties.
- the adoption of the **State of Conservation** (SOC) of the inscribed sites and the **Periodic Reporting**[9].

For what concerns the WHL, the sites currently inscribed are 936 properties, which are considered to have an **Outstanding Universal Value**[10] (OUV): 725 cultural, 183 natural and 28 mixed properties in 153 States Parties.
A site proposed by a State Party for the inscription on the WHL, has to be submitted for a long and deep process of evaluations, leaded by IUCN and ICOMOS, two of the Advisory Bodies (ABs). Further the WH Centre checks for the completeness of the information provided.
The ABs are three international non-governmental or intergovernmental organizations:

– **the International Union for the Conservation of Nature** (IUCN) is an international, non-governmental organization, which was founded in 1948.
IUCN evaluates **the natural and mixed properties** proposed for inscription on the WHL. These evaluations are exposed and provided to the WH Committee;

Fig. 2.3. The IUCN logo

– **the International Council on Monuments and Sites** (ICOMOS) is an international, non-governmental organization founded in 1965, after the Venice Charter, in order to promote and support the conservation of the heritage.

Fig. 2.4. The ICOMOS logo

ICOMOS evaluates properties with **cultural and mixed values, which** are proposed for inscription on the WHL. ICOMOS has also a principal role, regarding the adoption of the **State of Conservation** (SOC) of the inscribed sites. These evaluations are exposed and provided to the WH Committee, which decides to adopt or not them.

– **the International Centre for the Study of the Preservation and Restoration of Cultural Property** (ICCROM) is an intergovernmental body, founded in 1956.
ICCROM provides its technical support during the conservation and restoration activities carried out on the nominated sites. It promotes also training courses for the protection of the properties, teaching and comparing the techniques.

Fig. 2.5. The ICCROM logo

For what the **Periodic Reportings** concerns, ICCROM, ICOMOS and IUCN work together, strictly in relation with the WH Centre. The ABs and the WH Centre evaluate the documentation provided by the States Parties and draft the final paper to provide to the WH Committee for the adoption.

For what said above, it is fundamental to evaluate if the heritage is adequately protected and conserved or some elements, like human activities, the lack of maintenance of the site, the climate change, etc. can threaten the authenticity of the property.
The evaluation and protection of the sites as well as the concept of Outstanding Universal Value will be deeply explained in the subsequent chapters.

2.3.1.2. The Operational Guidelines for the Implementation of the World Heritage Convention

The WH Committee supports the conservation of the properties, providing international assistance under the World Heritage Fund, but on the other side, revises, modifies and approves **the Operational Guidelines for the Implementation of the World Heritage Convention** (OGs), which should be followed by the States Parties. The last and most recent version goes back to 2011.

The OGs provides all the criteria to inscribe a property on the WHL and what it is requested after the nomination, concerning for example the protection management plan of the site, which should be guaranteed in the future.
For this reason the evaluation of the SOC of an inscribed site is very important. The WH Committee approves or does not approves the SOC and makes recommendations to the State Party in order to improve the State of Conservation of the site.
If the Committee considers that the OUV of the site is potentially threatened, it can decide to put it on the WHLD. When the OUV is definitely lost, the Committee could decide to delist the property.

If a site is put on the WHLD, it means that the protection of the property needs "major operations (…) and for which assistance has been requested" (World Heritage Convention, 1972). Most of the sites, belonging to the WHLD, are, in fact, subjected to armed conflicts, earthquakes, uncontrolled tourism development etc.

Notes Chapter Two

1. For more information concerning the history of conservation: Jukka Jokilehto (1986 and recomposed in PDF format in February 2005). *A History of Architectural Conservation. The Contribution of English, French, German and Italian Thought towards an International Approach to the Conservation of Cultural Properties*. D.Phil Thesis. The University of York, England. Institute of Advanced Architectural Studies.

2. Eugene Viollet-le-Duc, architect, was born in Paris in 1814 and died in Lausanne (Switzerland) in 1879. Its concept of restoration was called "Stylistic Restoration".

3. John Ruskin, art critic, was born in London in 1819 and died in Brantwood (Coniston, Great Britain) in 1900. He proposed the concept of "Romantic Restoration".

4. Luca Beltrami, architect, was born in Milan in 1854 and died in Rome in 1933. He was one of the greatest representatives of the "historical restoration".

5. Camillo Boito, architect, was born in Rome and died in Milan in 1914. He tried to reconcile the conflict between the Eugene Viollet-le-Duc and John Ruskin about the concept of restoration.

6. Gustavo Giovannoni, architectural historian, architect, urban planner and engineer, was born in Rome in 1873 and died in Rome in 1947. Its position was called "Scientific Restoration".

7. Cesare Brandi, art critic and historian, specialist in conservation-restoration theory, was born in Siena (Italy) in 1906 and died in Vignano (Italy) in 1988. His book "Restoration Theory" was the base for drafting the Italian Charter of Restoration in 1972.

8. WH Centre UNESCO (2008). Mission Statement. In: Information Kit, pag.3.

9. Every six years the State Party has to send the Periodic Reporting to the WH Centre, which will further subjected it to the WH Committee for the evaluation. The document consists of a report on the legislative as well as administrative actions adopted by the State Party in order to implement the guidelines of the WH Convention. The Periodic Reporting also presents the state of conservation of each property inscribed on the WHL.

10. A State Party should demonstrate that a property has an Outstanding Universal Value in order to propose the site for the nomination on the WHL. OUV means that the site presents exceptional characteristics, which should be of great significance for the local population to which it belongs, as well as for the entire world.

Chapter Three: World Heritage: the Concept of the "Outstanding Universal Value"

3.1. Definition of World Heritage

The OGs of WH Centre-UNESCO provide a definition of World Heritage.
Under the category of "cultural heritage" we can find **monuments** and **groups of buildings** "which are of Outstanding Universal Value from the point of view of history, art or science"; **sites** "which are of Outstanding Universal Value from the historical, aesthetic, ethnological or anthropological points of view"[1].

Under the category of "natural heritage" we can find **natural features** "which are of Outstanding Universal Value from the aesthetic or scientific point of view"; **natural sites or precisely delineated natural areas**, which are "of Outstanding Universal Value from the point of view of science, conservation or natural beauty"[2].

The concept of "**Outstanding Universal Value**"[3] is very discussed because people in different countries and in different periods subject it to various interpretations. Analyzing the OGs of 1977, "the term "Universal" must therefore be interpreted as referring to a property which is highly representative of the culture of which it forms part"[4].
A monument has its own cultural value for a society, which considers it very significant for many complex reasons.
On the other side, the same monument that is considered valuable for a society is not necessarily important or precious for another.
For this reason, to determine the "OUV" of a property, several debates rise among the members of the Word Heritage Committee during the evaluations and selection of the sites to inscribe on WHL.

A lot of carefulness is predisposed to avoid an excessive increase of the number of sites inscribed on the WHL and the WH Committee also aims to have a balanced representation of the different natural and cultural heritages present in various parts of the World, but not yet well represented on the List.

In 1994 *A Global Strategy for a Balanced, Representative and Credible World Heritage List* is adopted with the aim to use a thematic approach to analyze cultural and natural properties that "best represent particular themes."
This way making, the WHL lengthens, embodying properties that are "representative of the best" rather that "best of the best", this is the opinion of Christina Cameron[5]. Besides she sets some matters, concerning the new thematic approach for the identification and selection of the sites to be inserted on the List. First of all she sets a doubt on the fact that a property, which may be considered "representative of the best" instead to be "best of the best", posses an "OUV". Secondly she hopes that "in the context of "representative of the best", the ABs and the Committee manage to keep the bar high enough to retain the World Heritage cachet" (Cameron C., 2006).

The attribution of "OUV" is in fact a peculiar characteristic of a Word Heritage. For example, a monument may be amazing and in a very good state of conservation but it is not enough. The property should demonstrate to have value not only at the local level but also for people all over the word.
Therefore the "OUV" cannot belong to each monument or sites; hence they should be deeply analyzed and interpreted with attention.

In 2005, for the first time, the OGs give a definition of "Outstanding Universal Value", which is still valid nowadays: "Outstanding Universal Value means cultural and/or natural significance, which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity. As such, the permanent protection of this heritage is of the highest importance to the international community as a whole"[6].
The intention of the Committee is not "to ensure the protection of all properties of great interest, importance or value, but only for a select list of the most outstanding of these from an international viewpoint. It is not to be assumed that a property of national and/or regional importance will automatically be inscribed on the World Heritage List"[7].
It is important to underline that possessing "OUV" for a monument is really significant because this characteristic may let a work of art be inscribed on the World Heritage List.
There are some helpful criteria, which can be followed for the inscription of properties on the WHL. The following set of criteria is taken from the revised OGs published in November 2011[8]. The cultural properties and the natural sites should:

(i) represent a masterpiece of human creative genius;
(ii) exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design;
(iii) bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared;
(iv) be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history;
(v) be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change;
(vi) be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance. (The Committee considers that this criterion should preferably be used in conjunction with other criteria);
(vii) contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance;
(viii) be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the

development of landforms, or significant geomorphic or physiographic features;

(ix) be outstanding examples representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals;

(x) contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

From 1977 to nowadays, the definitions of each criteria has been changed several times. For this reason in order to propose a site for the inscription, it is necessary to follow the last version of the OGs, studying the appropriate criteria, which may be met by the property. For example the criteria (iii) in 1977 quested that the site should "be unique, extremely rare, or of great antiquity", while the final version of the same criteria, drawn up in 2008, says that the property should "bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared". For more details about the criteria modifications during the time, see Appendix 2.

Until the 2002 OGs, the first six criteria were referred only to cultural properties, while the second last criteria to natural sites. Further the 6th Extraordinary Session of the Word Heritage Committee, taken place on March 17th 2003, decided to merge all those ten criteria mentioned above, in order to underline the numberless interactions between the cultural and the natural places. Sites, where human masterpieces are fused with the environment[9], are called "mixed" and considered of Outstanding Universal Cultural and Natural Value.

For what said above, a property can be deemed of "OUV" necessarily if it meets one or more of these criteria. Subsequently the property must meet other conditions: overcoming the test of **authenticity** for cultural properties and the test of **integrity** for cultural and natural sites[10]. Besides the cultural properties and natural sites must have "**an adequate protection and management system to ensure**" their **"safeguarding"**[11]. It means that the OUV of a property, together with its conditions of integrity and/or authenticity should be maintained in the future (Fig. 3.1).

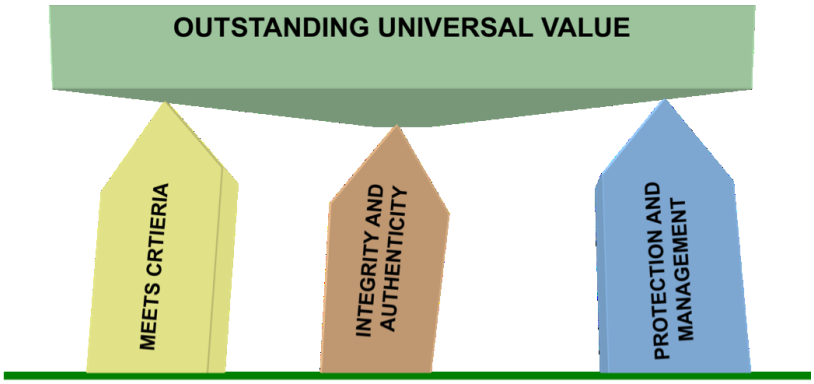


Fig. 3.1. The three pillars of the Outstanding Universal Value

3.2. The Draft of the Nomination Document

The potential OUV of a site should be already demonstrated for sites belonging to the Tentative List but for the nominations on the WHL, a more detailed work is requested.

3.2.1. The Tentative List

Each State Party submits a **Tentative List** to WH Centre. This list should be an inventory of properties, proposed for future nominations and considered to be of Outstanding Universal Value. The State Party should draft this Tentative List in strictly relation with a great variety of stakeholders, like site managers, local communities, regional governments, ONGs etc. If this list does not take into account the opinions of all interested parties of a site, it might create discord in the inhabitants.

This probably happened in the **Aeolian Islands**, in Italy, inscribed as natural site in 2000. The WH Committee approved the nomination of the site but underlined the importance of safeguarding the geological and volcanic aspects of all the seven islands Lipari, Vulcano, Panarea, Alicudi, Filicudi, Stromboli and Salina.
For these reasons the famous pumice caves in Lipari (Fig. 3.2) should have been shut down. The Aeolian Islands representatives guaranteed that the following year the work of extraction would have been closed.
Nowadays, the extraction activities are still carried out, supported by lots of inhabitants, who are afraid of loosing their jobs and, for this reason, they stand firmly against the closure of the caves. If the pumice caves will not be closed, the Aeolian Islands risk to be delisted of the WHL, because the authenticity of the landscape is threatened.

Fig. 3.2. Lipari (Italy), the pumice caves

3.2.2. The Contents of the Nomination Document

If a State Party[12] would propose a property for the inscription on the WHL, it should prepare the overall **nomination document**.
This document aims at describing the main characteristics of the site, underling the values and the attributes.
The examination of the values has to take into account the opinion of the stakeholders, which are the inhabitants of the site. Then "once the values are identified, the aim of management becomes the conservation through policy and action" (Marta de la Torre, 2001).
In the Resource Manual "Preparing World Heritage Nominations" the WH Centre, the ABs and other related contributors underline that "a good knowledge and understanding of the property and its condition are essential to identifying its potential outstanding universal value and the attributes that convey this value"[13].

The nomination dossier consists of several sections.
The identification of the property is an important part of the nomination document. The State Party has to define precisely the location of the site and its boundaries, in order to clarify the area subjected to the cultural and natural criteria and related values. The study of the boundaries and the **buffer zone** of the site allows to understand if the area, which the State Party would like to protect, should be or not extended in order to preserve the property from the uncontrolled urban development, agricultural expansion, tourism facilities etc.
A description of the property and its history are also presented in the nomination document. The site is described at the time of nomination and the text should report all the significant features of the property.
Another section of the document is **the justification for inscription**, which explains the importance of the property, without focusing on criteria.
The criteria under which inscription is proposed, are exposed in another part of the nomination document. The State Party should provide a justification concerning each criterion, which the property meets (see Paragraph 3.1.).
A **global comparative analysis** is carried out in order to avoid the possibility that WH-properties or other sites, which might be nominated in the future, have similar values respect to the one proposed for the inscription. This document is also part of the nomination dossier. For what the cultural sites concerns, the analysis focuses on properties belonging to the same geo-cultural area, while for the natural sites, the area is considered globally. It can happen that there is no possibility to compare a site to another nominated one. In this case the aim of the comparative analysis is to demonstrate the OUV of that property in that specific context, not its uniqueness. A nominated site can be similar to other properties for attributes and values but it should be seen as the best exemplar or representative. For this reason, in the analysis, the results of the test of authenticity and integrity of a property are really important, because they can make the difference during the comparison among the sites: some of them can present different levels of authenticity and integrity. Often the Global Comparative Analysis is developed by a group of experts composed by national and international specialists, nominated from the State Party.

Further the nomination document has to provide the results of the tests of **authenticity** and **integrity** and **the state of conservation of the property**, exposing potential OUV affecting factors, like the development pressure as well as the unsustainable tourism.
The document has also to provide **the protection and management** plan of the property as required by the World Heritage Convention. These protective measures are necessary to sustain the OUV of the property, also in the long-term future.
In order to provide a clear imagine of the property, the State Party can provide a wide **documentation** related to the site. It consists in pictures, slides etc.
The proposed **Statement of Outstanding Universal Value**[14] (SOUV) is also a part of the nomination document. It can be considered as a summary of the previous parts of the overall dossier. The SOUV presents a brief state of the property, providing information and qualities and focusing on the values and criteria that may apply to the site. It also provides the requirements for protection and management necessary to maintain the potential OUV.

When the nomination document is completed, is evaluated by ICOMOS and/or IUCN. ICOMOS for cultural sites and IUCN for natural properties take technical missions on the sites in order to examine their possible OUV, considering boundaries, authenticity, integrity and management.
The OUV is also evaluated by other examiners who do not take part to the mission, but read the documents and give a written assessment. Finally, ICOMOS and IUCN give a final recommendation of OUV and all other aspects through the work of a panel of experts that meets for this purpose.

Subsequently the nomination dossier, concerning a specific site, is inserted in a Working Document for the Committee, which decides to inscribe, refer or defer that property. Before the vote of the Committee, the ABs explain their evaluation of the site. In order to carry out this task, ICOMOS and IUCN follow a clear check box tool, deeply based on the requirements for nominations in the OGs (Tab. 3.1).

The evaluation and recommendations of the ABs are very important and should be taken into account by the States Parties during the Committee decisions and for future evaluation processes.

When a site is inscribed on the WHL, all requirements of the OGs are met, in case of a referred proposal, the OUV is demonstrated but the State Party has one year of time to repurpose the site for the nomination, adding some supplementary or improved information materials.
If the nomination is deferred, OUV of that site is not demonstrated but the property can be repurposed for the nominations after two years, with the inclusion of lots of new needed information, attributes and/or a substantial revision of all data in order to justify the SOUV. In this case, a new technical mission on site, held by the ABs, IUCN and ICOMOS, is also required. During this time the States Parties can also analyze the boundaries of the sites and enlarge the area to inscribe.
The last option, which the Committee can adopt, is not to inscribe a site.

During the examination of nominations of natural, mixed and cultural properties on the WHL, the Committee also examines: extension of boundaries of sites already inscribed, re-nomination of WHL properties under additional criteria and clearly the nominations referred and deferred by previous sessions of the Committee.

It is important to underline that the States Parties members of the Committee, during the evaluation, can change and vote the nomination criteria for the sites and the ABs' proposals to refer, defer or not inscribe a property. It can also happen that ICOMOS and IUCN do not agree on the evaluation of a mixed site.

For example, during the 35th Committee the State Party Ethiopia repurposed the nomination of **"Konso Cultural Landscape"**, which was referred by the 34th Committee.
In 2011 the property was proposed for the inscription as cultural sites under the criteria (iii), (v) and (vi). ICOMOS suggested to defer the nomination but after several discussions and vote, the site was inscribed on WHL under the criteria (iii), (v)[15].

Fig. 3.3. Konso cultural landscape in Ethiopia

Another example concerns the mixed site of "Saloum Delta" in Senegal. The criteria proposed by the State Party were (iii), (iv), (v), (vii) and (x). ICOMOS suggested to inscribe it on the WHL under the cultural criteria (iii), (iv) and (v), while IUCN decided not to inscribe the property under the natural criteria (v) and (vii) (see Appendix 3). The Committee voted and inscribed the site as only cultural property under the criteria (iii), (iv), (v).

Fig. 3.4. Saloum Delta (Senegal), fishermen villages

Table 3.1. ICOMOS and IUCN* Evaluations

Comparative analysis	Integrity	Authenticity	Criteria	Selection justified (series)	Boundaries	Protection property	Protection buffer zone	Conservation	Management	Threats addressed	Mission required	Conclusion
√	√	√	√	√	√	√	√	≈	≈	≈	**No**	**Inscription**
√	√	√	√	√	≈	X	X	≈	≈	≈	**No**	**Referral**
√	√	√	√	√	X	X	X	X	X	X	**Yes**	**Deferral**
O	√	√	O	√							**Yes**	**Deferral**
O	O	O	O	O							**Yes**	**Deferral**
X	X	X	X	X							-	**No inscription**

√	OK - Good
≈	Adequate - Can be improved
O	Not demonstrated at this stage
X	Not OK - Not adequate

The grid does not give all possible combinations, but only the lowest benchmarks below which a nomination moves to another category.
This tool is to be used jointly with the table summarizing the ICOMOS recommendations.

*In IUCN evaluations table the column of the authenticity is not considered.

3.3. The Property Meets the Criteria

The selection of the criteria to define a property of OUV is a very important process. This phase in fact can prejudice the inscription of a site on the WHL. If the choice of the criteria is not appropriated, the OUV risks to be not demonstrated.
In order to explain how the criteria are adopted and justified, beneath there are three examples of cultural stone and/or earthen sites inscribed on the WHL: the Island of Mozambique in Africa, the city of Choga Zanbil in Iran and the archaeological site Chan Chan in Peru. The information is, most of all, taken from ICOMOS evaluation documents and other related contributors.

3.3.1. The Island of Mozambique

The Island of Mozambique is characterized by the presence of traditional building technologies, which use lime stone or *macuti* (palm fibres).
The buildings and the dwellings on the Island are considered an outstanding example of architecture, deriving from local traditions, Portuguese and also Indian and Arab influences, an interplay often referred to as Swahili architecture (**Criterion IV:** the site is an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history).
The Island of Mozambique bears important witness to the establishment and development of the Portuguese maritime routes between Western Europe and the Indian sub-continent and thence all of Asia (**Criterion VI:** the site is directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance).
The North of the Island is called the "Stone Town" due to the main building material. In this area, fortifications and traditional dwellings are built with the local lime stone. In some houses it is possible to observe sun dried clay bricks (adobe) used for internal partition walls. More recently the earthen bricks are substituted with cement or standard clay bricks.
The mortar mixture is often made of beach sand and lime.
In the South of the Island is situated the "Macuti Town", characterized by the typical vernacular dwellings, representing great examples of traditional earthen architecture.
The technology used to build the masonry of these typologies, is called *pau a pique*, in English also known as "wattle and daub" (Fig. 3.5.).
It consists of a wooden round poles masonry cage, filled with clay, small stones and/or shells. Then the wall is covered with different types of mortar made from clay, lime and sand and preserved with cashew-nut-shell-liquid-oil, lime plaster, cement bag wash or industrial paint. The roof structure is mostly made from mangrove round poles, coconut wood or bamboo.
The roof is covered with different kinds of plant materials from the simple grass palm leaves or straw, to the more elaborated and sophisticated vegetal "tile", the so called *macuti*, which has given name to this part of town.

Fig. 3.5. Macuti Town (Mozambique), the earthen houses are made with the wattle and daub technology while the roof is covered with palm leaves

3.3.2. Choga Zanbil

The site Choga Zanbil, located in the present-day Khuzistan province of southwestern Iran, correspond to the ancient holy city of Dur Untash, founded as a religious capital during the Elamite period by Untash-Napirisha[16] (1275-1240 BC). The city presents the Ziggurat, which is considered to be the most unique, and one of the largest holy cities of its kind, a survival from the Elamite period. Choga Zanbil is an evidence of Elamite times, which can provide extensive information about this period and culture. It is the most valuable monument left from the Middle Elamite period (**Criterion III:** the site bears a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared).
This extraordinary site has only revealed its secrets to archaeologists in recent times. The research and excavation work carried out in the course of the last 70 years have brought to light a city of exceptional historical and architectural value.
The masterpiece of the complex is the world's largest Ziggurat (was 105.20 m circumference, 53 m high, of which 25 m remain approximately), which is the last remaining one in Iran (**Criterion IV:** the site is an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history).
The complex is composed of three concentric walls inside which are arranged places and temples with, in the centre of all; the Ziggurat is located (Fig. 3.6).
For the construction of Choga Zanbil, the architects used the Near East's traditional and most readily available building material: earth.
The ensemble was, in fact, essentially built with mud brick (adobe), the Ziggurat itself consists of a mud-brick nucleus covered with a facing of fired bricks.
Traditional mud bricks were either square or rectangular.

The basic adobe ingredients were earth, straw and water and they were vigorously mixed using hands, feet and/or tools. Baked bricks were used for vaults and drainage gutters, pavements, and other architectural and decorative features.
Some of baked bricks were, in fact, covered with a blue or green glaze while others were inscribed by hand with cuneiform characters and in the Elamite language.

Fig. 3.6. The great Ziggurat of Choga Zanbil (Iran) is in adobe

3.3.3. Chan Chan Archaeological Zone

The Chimu Kingdom, with Chan Chan as its capital, reaches its apogee in the 15th century.
In about 1470, after a long war, the Inca Tupac Yupanqui takes King Minchancaman in captivity to Cuzco. The king's son, Chumun Caur, governs the Kingdom of the North, thereafter weakened and divided, on behalf of the Inca. Some 60 years later, the Spanish conquistadores, favourably welcome by the Chimus out of hate for the Incas, found a new capital, Trujillo, just 5 km from Chan Chan. Afterward the site of Chan Chan is quickly abandoned.
Chan Chan is considered the largest city of pre-Colombian America and it is an absolute masterpiece of town planning: rigorous zoning, differentiated use of inhabited space and hierarchical constructions illustrate a political and social ideal which has rarely been expressed with such clarity (**Criterion I:** the site represents a masterpiece of human creative genius).
The planning of this huge city reflects a strict political and social strategy, marked by the city's division into nine “citadels” or “palaces” forming autonomous units.
Chan Chan bears also a unique testimony to the disappeared Chimu Kingdom where eleven thousand years of cultural evolution in northern Peru are synthesized and expressed. The architectural ensemble uniquely integrated the symbolic and sacred architecture with technological knowledge and the adaptation to the native environment (**Criterion III:** the site bears a unique or at least exceptional testimony

to a cultural tradition or to a civilization which is living or which has disappeared). There is no doubt about the intrinsic quality of this cultural property.
The walls are made by earthen bricks made by a mixture of earth, dried straw and water and then covered with plaster into which intricate designs are carved. The decorations consist of raised friezes in which abstract motifs, anthropomorphic and zoomorphic subjects add to the exceptional splendour of these large arrays of ruins.
Many of the structures excavated and surveyed in the past have entirely disappeared.

Fig. 3.7. Chan Chan archaeological zone (Peru)

3.4. The Test of the Authenticity

First of all it is necessary to say that in this research, space will primarily be given to cultural properties, therefore the concept of authenticity will be deeply analyzed.

With the Venice Charter (1964) it is introduced for the first time the term **authenticity**: "The historic monuments of generations of people remain to the present day as living witnesses of their age-old traditions. People are becoming more and more conscious of the unity of human values and regard ancient monuments as a common heritage. The common responsibility to safeguard them for future generations is recognized. It is our duty to hand them on in the full richness of their authenticity."

Following the opinions of Claudio D'Amato and Paolo Marconi[17], the concept of authenticity and the related conservation problems are the consequence of a merchant society. The presence of several copies or falsifications of some works of

art is, in fact, a characteristic of this merchant context and that is why the conservation of the monuments is deeply supported.

A meaningful monument, in fact, can be handed on to the future generations, subjecting it to periodic interventions of maintenance during time. This means preserving the authenticity of cultural heritage.

The test of the authenticity considers, in fact, the original form and structure of a property but also analyzes all subsequent modifications and additions, which are important at an artistic and/or historical level.

On another side, without conservation treatments, a property risks to fall in ruin and with it, the cultural values, which it represents.
A building, in fact, not subjected for years and years to interventions of maintenance, if submitted to restoration activities, risks to be the object of very conspicuous and visible interventions, which might not safeguard its authenticity.
These concepts aim to prefer the maintenance of the monuments rather than their restoration, according to a preventive conservative methodology, that avoids drastic interventions in the future.

3.4.1. The Nara Document: a turn in the conception of the authenticity

The 1977 OGs, inspired by the Venice Charter, propose for the test of the authenticity that the monument sites meet "material" attributes: **design** (form and project), **materials, workmanship** (constructive technique) and **setting** (context).

In 1992 other very significant changes on the definition of authenticity start from a debate at the Japan joining Convention.
Further the Government of Japan offers to hold in Nara, an international conference of experts, concerning the investigation of the authenticity in relation to the World Heritage Convention.
In order to prepare the Nara Conference, a workshop is sponsored in Bergen in 1994, by the Norwegian and Canadian governments, together with ICOMOS, ICCROM and the WH Centre. During this meeting, a long discussion reveals the necessity to define the term of authenticity. The reports are published under the title "Conference on Authenticity in Relation to the World Heritage Convention"[18].
In 1994 the Nara Conference on Authenticity[19] takes place and the result of this debate is the layout of the Nara Document on Authenticity, drafted by the 45 participants (see Appendix 4).
First of all the purpose of this Document is to give deeply relevance to the different cultures and heritages in relationship to the conservation practices.
The Nara Document follows the principles of the Venice Charter but it expands them.

Before Nara, the OGs attributes that had to satisfy the conditions of authenticity are perhaps too limitative. It is possible to realize this limitation if it sets in relationship to the architecture in earth or to other contexts where the techniques of maintenance

and conservation are very distant from those European. The Nara Document, in fact, discusses also about "Cultural Diversity and Heritage Diversity" saying "The diversity of cultures and heritage in our world is an irreplaceable source of spiritual and intellectual richness for all humankind. The protection and enhancement of cultural and heritage diversity in our world should be actively promoted as an essential aspect of human development. Cultural heritage diversity exists in time and space, and demands respect for other cultures and all aspects of their belief systems"[20].
For these reasons the Nara Document underlines how the cultural community that has generated a monument or cares for it, it is responsible for this cultural heritage and for its management.

On the other side the Document also specifies that "..adherence to the international charters and conventions developed for conservation of cultural heritage also obliges consideration of the principles and responsibilities flowing from them. Balancing their own requirements with those of other cultural communities is, for each community, highly desirable, provided achieving this balance does not undermine their fundamental cultural values."

The evaluation of the authenticity of a site should take into account the cultural context to which it belongs. The contexts and their evolutions through time are very different around the world and reflect specific varieties of information, which should be deeply analyzed and not too much generalized.

Therefore the "..aspects of the sources may include **form** and **design**, **materials** and **substance**, **use** and **function**, **traditions** and **techniques**, **location** and **setting**, and **spirit** and **feeling**, and other **internal** and **external factors**. The use of these sources permits elaboration of the specific artistic, historic, social, and scientific dimensions of the cultural heritage being examined"[21].

Very tied up to this concept is the main suggestion proposed by Herb Stovel, who underlines the importance to avoid the standardization and the uniformity of the procedures for the valuation of the authenticity of monuments and sites. He also suggests to improve the awareness of the populations in conservation of diverse cultural heritage, in order to develop the global respect for properties, belonging to a great variety of cultures with different values.

It is important to cite also the meeting, held in Great Zimbabwe in 2000, which concerns the Authenticity and Integrity in an African Context[22]. During this event, other authenticity attributes are proposed: **managements systems**, **language, and other forms of intangible heritage.**

The new attributes of authenticity, proposed by the Nara Conference and by the Great Zimbabwe meeting, are then adopted by the WH Committee, which inserts them in the revised 2005-OGs. The new authenticity attributes include "**dynamic qualities,** important in looking for example at authenticity in relation to historic cities or landscapes" and "(…) attributes such as **tradition** and **function**, as being appropriate vehicles to carry the particular values of a place" (Herb Stovel, 2000).

3.4.2. The 2005 Operational Guidelines: the New Revised Attributes for the Test of the Authenticity

As said before a **cultural property** to be deemed of OUV must meet one or more of the criteria from (i) to (vi) and then its cultural value must be "expressed truthfully and credibly through a variety of attributes"[23]. Since 2005 the test of the authenticity has had to satisfy a detailed list of attributes, to be fulfilled:

- form and design;
- materials and substance;
- use and function;
- traditions, techniques and management systems;
- location and setting;
- language, and other forms of intangible heritage;
- spirit and feeling;
- other internal and external factors.

The new attributes required underline the importance given to the study of the intangible values that should precede the judgments regarding the authenticity of any monument.
These attributes in fact should represent and convey "truthfully" the meaning of the site; hence the respect of them should be deeply preserved.
If in the course of time, the satisfaction of one or more of these attributes fails or is compromised, the authenticity test loses its requirements.
For this reason the authenticity of a monument and its setting should be safeguarded, during the maintenance interventions, concerning also the following years.
The objective of a correct maintenance should contemplate really this condition: analyze the intangible values of a population in order to understand its cultural aspects, from which the different constructive and conservative techniques spring. These technologies allow to operate on the monuments in the respect of the local culture.
The satisfaction of the attributes is not so immediate. When the State Party wants to prepare a nomination for a site, it should deeply analyze all the attributes, which can meet the conditions of the authenticity for that property.

For what the **form** and **design** concerns, in the statement of authenticity it is important to underline if the aspect of the monument is the original one or has been changed during the time because of some natural effects, like flood, earthquake etc. or by human actions. Some inappropriate conservation activities, in fact, or the totally lack of maintenance of the building often lead to the reconstruction of parts of the property, even if this procedure is not considered as conventional. The

reconstruction of the property, in fact, is tolerated only in very specific circumstances. For example this intervention can be adopted when a building, which is high representative of a cultural society, collapses or is destroyed due to environmental events or conflicts.
Belong to this category, buildings, which are considered meaningful, symbols that represent the history and the traditions of an area and most of the time, they contributes to the cohesion of the population.

During the conservation activities of a monument, the use of the **material** and the **substance** are very much considered.
The heritage has a historicity to represent. For this reason the authenticity of the materials "does not mean that the material has remained exactly the same from year to year. Rather, it may have gradually lost part of its initial consistency and acquired a different look, obtaining a patina of age" (Jukka Jokilehto and Joseph King, 2001).
In order to safeguard the authenticity of the site, it is deeply important to implement, if it is possible, materials belonging to the traditional building construction for composition and performances. The introduction of "modern" materials like cement and concrete, on traditional buildings, is very controversial and it is subjected to a great debate, most of the time if the site is made of "natural" materials like earth, stone and wood.

The statement of the authenticity has to satisfy also the attributes of **use** and **function** of the site. It is important to maintain or revive the traditional use and function of a property, when it is possible, because they represent the real motivations for which the property was created.

A complex debate related to the use of the materials, concerns the **traditions**, the **techniques** and the **management systems.**
The conservation of the site should be carried out, using traditional building technologies, the same implemented for the construction and the past maintenance of the property.
The debate is focused on finding or not a compromise between traditional building technologies and modern techniques to use during the preservation management of the monuments. During the conservation activities, the traditional building technologies, used to build the property, should be taken into consideration and can be "mixed" with some modern techniques in order to improve the durability and the performances of the site, maintaining the authenticity of the property. These interventions shall not be invasive and most of all should be deeply studied before their implementation. Otherwise, there is a high risk of threatening the authenticity of the traditional techniques. At this point, there are several different opinions which can be unify in three main groups:

- the modern technology adepts who approve the use of new techniques in order to extend the life of the monuments and to prolong their maintenance on time;
- the conservators, who think that is absolutely to avoid the use of modern technology for the restoration of traditional/vernacular buildings;
- the third group, which proposes to improve the traditional buildings technologies thanks to the introduction of no-invasive and, if it is possible, reversible new conservation technologies.

Related with the respect of the traditional technologies, is the choice of the **specialized technicians,** who are responsible of the conservation works of the site. Also in this case, satisfying this request is not always so guaranteed. The sites are really different to each other and located in several realities, in which the maintenance of the property can be tided to the spirit of the local population, which is not composed of specialists of the conservation.
The State Party can propose a local manager of the site who is in charge to nominate the members of the conservation team, which can be composed by his collaborators, and members of the local population. For this reason this team can be made of specialized workers, who had the possibility to learn the building technologies at school. The work training schools, that teach specialized conservation procedures are present most of all in European and North American sites. In other cases, like in some areas in Africa or in Asia, the local workers are not school trained and they learn the conservation and maintenance techniques from parents or other members of the population. Even if they do not attend the school, however they know their traditional technologies and the best way to apply them on the construction. For this sites, the local manager often proposes a training course for local labours before the beginning of the conservation activities, in order to improve their knowledge on the choice of the right material and technology and their implementation, notions on the security at work etc.

The satisfaction of the attributes of **location** and **setting** foresees the maintenance of the original position of the property and all of its parts.
The article n.4 of the UNESCO Recommendations Concerning the Safeguarding and Contemporary Role of Historic Areas[24] (1976) says that" every historic area and its surroundings should be considered in their totality as a coherent whole whose balance and specific nature depend on the fusion of the parts of which it is composed and which include human activities as much as the buildings, the spatial organization and the surroundings. All valid elements, including human activities, however modest, thus have a significance in relation to the whole which must not be disregarded".
Following these concepts, the study analyzes the context of the site, focusing on its boundaries in order to understand if they have been changed and extended during the time and for what reason. The reason can be attributed to urban development, unsustainable tourism, which request new roads and facilities etc.

As example, concerned the change of the position of a property or parts of it; we can study the historical evolution of the ruins of the ancient **city of Aksum**, in Ethiopia (Figs. 3.8-9). The granite Obelisk of Aksum, called the Rome Stele or the 2nd Stele is 1,700 years old, 24 metres tall and 160 tonnes weight.
The Obelisk was erected probably during the 4th century A.D. during the Kingdom of Aksum, an ancient Ethiopian civilization.
In 1935, after the Italian conquest of Ethiopia, the soldiers discovered the site of Aksum with all of its stelae and the Obelisk broken in three parts, probably due to earthquakes, structural collapse or human action.
The Italian soldiers had the order to move the Obelisk to Rome, which in 1937, was assembled and erected as the symbol of the Fascist regime hegemony.
Despite the absence of the stele, the Aksum archaeological site was considered to

have enough OUV and for this reason, in 1980 it was inscribed on the WHL.
In April 2005, Italy gave the Aksum Obelisk back to Ethiopia. Both the States Parties asked UNESCO to direct the works for re-installing the stele in the original location. These engineering works started in 2007 and concerned the study of the sites, the re-installation of the Obelisk with the introduction of bars in synthetic fibres to improve the stability of the structure against earthquake, etc.

The introduction of the stele in the Aksum archaeological site, after 60 years, can originate some debates concerning the respect of the authenticity of the setting.
The Obelisk can be considered an element which enriches the context but, at the same time, modifies it. Therefore, the conditions of the site at the time of the inscription on the WHL are changed due to the introduction of the stele. For this reason, even if the Obelisk originally belonged to the site, now it can be considered by some conservators, as a factor which can alter the authenticity of the heritage context.

Moreover, the stele arrived in Ethiopia divided in three granite blocks, then joined together. This methodology can also originate some considerations regarding the authenticity of the original position of the property and all of its parts.
Some conservators think that the authenticity of the site can be safeguarded, not reassembling all the parts belonging to the monument but leaving them as they were discovered. Following this opinion, in the case of Aksum, the three granite masses should have been maintained separated and repositioned on the ground as they were found by the Italians.

On another side, some conservators consider that the authenticity of the original position of the site with all its parts is preserved when the sections of a monument are reassembled in order to rebuild the original property, like happened with the Obelisk in Aksum. The re-installation of the stele was completed in 2008.

Fig. 3.8. Rome, the Obelisk of Aksum when it was located in the centre of Rome

The study of the attributes of **language**, and **other forms of intangible heritage**, aims at understanding if these forms of heritage are still surviving in a specific area or have declined and for what reason.
The language and the intangible heritage are the expressions of the cultural diversity and are passed on from a generation to another. They belong to the cultural heritage such as: "oral traditions, performing arts, social practices, rituals, festive events, knowledge and practices concerning nature and the universe of the knowledge and skills to produce traditional crafts"[25] (ICH UNESCO, 2009). It is important to know who are the people, who speak the language or are the custodians of the cultural intangible heritage, because the analysis allows to comprehend if these persons have the capability to support, safeguard and pass on these attributes for the future time, against any kind of external threats.


Fig. 3.9. Aksum (Ethiopia), the Obelisk of Aksum come back to its original location

The last attributes to satisfy in the Statement of the Authenticity are **spirit** and **feeling**. The OGs says that "attributes such as spirit and feeling do not lend themselves easily to practical applications of the conditions of authenticity, but nevertheless are important indicators of character and sense of place, for example, in communities maintaining tradition and cultural continuity"[26].
It is necessary to understand if the spirit and the feeling, which let the society to build a heritage, are still alive or not. Deeply studies and interpretations related to the property should be carried out in order to analyze if the societal mechanism supports the appreciation of the spirit or feeling or is not able to avoid their decline because it is not strong.

3.5. The Test of the Integrity

This test has been applied only to the natural site until February 2005, when the WH Committee decided that all properties nominated for inclusion on the WHL should satisfy conditions of integrity[27].
The purpose of this decision was to reinforce the bond between the properties, their "owners" and the natural context in which they live.

A State Party, which wants to propose a site for the nominations, has to present the Statement of Integrity, regarding that property.

Following the OGs, paragraph 88, the document should demonstrate the "wholeness and intactness of the natural and/or cultural heritage and its attributes", assessing "the extent to which the property:

- includes all those elements necessary to express its outstanding universal value;

- has the adequate size to ensure the complete representation of the features and processes which convey the property's significance;

- suffers from adverse effects of development and/or neglect".

The concepts can be summarized in three key words: "wholeness", "intactness" and "absence of threats":

- Wholeness: almost all the attributes, which express OUV, are included in the site.

- Intactness: a significant proportion of all the attributes are still present and not in a serious state of decay.

  For example, if we consider an archaeological site, the ruins in itself should still be able to express the OUV. It is the case of **the Archaeological Remains of Jam with its Minaret**, inscribed on the WHLD in 2002, under criteria (ii), (iii) and (iv) (Fig. 3.10).
  In the SOUV, Afghanistan, the State Party, set out the Statement of Integrity, underling that no extensive restoration activities were carried out in that area, except some precautionary measures in order to improve the stability of the minaret.
  The State Party also explained that all the attributes, which expressed the OUV, were not damaged (concept of intactness) and they were included within the boundaries of the property (concept of wholeness).
  The integrity paragraph in the SOUV of Afghanistan is reported below.

  Integrity
  "Since the building of the minaret about eight hundred years ago, no reconstruction or extensive restoration work has ever taken place in the area. The archaeological vestiges have been surveyed and recorded as off 1957 when the remains were first discovered by archaeologists, but these studies have only led to simple precautionary stabilization measures. Thus, the attributes that express the Outstanding Universal Value of the site, not least the minaret itself, other architectural forms and their setting in the landscape, remain intact within the boundaries of the property and even beyond their limits"

- Degree of threats: development effects, poor maintenance or other human neglect does not threaten the attributes.

  Always speaking about the Minaret and the Archaeological Remains of Jam, the SOUV foresaw necessary a management and protection program, which was subsequently carried out and will be concluded soon. This project concerns the emergency of consolidation, conservation and restoration of the

Minaret of Jam together with the Fifth Minaret in Herat and the safeguard of the archaeological areas.

For what said above, the Statement of the Integrity should concern a deep analysis of the values and their evolution during the time in order to understand if they are still present intact in the property or some of them have been modified or lost.
Another important part of the document is related to the boundaries of the site. They should be identified and of adequate size in order to include all the attributes of the property.
It is necessary to strictly define the borders, that divide a site from another potential OUV property, belonging to a wider area, and motivate the choice.

In the Statement of the Integrity, an evaluation of the **state of conservation** of the property and its values has to be reported. The conservation conditions should be critically evaluated and satisfactory. This situation will be the best condition to present a site for the nominations. On the other side, in some cases, there can be some critical elements like human actions or conflicts etc., which may threaten the site and its values. In this case a management program of the site should be set out in order to reduce these vulnerabilities.

Fig. 3.10. The Archaeological Remains of Jam with its Minaret (Afghanistan)

3.6. Protection and Management Requirements

In the SOUV, the State Party should define the real state of conservation of the site. During the draft of the document, it is necessary not to leave out the threats, which may affect the OUV of a property, damaging it, and propose some protection activities. The OGs in paragraph 96 say in fact: “Protection and management of World Heritage properties should ensure that the outstanding universal value, the conditions of integrity and/or authenticity at the time of inscription are maintained or enhanced in the future”.

The OGs divide the affecting factors in four main groups: **development pressure** (encroachment, adaptation, agriculture, mining etc.), **environmental pressure** (pollution, climate change and desertification etc.), **natural disasters** (earthquakes, floods, fires etc.) and **visitors/tourism pressure**.
It is important to indentify the relevant factors related to each specific site.

In order to evaluate how the State Party maintains and safeguards an inscribed site, which can be threatened by some affecting factors, the **State of Conservation** of the property, called SOC, can be requested, reviewed by the WH Centre together with the ABs and further evaluated during the Committee. For all the sites inscribed on the WHLD, the SOCs are to be presented to the Committee each year.
The evaluation of the SOC is really important for the future of a site because it provides the Committee with information to allow it to decide whether to move a property from the WHLD to the WHL or the contrary. Eventually, in some specific cases, where the OUV has been considered to be lost, it is very likely for that property to be delisted from the WHLD.

During the 35th WH Committee (2011), the United Republic of Tanzania presented the SOC of the Stone Town of Zanzibar. The plans for the construction of a hotel were supported by the Committee, which suggested that the works should have been realized in strictly relation with the Sate Party, the WH Centre and ICOMOS.

The WH Centre and the ABs should be always informed about the construction activities as well as the rehabilitation of other buildings in an inscribed property, in order to control and support the maintenance of the integrity and the authenticity of the site, avoiding factors related to the uncontrolled development of tourism facilities which may affect the OUV of the heritage.

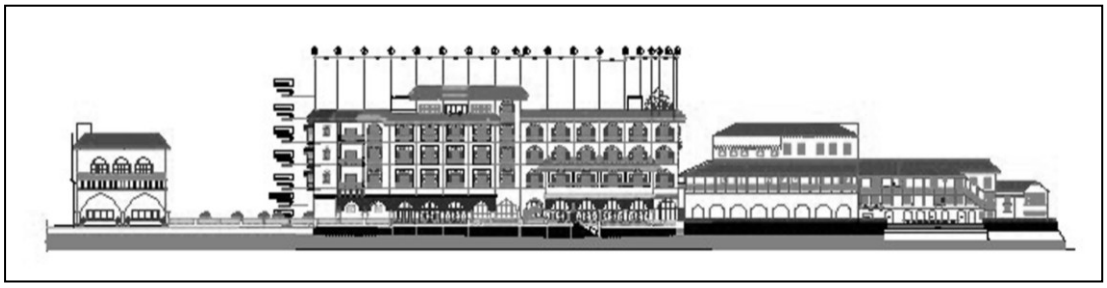


Fig. 3.11. The hotel project for the Stone Town of Zanzibar

Fig. 3.12. A rendering of the future hotel for the Stone Town of Zanzibar

3.6.1. The Case of Dresden Elbe Valley: a Site Delisted from the WHL

The Elbe valley was inscribed on the WHL in 2004, after the vote of the 28th WH-Committee, under the criteria (ii), (iii), (iv) and (v), as a cultural landscape extended for 18 Km along the Elbe river (Fig. 3.13). The property was considered an example of natural site which during the time had been gradually populated, harmonically maintaining the presence of each historical layers, representing different periods, from the 18th and 19th centuries. The ICOMOS considered the Dresden Elbe Valley ”an outstanding cultural landscape, an ensemble that” integrated “the celebrated baroque setting and suburban garden city into an artistic whole within the river valley”[28]. Even after the Second World War, when the centre of Dresden was destroyed, the suburban buildings, present along this Valley, were saved together with their values and integrity. The process of reconstruction, in fact, concerned only a small part of the nominated area.
In 1996, the idea of the Dresden's city council, concerning the building of a bridge in order to bring together the two parts of Dresden and reduce the traffic congestion, kept on growing. In 2005 the citizens of Dresden voted a referendum about the construction of the new bridge in the Elbe Valley. The majority of the population was in favour of the new infrastructure.
For this reason, in 2006, the 30th WH-Committee, taken place in Vilnius (Lithuania), started to threaten to remove Dresden Elbe Valley from the WHL and placed the property on the WHLD, suggesting to halt the construction of the bridge, founding even some alternative solutions.

Despite the warning of the WH-Committee, in 2007 the construction of the four-lane bridge called “Waldschloesschenbruecke” began (Fig. 3.14-15). The WH Centre-UNESCO felt that the safeguard of the property was threatened by the new transportation infrastructure, which could damage and modify the original aspect of the valley and its boundaries, compromising the authenticity and the integrity of the site and as consequence, its OUV. After some years, in 2009, during the 33rd WH-Committee in Seville, the Dresden Elbe Valley was delisted from the WHLD.
Nowadays the construction of the bridge is still ongoing.

3.13. The Dresden Elbe Valley in Germany

Fig. 3.14. The area chosen for the construction of the bridge

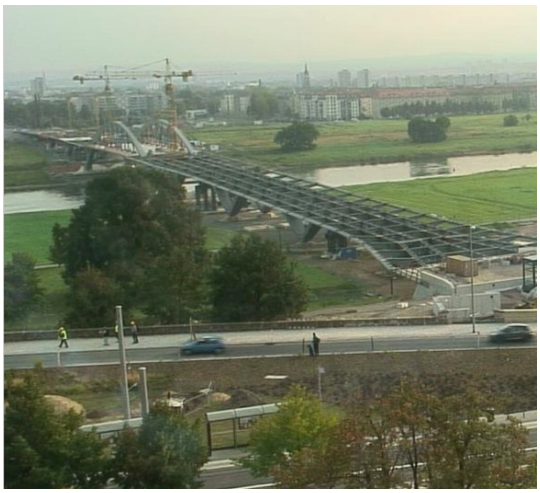
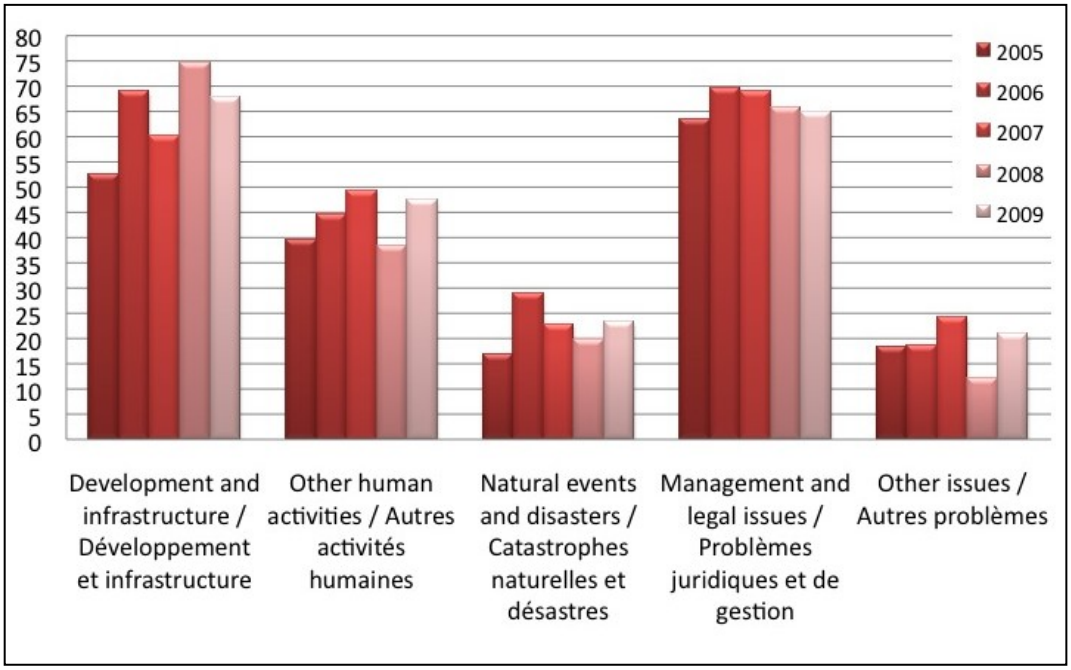


Fig. 3.15. The bridge construction works in September 2011

3.7. The Analysis of the Threats, Which May Affect the Heritage

As said before it is really important discovering and evaluating all the risk factors, which may affect the heritage. Studying and comparing the several SOCs, the WH Centre provides to the States Parties, graphics of the trends of the affecting factors during the time. The Graphic 3.1 was presented during the 35th WH Committee in 2011.

Graphic 3.1. Percentage of properties affected by each primary group of threats



The WH Centre analysis is also focused on the results concerning the threats

evolution in the whole WH Centre Regions: Africa, Arab States, Europe and North America, Asia and Pacific and Latin America and the Caribbean.

Table 3.2. Evolution of the threats over time, in each Region

	AFR	ARB	APA	EUR/NA	LAC
Development / Infrastructure Développement et infrastructure	↗	=	=	=	↘
Other human activities Autres activités humaines	↗	↗	=	=	=
Natural events and disasters Catastrophes naturelles et désastres	=	=	↗	=	=
Management and legal issues Problèmes juridiques et de gestion	=	=	=	=	=
Other factors Autres facteurs	=	↘	=	=	↗

The table can be prepared thanks to the **Periodic Reports**.

Every six years the States Parties are requested to send a periodic report to the WH Committee. Before the evaluation, the WH Centre Units work in strict collaboration with their States Parties in order to draft a Regional Reporting.

For example, all the African States Parties, like Burkina Faso, Benin, Ethiopia, Mali, Mozambique, etc., which refers to the WH Centre Africa Unit, are requested to prepare a report concerning legislative and administrative provisions and activities, implemented for the application of the WH Convention. In order to draft this document, the States Parties are called to answer two questionnaires: the first requests general information about the Country, while the second asks questions about each specific inscribed site and its state of conservation.
All the reports should be sent to the WH Centre Africa Unit, which consolidates a Regional Report concerning all the African World Heritage. The Periodic Reporting is further subjected to the evaluation of the Committee.
Therefore, the Periodic Reporting presents up-dated information, which is exchanged between the States Parties, developing cooperation processes.

The analysis of the Periodic Reporting permits to evaluate if the OUV of the inscribed sites is being maintained over the time and which affecting factors may or have already started to threaten the properties.

The WH Centre provides to the States Parties a questionnaire concerning the threats, which may affect the OUV of a site. Each State Party can answer following the table 3.2 below.

Table 3.2 List of primary factors affecting the OUV

DEVELOPMENT AND INFRASTRUCTURES

1. BUILDINGS AND DEVELOPMENT
1.1. Housing
1.2. Commercial development
1.3. Industrial areas
1.4. Major visitor accommodation and associated infrastructure
1.5. Interpretative and visitation facilities

2. TRANSPORTATION INFRASTRUCTURE
2.1. Ground transport infrastructure
2.2. Air transport infrastructure
2.3. Marine transport infrastructure
2.4. Underground transport infrastructure
2.5. Effects arising from use of transportation infrastructure

3. UTILITIES OR SERVICE INFRASTRUCTURE
3.1. Water infrastructure
3.2. Renewable energy facilities
3.3. Non-renewable energy facilities
3.4. Localised utilities
3.5. Major linear utilities

4. POLLUTION
4.1. Pollution of marine waters
4.2. Ground water pollution
4.3. Surface water pollution
4.4. Air pollution
4.5. Solid waste
4.6. Input of excess energy

6. PHYSICAL RESOURCE EXTRACTION
6.1. Mining
6.2. Quarrying
6.3. Oil and gas
6.4. Water

HUMAN ACTIVITIES

5. BIOLOGICAL RESOURCE USE/ MODIFICATION
5.1. Fishing/collecting aquatic resources
5.2. Aquaculture
5.3. Land conversion
5.4. Livestock farming/grazing of domesticated animals

5.5. Crop production
5.6. Commercial wild plant collection
5.7. Subsistence wild plant collection
5.8. Commercial hunting
5.9. Subsistence hunting
5.10. Forestry /wood production

6. SOCIAL/ CULTURAL USES OF HERITAGE
6.1. Ritual/spiritual/religious and associative uses
6.2. Society's valuing of heritage
6.3. Indigenous hunting, gathering and collecting
6.4. Changes in traditional ways of life and knowledge system
6.5. Identity, social cohesion, changes in local population and community
6.6. Positive impacts of tourism/visitor/recreation
6.7. Negative impacts of tourism/visitor/recreation

7. OTHER HUMAN ACTIVITIES
7.1. Illegal activities
7.2. Deliberate destruction of heritage
7.3. Military training
7.4. War
7.5. Terrorism
7.6. Civil unrest

8. INVASIVE/ ALIEN SPECIES OR HYPER-ABUNDANT SPECIES
8.1. Translocated species
8.6. Modified genetic material

NATURAL EVENTS AND DISTASTERS

9. LOCAL CONDITIONS AFFECTING PHYSICAL FABRIC
9.1. Wind
9.2. Relative humidity
9.3. Temperature
9.4. Radiation/light
9.5. Dust
9.6. Water
9.7. Pests
9.8. Micro-organisms

10. CLIMATE AND SEVERE WEATHER EVENTS
10.1. Storms
10.2. Flooding
10.3. Drought
10.4. Desertification
10.5. Changes to oceanic waters
10.6. Temperature extremes

11. SUDDEN ECOLOGICAL OR GEOLOGICAL EVENTS

11.1. Volcanic eruption
11.2. Earthquake
11.3. Tsunami/tidal wave
11.4. Avalanche/ landslide
11.5. Erosion and siltation/ deposition
11.6. Fire

12. INVASIVE/ ALIEN SPECIES OR HYPER-ABUNDANT SPECIES

12.2. Invasive/alien terrestrial species
12.3. Invasive / alien freshwater species
12.4. Invasive / alien marine species
12.5. Hyper-abundant species

MANAGEMENT AND LEGAL ISSUES

13. MANAGEMENT AND INSTITUTIONAL FACTORS

13.1. Legal framework
13.2. Governance
13.3. Management systems/ management plan
13.4. Financial resources
13.5. Human resources
13.6. Low impact research/monitoring activities
13.7. High impact research/monitoring activities
13.8. Management activities

OTHER FACTORS

14. OTHER FACTOR(S)

All these factors, if not monitored by an appropriate conservation site management, can generate dangerous circumstances for the safeguarding of the authenticity and the integrity of the heritage.

In the following chapter some of these factors are deeply analyzed, referring to the preservation of the authenticity and integrity of the earthen sites.

Notes Chapter Three

1. World Heritage Committee (2011), Operational Guidelines for the Implementation of the World Heritage Convention, *Definition of World Heritage*, chap. 2, par. A, November 2011, Paris (F). http://whc.unesco.org/archive/opguide11-en.pdf.

2. *Ibidem.*

3. About the argument, see:
   Petzet M. et alii (eds.). *What is OUV? Defining the Outstanding Universal Value of Cultural World Heritage Properties.* An ICOMOS study compiled by Jukka Jokilehto. Hendrik Bäßler Verlag, Berlin (Germany).

4. World Heritage Committee (1977), Operational Guidelines for the Implementation of the World Heritage Convention, *Establishment of the World Heritage List*, chap.1 par. 6, 20 October 1977, Paris (F). http://whc.unesco.org/archive/opguide77a.pdf.

5. Christina Cameron is a Professor in the School of Architecture and holds the Canada Research Chair on Built Heritage at the University of Montreal. She is an expert on the evolutions of UNESCO's World Heritage Convention during the years.

6. World Heritage Committee (2005), Operational Guidelines for the Implementation of the World Heritage Convention, *Definition of World Heritage*, chap. 2 par. A, n.49, 2 February 2005, Paris (F).
   http://whc.unesco.org/archive/opguide05-en.pdf
   World Heritage Committee (2011), Operational Guidelines for the Implementation of the World Heritage Convention, *Definition of World Heritage*, cit., n.49.

7. World Heritage Committee (2011), Operational Guidelines for the Implementation of the World Heritage Convention, *Definition of World Heritage*, cit., n.52.

8. World Heritage Committee (2011), Operational Guidelines for the Implementation of the World Heritage Convention, *Criteria for the Assessment of Outstanding Universal Value*, chap. 2, par. D, November 2011, Paris (F).

9. About the argument, see:
   von Droste B., Plachter H. and Rössler M. (1995). *Cultural Landscapes of Universal Value. Components of a Global Strategy*. Jena, Fischer Verlag;
   von Droste B., Rössler M. and Titchen S. (eds) (1999). *Linking Nature and Culture ... Report of the Global Strategy Natural and Cultural Heritage Expert Meeting*, 25 to 29 March 1998, Amsterdam, The Netherlands. Paris/The Hague, UNESCO/Ministry for Foreign Affairs/Ministry of Education, Science and Culture.

10. World Heritage Committee (2005), Operational Guidelines for the Implementation of the World Heritage Convention, *Integrity and/or authenticity*, chap. 2, par. E, 2 February 2005, Paris (F). http://whc.unesco.org/archive/opguide05-en.pdf

11. World Heritage Committee (2011), Operational Guidelines for the Implementation of the World Heritage Convention, *Criteria for the Assessment of Outstanding Universal Value*, cit., n.78.

12. State member of World Heritage Committee.

13. IUCN, ICOMOS, ICCROM and WH Centre-UNESCO (2011). *Preparing World Heritage Nominations*, World Heritage Resource Manual, pag. 56.

14. The SOUV was not required before 2005. As consequence, for those properties already on the WHL, but which do not have a SOUV, a retrospective SOUV is requested. In that case, the State Party

sends the draft of the retrospective SOUV which is then examinated by ICOMOS and/or IUCN. Further, the ABs send the SOUV back to the State Party for its agreement. During this process, there is formal exchange back and forth of the SOUV with the State Party. In this case, no mission to the site is taken by ICOMOS and IUCN.

15. Decision The 35th World Heritage Committee esamines the Documents WHC-11/35.COM/8B.Add (http://whc.unesco.org/archive/2011/whc11-35com-8B-Adde.pdf) and WHC-11/35.COM/INF.8B1.Add (http://whc.unesco.org/archive/2011/whc11-35com-inf8B1-Adde.pdf), and decides to inscribe the Konso Cultural Landscape, Ethiopia, on the World Heritage List on the basis of criteria (iii) and (v). The Original Decision Document is WHC-11/35.COM/20, available at: http://whc.unesco.org/archive/2011/whc11-35com-20e.pdf.

16. Untash-Napirisha was king of Elam (South-western Iran) from about 1275 to 1240 BC.

17. Claudio D'amato, Paolo Marconi (2006), *Premessa alla revisione della Carta di Venezia del 1964*. http://www.intbau.org/References/marconi.damato.vc.commenti.it.pdf.
Claudio D'Amato Guerrieri is professor at the Faculty of Architecture of the University of Bari, of which he is also the Dean.
Paolo Marconi is professor at the Faculty of Architecture of the University "Rome Tre".

18. Knut Larsen and Nils Marstein (editors). (1994). *Conference on Authenticity in Relation to the World Heritage Convention Authenticithy*. Preparatory Workshop in Bergen, 31 January-2 February 1994.

19. The Nara Conference is held at Nara, Japan, from November 1st to 6th 1994. The Agency for Cultural Affairs and the Nara Prefecture organize the Conference in cooperation with UNESCO, ICCROM and ICOMOS.

20. The Nara Document on Authenticity (1994). *Cultural Diversity and Heritage Diversity*, n. 5-6.

21. The Nara Document on Authenticity (1994). *Values and authenticity*, n. 13.

22. Saouma-Forero G. (editor) (2000). *Authenticity and Integrity in an African Context.* Expert Meeting. Great Zimbabwe, 26-29 May 2000.

23. World Heritage Committee (2011), Operational Guidelines for the Implementation of the World Heritage Convention, *Integrity and/or authenticity*, chap. 2, par. E, 31 November 2011, Paris (F).
http://whc.unesco.org/archive/opguide11-en.pdf.

24. The Recommendation Concerning the Safeguarding and Contemporary Role of Historic Areas is available at http://www.icomos.org/unesco/areas76.html

25. ICH UNESCO (2009). *What is Intangible Cultural Heritage?,* Infokit 2009, pag.8.

26. World Heritage Committee (2011), Operational Guidelines for the Implementation of the World Heritage Convention, *Integrity and/or authenticity*, chap. 2, par. E, n. 83.

27. World Heritage Committee (2005), Operational Guidelines for the Implementation of the World Heritage Convention, *Integrity and/or authenticity*, cit.

28. ICOMOS Recommendations (2003) available at http://whc.unesco.org/archive/advisory_body_evaluation/1156.pdf

Chapter Four: Safeguarding the Authenticity of the Earthen Heritage

4.1. The Earthen Architecture in the World

More than three billions of the worldwide population live or work in earthen buildings, belonging to the vernacular construction culture or to the contemporary architecture.

Fig. 4.1. Earthen buildings areas

The raw earth is a material tied to several building technologies as well as to different Regions of the world: from Europe to Africa, from Latin America to Asia, from Middle East to Australia, etc.

The main earthen building technologies are:

- **Adobe**: earthen bricks dried under the sun
- **Rammed earth (pisè, stampflehm, tapial)**: earth rammed in layers within formworks.
- **Straw-loam**: a mix of humid earth and lot of straw, which can be implemented using formworks.
- **Wattle and daub (torchis, fachwerk, strohlehm, colombage)**: application of straw-loam on a wooden structure.
- **Cob (massone**, **bauge)**: mix of humid earth and straw made up using hands or feet. The mix is directly used to form the framework, without any kind of under-structure.
- **Compressed earth block (CEB)**[1]: adobe improved with additives (e.g. 5% of cement) and produced thank to a machine.

Fig. 4.2. Kanji, Ladakh (North India), the drying of the adobe

Fig. 4.3. Kanji, Ladakh (North India), the implementation of the adobe

Fig. 4.4. Kagbeni (Nepal), the manual implementation of the rammed earth technique

Fig. 4.5. A rammed earth wall

Fig. 4.6. Straw-loam in a formwork

Fig. 4.7. Straw-loam after the drying process

The implementation of the raw earth as construction material is often subjected to several preconceptions, which consider it a "poor" as well as primitive material.
The insufficient knowledge of the earthen heritages and the concepts of poverty and low resistance, associated to the earth material, have caused the faster degradation of the sites and their scarce consideration in the world.

Fig. 4.8. Caia (Mozambique),
the *torchis* technique

Fig. 4.9. Pays d'Auge (Normandy),
the *colombage* technique

Fig. 4.10. Koutammakou (Togo),
the implementation of the cob technique

Fig. 4.11. Koutammakou (Togo),
the cob houses, called *Takienta*

Fig. 4.12. Maputo (Mozambique),
the preparation of the CEB

Fig. 4.13. Maputo (Mozambique), rural house
made of CEBs

In the beginning of the 80ies, the great exhibition at the Centre Pompidou, "Des Architectures De Terre", contributed remarkably to increase the attention on the earthen architecture.

From that time on, the interest on this heritage has been grown up, also through a series of UNESCO projects.
The last one is the World Heritage Earthen Architecture Programme[2] (WHEAP).

4.2. The WHEAP Programme and its Main Concepts

The World Heritage Earthen Architecture Programme started in 2007 and will support the conservation and valorisation of the values of the earthen sites for one decade, till 2017 (see Appendix 5).

Before the WHEAP Programme, several projects and meetings were held concerning the conservation of the earthen heritage: the GAIA/TERRA Programme (it was established in 1987 by an initiative of ICCROM and CRATerre, in 1994 the Getty Conservation Institute joined the project), the AFRICA 2009 Programme (a partnership of ICCROM, WH Centre, CRATerre, EPA-École du Patrimoine Africain and CHDA-Centre for Heritage Development in Africa). Other relevant activities were carried out by CRATerre, which compiled the first database of WH properties in earth materials. The research was a part of the TERRA Programme.

In 2011, 135 out of 936 cultural and mixed properties are earthen sites, inscribed on the WHL and WHLD.
Also during the last 35 WH Committee, other earthen sites were inscribed: **the Cultural Sites of Al Ain (Hafit, Hili, Bidaa Bint Saud and Oases Areas)**, in the United Arab Emirates.
The properties present circular stone tombs and lots of adobe buildings of different use and function: dwellings, palaces, administrative buildings, etc.

Fig. 4.14. Al Ain Oasis (United Arab Emirates), Al Ain Palace Museum

The earthen heritage is very particular and represents an expression of the human capability to create masterpieces, implementing only basic as well as very cheap

resources like earth material, wood and stone. The earthen sites are very different to each other, following the traditional building technologies of specific areas. Therefore, the earthen heritage presents mosques, historic city centres, dwellings etc.

The WHEAP aims to ameliorate the conservation technologies and management, implemented on the earthen sites, which are included on WHL or present on the Tentative Lists. The WHEAP supports the preservation of the traditional techniques, holding workshop with the local populations. The objective is the safeguard of the original building technologies, improving them with some new modern methods in order to provide safer buildings to the local populations, maintaining the OUV of the sites. The method foresees the appropriate introduction of some new reinforcement practices in order to improve the durability of the earth material and limit the collapse of the structure during floods, earthquakes etc. Another important point of the programme consists to ameliorate the inhabitants living conditions, thought the conservation and the support of these earthen sites, in order to contribute to poverty alleviation and sustainable development. For these reasons, always respecting the original aspect of the sites and their buffer zones, some general comforts are introduced and the healthy conditions are improved, carrying out some activities like the cleaning of existing plumbing systems or their new installation.
Another aim of the WHEAP is also trying to satisfy also the request of the local populations, which, following the economic and urban development, ask to have more conveniences. This aim is taken into a deep account, in order to avoid the phenomenon of the abandonment of the houses, which degrade consequently faster, without the maintenance activities carried out by the inhabitants. Some WHEAP principles are presented below:

"The World Heritage Programme on Earthen Architecture aims for the ***improvement of the state of conservation*** *and* ***management*** *of earthen architecture sites worldwide. Pilot projects on earthen architectural sites inscribed on the World Heritage List, or included in States Parties' Tentative Lists, will help identify best practices and set examples for the development and dissemination of* ***appropriate methods*** *and* ***techniques in conservation***, ***management***, *and* ***capacity building***. *Scientific research will further the endeavour to ameliorate know-how in the filed. Expected results include a better understanding of the problems facing earthen architecture, the* ***development of policies favouring its conservation***, *the* ***definition of practical guidelines*** *and the* ***organization of training*** *and* ***awareness activities***, *particularly in local communities through workshops, exhibitions, conferences and technical publications. Further, the WHEAP seeks to* ***raise the recognition of earthen architecture*** *and the creation of an active global network for the exchange of information and experience"*[3].

The Programme promotes cooperation agreements with the States Parties, which provide, together with external donors, the financial support of several activities. The Programme actions are structured in four phases:

1° was the preparatory phase (concluded in 2008),
2° (2009-2011) focuses on Africa and the Arab States,
3° (2012-2014) focuses on Latin-America and Central Asia,
4° (2015-2017) focuses on Europe and Asia.

Fig. 4.15. The WHEAP info leaflet about the activities carried out till 2011

For example, **the rehabilitation of Djenné** and **the conservation project of its "Youth House" (la Maison des jeunes)** are included into the WHEAP.
The city of Djenné is one of the most representative earthen heritage in the world and

now it is involved in a slow process of architectural transformation due to the impact of modernity as well as to the processes of decay and renewal which threaten the safeguard of the authenticity of the site and consequently its OUV. These changes are also affecting the environmental as well as the socio-economic structure of the city. More and more often new housing standards are required and the local population demands better sanitary conditions.
For what the **Youth House of Djenné** concerns, this structure was built in 1962, during Modibo Keita presidency. The Youth House is not a World Heritage site but its conservation is very important for the community of Djenné, which considers the building, a meeting, cultural as well as sport point for the youth and for the society in general. For these reasons some interventions have been already carried out:

Improve the building condition and general comfort of the Youth House

- rehabilitate the main facades on the basis of the original designs
- reconstruct the roof and the ceilings
- conserve and restore the surrounding walls
- rehabilitate the earth floor of the courtyard

Install plumbing system

- rehabilitate the surrounding canals and improve water flows
- rehabilitate the existing toilets and install new public ones
- realize another sanitary block for the town hall

Revitalize space to host community activities (school, sports, theatre classes, dance, concerts, weddings etc.)

- equip with material for sound and lighting
- install electricity
- provide furniture (chairs and wheelchairs)
- rehabilitate the main bar

"The Youth House", used now only by local population, is considered a public building, which, after the conclusion of the conservation project, may also have a great potential for the tourism.

Fig. 4.16. Djenné (Mali), rehabilitation of the canal: cleaning and improvement of drainage system

Fig. 4.17. Djenné (Mali), the clearing of the surrounding canals

4.2.1. The WHEAP Inventory

The WHEAP drafts and punctually updates the **Inventory and condition of properties built with earth**.

Fig. 4.18. The front page of the WHEAP Inventory

An earthen site, which is selected for the Inventory, should satisfy one or more of these items (see Appendix 6):

- Load-bearing walls in earth (rammed earth, adobe, cob, hand shaped...)
- Earth used as mortar for stones or burnt bricks,
- Wattle and daub techniques,
- Roofs or floors, even though they are often supported by wooden structures,
- Earth based plasters and paints, either inside or outside the structures,
- Large earth works to model the landscape when specific engineering knowledge was required[4].

Other sites are not included, like:

- Properties for which earth has been used in an anecdotal way like for example when used for backfilling wall basements;
- Properties that have solely agricultural purposes. (e.g. rice fields in the Philippines).

The Inventory presents some data, which report the types and construction models, the current situations of properties, the threats and the priorities for action. This information considers the situation of the earthen sites in the world and in each WH Centre-UNESCO Region (Africa, Arab States, Asia and Pacific, Europe and North America, Latin America and the Caribbean). In order to have this information, the

WH Centre asks the States Parties and their site managers to answer a questionnaire. The questions are related to: the earthen building technologies implemented in the sites, the existence of a management plan for the property, the state of decay of the structures, the threats which affect the heritage and other items which seem necessary for the site, like the reinforcement of the skills of workers or the improvement of the facilities etc.

The WHEAP supports the maintenance of the earthen sites, preserving their authenticity.
On the other side, lots of debates keep on going about the respect and the satisfaction of the authenticity requests of the earthen properties.
For the interpretation of the authenticity, it is important to realize that there are realities, which apply conservation technologies totally different respect to the European ones. These methodologies for safeguarding the heritage, derives from different cults, rituals, building technologies and conservation methods, which should be respected and analyzed. For this reason it becomes difficult to strictly apply the same authenticity parameters to all the regions of the World.

4.3. The Attributes for the Test of the Authenticity in Relation with Different Cultures

"..the World Heritage Committee's desire to apply the test of authenticity in ways which accord full respect to the social and cultural values of all societies, in examining the outstanding universal value of cultural properties proposed for the World Heritage List" (The Nara Document On Authenticity, art. 2).

As said in Chapter three, before the Nara Document, the Venice Charter was blamed for referring too much to European cultural values, instead of providing "universal" parameters.
The Nara Document brings along some innovative ideas to the test of the authenticity, introducing attributes like: traditions, techniques, spirit and feeling, strictly related to the culture diversity, where the site was built and is maintained during the time.

For Jukka Jokilehto and Joseph King "the test of the authenticity can be seen as the search for truth in the field of culture (...). The issue of the authenticity is not only an administrative verification of the truth; it is above all the critical foundation for the conservation and restoration of this heritage"[5].
The truth as the authenticity of a monument can be understood as the confirmation of the information, thanks to which, the values of a property can be considered credible.

The values are born from different cultural communities, which evolve during the time, generating and modifying these values. The monument and its boundaries, in themselves, can change their aspect due to some natural or human factors.
The monument, in fact, represents all its historic background with the following modifications due to conservation activities, damages related to conflicts or atmospheric events etc. The interpretation of the authenticity should take into

account all these heritage evolutions, considering them as a mirror of the social development as well as the conservation technologies, which are very different around the world.

Therefore, the test of the authenticity should be applied, taking into account the different cultural and social contexts, in which the heritage was in mind design, realized and now it is conserved.
In 1977 the OGs have already specified that the authenticity "does not limit consideration to original form and structure but includes all subsequent modifications and additions over the course of time, which themselves possess artistic or historical values".
For what said above, it is not possible to generalize the right methods in order to evaluate the test of authenticity, but only to follow some parameters, which should not be taken by the letter, but referred to different types of heritage, realized with different materials and building technologies.
Related to this argument, Mahdi Hodjat thinks that "the creating works of art as a method for the conservation of ideas, feelings, and perceptions, then the difference between the methods of creating works of art in various cultures may be considered identical to the difference between the methods for their conservation"[6].

For example in Japan each three/four hundred years, the sacred wooden temples are dismantled and rebuilt[7]. This is a form of conservation approach, totally different from the European ones. With the Nara Document this methodology starts to be recognized as appropriate, because it derives from the secular preservation practices, which represent the Japanese cultural concept of maintenance of the buildings as well as the authenticity.

In another context, in Africa for example, the populations, moved by their religious cult, periodically maintain the earthen mosques, or royal tombs. The conservation technologies are often implemented by hand, without specialized technicians. In this way the traditional know-how still remains in these areas and may be hand on. It is important to note that the authenticity of the traditions and the techniques as well as the spirit and the feeling of that culture is safeguarded but, in these cases, the aspect of the buildings has to suffer, every time that maintenance works happen.

The conservation of monuments and sites is very important as well as the maintenance of the traditional conservation methods.
The experts should know each traditional method of conservation, because it represents cultural values belonging to a specific population.
These measures of traditional maintenance are, in fact, tied up to the vernacular constructive techniques, which are differentiated from a population to another. The vernacular conservation techniques are very close to the environment in which they develop themselves and to the history and the religious cults of the inhabitants.

For this reason, if technical specialists have to carry out some appropriate conservation approaches, before starting the activities, they should necessarily improve their knowledge of the vernacular building techniques of a specific site and

subsequently they should pay more attention to the traditional methods of maintenance.
This procedure is fundamental to the purpose of "..unifying the diverse methods that have emerged in different cultures, rather than merely disseminating a kind of uniformity" (Mahdi Hodjat, 2009).
Sometimes the modern conservation methods have the tendency to prevail on the traditional ones. This wrong approach should be avoided.

For what said above, during the interpretation of the authenticity of heritages, sited in various cultural contexts, "it is necessary to accept that the different cultures may have different ways of expressing themselves about issues such as truth and authenticity" (Jukka Jokilehto, 2006).

Herb Stovel presents some efforts to carry out to determine the authenticity, in order to respect the culture diversity. These efforts are listed in the appendix 1 of the Nara Document.
He thinks that each culture should develop specific analytical approaches, supporting common aspects:
- efforts to ensure assessment of authenticity involve multidisciplinary collaboration and the appropriate utilisation of all available expertise and knowledge;
- efforts to ensure attributed values are truly representative of a culture and the diversity of its interests, in particular monuments and sites;
- efforts to document clearly the particular nature of authenticity for monuments and sites as a practical guide to future treatment and monitoring;
- efforts to update authenticity assessments in light of changing values and circumstances.

Referring to the last point, it is important to underline that the values change with the generations. Therefore the communications between the different cultures should be supported and improved in order to update and maintain general references, which can help for the interpretation of the authenticity.

4.4. The Attributes of the Authenticity in Earthen Sites

During the Committee the SOCs of the sites inscribed on the WHL and WHLD are evaluated. The States Parties should guarantee the respect of the criteria of the authenticity and integrity and consequently the safeguard of the OUV, attributed to the heritage.

The SOC and the management plan for the maintenance of the site can be evaluated, analyzing the evolution of the property during the years through: a pictures report, which shows the modifications of the heritage; a catalogue of occupied or abandoned houses; some draws related the progression of the site and finally but not less important, the study of the inhabitants opinions on the organization of the property.

For what the authenticity concerns, the conservation management of an earthen site

should meet and take into account the satisfaction of these attributes: form and design, materials and substance, use and function, traditions, techniques and management systems, location and setting, language, and other forms of intangible heritage, spirit and feeling, other internal and external factors.

If we consider the authenticity of **form** and **design**, the debate, focused on the conservation of the earthen architecture, is very complex.
Most of the time the earthen buildings are built and maintained by local populations.
The inhabitants built the earthen heritage without following any kind of paper project during the construction. For this reason during the conservation activities, they do not have any original schemes on which they can refer.
The earthen material is also very living and when it comes in contact with moisture, wind, extreme temperatures and inappropriate human actions, is subjected to several chemical-physical mutations. As consequence, the buildings, made by earth, change their colour, form and facades too.

It is important to note that also in traditional contexts, a mental design of the buildings exists and plans the structural aspects, the right technologies to implement and supports the transmissions of the know-how to the future generations, which should preserve the heritage.
The conservation technologies are often implemented by hand, without modern instruments and it contributes to modify each time the facades of the earthen buildings. The decorations are unique because made by hand, most of the times by women and for this reason, they cannot be reproduced equal by other persons in the following years.

In other sites, built in fired bricks or stone, the problem of the conservation of the form is limited. In these cases the construction materials are less affected by the external climatic factors (rain, snow etc.) and for this reason the maintenance activities on those monuments are reduced, if compared to the conservation interventions implemented on the earthen building.

For example, in the case of the mosque of **Djingerey-ber**, in Timbuktu, the building is subjected to a continuous process of renewal.
It happens that every year some weaken sections of the monument are dismantled and replaced. Further the community go on with the conclusion of all the preservation activities, plastering the whole building.
In the pictures below it is possible to observe the evolution of the form of the mosque.

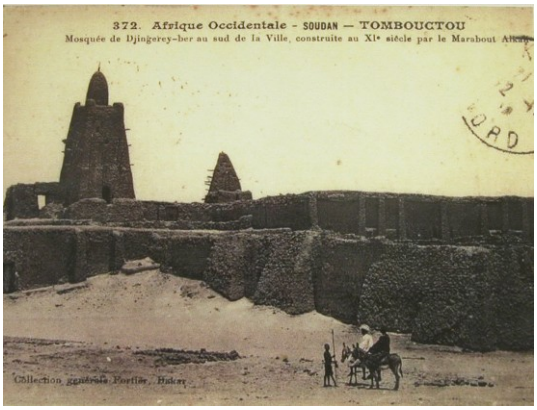


Fig. 4.19. Djingerey-ber (Mali), the mosque in a postcard of several decades ago

Fig. 4.20. Djingerey-ber (Mali), the mosque in 2005

Fig. 4.21. Djingerey-ber (Mali), the mosque in 2010

During the conservation or reconstruction activities, the original aspect of the site can be restored, dismantling some inappropriate additional parts.

The rehabilitation of the **Youth House of Djenné** concerns some activities like the restoration of the South façade of the building, carried out following design projects of 1985 and the related pictures. The work team was composed by experts and local people.

Fig. 4.22. Djingerey-ber (Mali), the conservation activities of the mosque

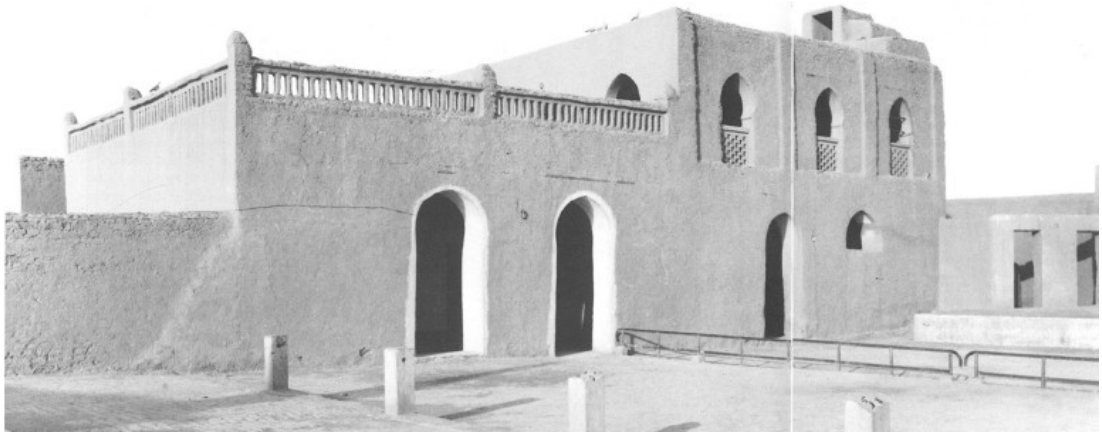


Fig. 4.23. Djenné (Mali) the South façade of the Youth House in 1985

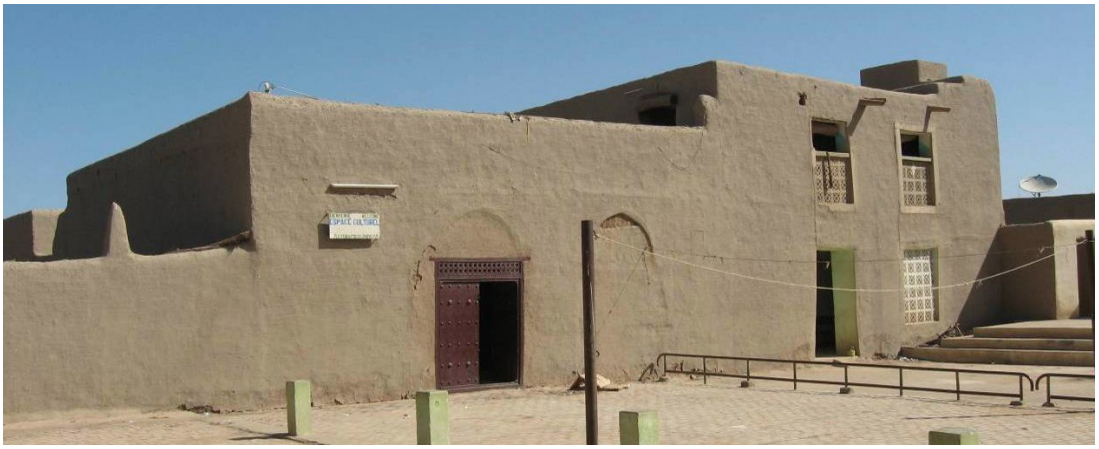


Fig. 4.24. Djenné (Mali), the South façade of the Youth House before the intervention in 2009

Fig. 4.25. Djenné (Mali), South façade evolution: the overlap between 1985-aspect and 2009-aspect

A comparison was made between the 1985-aspect and the last one in 2009. The original facade was different from the 2009-one. The left part was almost the same

but the right one needed to be reviewed. For this reason the wrong part was dismantled and rebuilt. The roof was restored and the original openings were realized.

Fig. 4.26. Djenné (Mali), the dismantling of the South façade (starting phase)

Fig. 4.27. Djenné (Mali), the dismantling of the South façade (ending phase)

Fig. 4.28. Djenné (Mali), the reconstruction of the South façade

Fig. 4.29. Djenné (Mali), the reconstruction of the South façade

Fig. 4.30. Djenné (Mali), the original openings were restored

Fig. 4.31. Djenné (Mali), the original openings were restored

Fig. 4.32. Djenné (Mali), the rehabilitation of the Youth House of Djenné: the South facade aspect in 2011

If we consider the reconstruction intervention, the WH Centre-OGs in relation to the authenticity, say, "the reconstruction of archaeological remains or historic buildings or districts is justifiable only in exceptional circumstances. Reconstruction is acceptable only on the basis of complete and detailed documentation and to no extent on conjecture"[8].

In Uganda, the **Tombs of Buganda Kings at Kasubi** are being rebuilt. In 2010 a great fire happened, devastating the Muzibu Azaala Mpanga building, which contained four royal Buganda tombs.
The site was the major spiritual centre for the community and it was a place in which the traditional and cultural practices were performed and handed on.
For this reason, the loss of this important structure was a big tragic event for the local community, which felt deprived of their own intangible values.
For example, the 52 roof rings made with palm fronds and burnt in the fire, represented the 52 clans of the Kingdom. Before the fire, the clans, moved by the spiritual values of the tombs, were responsible to carry out almost all the maintenance activities of the sites.
In spite of everything, the site still

Fig. 4.33. Kasubi (Uganda), the remains of the Buganda tombs after the fire

maintains its life even if some rituals cannot be performed. In order to preserve the authenticity of the rest of the site as well as the authenticity of the community intangible heritage, with its religious and spiritual values, the WH Centre supports the reconstruction of the Muzibu Azaala Mpanga. The interventions are ongoing.

Fig. 4.34. Kasubi (Uganda), the Buganda tombs in 1911

Fig. 4.35. Kasubi (Uganda), the Buganda tombs in 1938

The satisfaction of the attributes of **location** and **setting** is also very important. The earthen sites are often located in areas, which are progressively changing their configuration, due to the abandonment of the houses or their enlargement, the construction of roads as well as new tourism facilities, like hotels and shops, etc. For this reason it is very important to monitorize the evolution of the site and its context in order to avoid that the urban development encroaches and damages the sites.

Fig. 4.36. Kasubi (Uganda), the Buganda tombs future project in 2011

Analysing the management plan of the
Ksar of Aït Ben Haddou 2007-2012, in Morocco, it is possible to observe quite minimum changes of the setting, which can keep on satisfying the requested authenticity (Fig. 4.37-39).
The implementation of the materials, rammed earth and wood, is deeply monitored, in order to avoid the introduction of concrete and cement.
Although the controls on the site are very rigorous, the concrete is used in some unauthorized conservation treatments. In these cases, the site conservators suggest to hide lintels and other reinforcement in concrete with earthen plaster.
The use of wood for doors and windows is strongly supported. It is sufficient to think that only the choice of inappropriate shapes of doors and windows can also change the aspect of a monument.

The traditional materials are sometimes replaced by apparently “modern” materials like cement, concrete etc, which are totally visually incompatible with earth. “Modern” material can improve the durability of a building, compromising the authenticity of the **material.**

The implementation of new materials is often subjected to debate, most of all if we speak about earthen architecture.
Some modern conservation technologies can allow to reinforce the earthen structure but the choice of the techniques should be previously analyzed. They should be possibly reversible and not compromise the original aspect of the site. Nevertheless, in these cases, the authenticity of the traditional materials and technologies is not safeguarded. For this reason the choice of natural materials should be preferred, supporting a cyclical maintenance of the buildings.

Fig. 4.37. Aït Ben Haddou (Morocco), the Ksar in 1994

Also the use of fired brick, which can be considered more compatible with the earth, may generate lots of damages.
In **Djenné**, for example, the implementation of terracotta bricks, instead of the original earthen plaster, causes a change of the traditional aspect of the buildings (Figs. 4.40-43). The inhabitants always try to find some construction methods in order to avoid the cyclical maintenance of the earthen plasters. The coat, made with fired bricks, may be more durable but it generates serious and irreparable damages. The water infiltrations can penetrate through out the cracks among the bricks and corrode the under earthen masonry.

Fig. 4.38. Aït Ben Haddou (Morocco), the Ksar in 2005

The request of better living conditions pushes the people to abandon their traditional earthen houses, in order to live in a more comfortable and modern buildings with all conveniences. Most of the time these new structures are realized implementing cement, concrete, steel, etc.

Fig. 4.39. Aït Ben Haddou (Morocco), the Ksar in 2007

In the subsequent chapter we will see that there are almost three thought schools for the preservation of the earthen buildings: conservators who support of the use of "modern" and chemical material for the preservation of the earthen building, others who implement only natural and compatible materials and the third group, which is

in the middle of the other opinions and it tries to melt harmonically the traditional concepts and material with the new technologies.

Fig. 4.40. Djenné (Mali), an earthen building totally covered with terracotta bricks

Fig. 4.41. Djenné (Mali), the damages of an earthen masonry, plastered with terracotta bricks

Fig. 4.42. Djenné (Mali), the damages of an earthen masonry, plastered with terracotta bricks

Fig. 4.43. Djenné (Mali), the damages of an earthen masonry, plastered with terracotta bricks

As said above, the authenticity of the traditional **materials** and **technologies** is not easy to safeguard.
In **the historic city of Sana'a** in Yemen, for example, some vertical or horizontal additions of elements made with concrete and cement have modified the original profile of the Old City. Lots of the inlaid wooden doors are being replacing with metal or aluminium ones and the installation of aerials are changing the traditional aspect of Sana'a. It is important to underline that a recent inventory was drafted

Fig. 4.44. Sana'a (Yemen), the aerials on the top of the roofs

and a conservation campaign is still ongoing in order to preserve the OUV of the city.
The authenticity of traditions, techniques and management systems are often threatened during these times, where the new modern material and their implementations are trying to replace the older ones.

Fig. 4.45. Kanji (North India), a concrete curb in an earthen house

Fig. 4.46. Kanji (North India), the new women meeting point, built with stones and cement instead that with adobe, wood and stone

As said above, the traditional earthen technologies are still very often implemented by hand, without mechanical instruments. On the other side, the lack of specialized conservation technicians on the field might threaten the authenticity of a site. A site manager can monitor the conservation activities and coordinate and instruct the local workers.
Most of the times, in fact, the local population usually carries out the conservation interventions, which are handed on orally and do not follow any kind of law or standards. For these reasons, the respect and the safeguard of the authenticity of the **language** and **the religious cult** become very important. The language can allow the knowledge of the traditional technologies to survive in the time. The religious cult is a form of intangible heritage, which should be understood and preserved because it moves and supports the conservation interventions.
The cyclical maintenance of the earthen holy buildings, like mosques, is possible, thanks to the local communities, which believe to assure a place in the other world, maintaining the sacred building.
The religious cult is very tied to the concept of **spirit and feeling**, which are the base for the construction of a building. The spiritual, emotional and cultural aspects make the building be meaningful for the society.

The attributes of **use** and **function** are very threatened. Nowadays the development pressure pushes the inhabitants of the earthen villages to ask more and more high housing conditions and modern conveniences.
The inhabitants want to have more space, bigger rooms and, lots of times, they operate changes by themselves without any authorization, like it often happens in Djenné.
The authenticity of this earthen city is still preserved but contemporary affected by some human factors. The Great Mosque, considered the largest adobe building in the

world, is still conserved, implementing earth as principal material. The adobe called *ferey* is made by earth, straw, rice husks and water.
There are lots of houses around the mosque, which should be restored following the principles of the WH Centre-OGs. On the other side, the inhabitants request to have more comfortable and large space, new household-electric, showers etc. The conciliation between the expert conservators and the local population is not easy to find. For this reason some protests and discontents are growing among the population, which is tired to live in a traditional but almost "untouchable" habitat.

Fig. 4.47. Djenné (Mali), the Great Mosque

For example, Elhajj Diakaté, 54 years old, lived in an earthen house and he wanted to have a big room in order to put inside a double bed and a cupboard.
The space for the cupboard was not foreseen in the restoration projects of that type of buildings. For this reason, Diakaté dismantled a wall, probably a load-bearing one, in order to gain more space, but the entire house collapsed.

For what said above, following the principle of the WHEAP, the conservation of the sites and their authenticity should be strictly related to the improvement of the living conditions of the communities, in order to avoid the abandonment of the traditional

houses for other newer and modern ones. The inhabitants of rural areas should be assured and invited not to leave their own dwellings. Therefore, it is necessary to evolve the vernacular earthen structures, introducing some controlled modifications, which should respect and preserve the traditional building technologies.

The situations of **Pueblo de Taos** in USA, is quite similar.

The dwellings and ceremonial buildings of the town, made by adobe, seem to be maintained by conservation activities, which implement traditional materials and technologies.

Only doors and windows are introduced in order to better enter inside the houses. The conveniences are still insufficient and therefore, the inhabitants often decide to abandon the vernacular houses to build new ones. In this case, the traditional dwellings can become tourist attraction and places used only for ceremonies.

Fig. 4.48. Pueblo de Taos (USA), the traditional adobe buildings

4.5. The Preservation of Authenticity at Risk: Reflections on the OUV Affecting Factors in Relation to WHEAP Inventory Sites

The safeguard of the OUV of an inscribed site should be guaranteed and supported by the State Party in order to avoid the risk that the heritage is delisted.
For this reason the conservation management of the property is really important.
Anyway, there are some dangerous categories of factors, which may affect the preservation of the authenticity and consequently the OUV of the heritage.

We present some examples of earthen sites, totally or partially built in earth material, which are affected by factors related to human activities (conflicts, thefts), urban development, pollution, climate change and disasters.

4.5.1. OUV Affecting Factors in WHEAP Inventory Sites

Unfortunately several sites around the world are under **conflicts**, which can be of different origin: civil wars, internal guerrillas among gangs, fights moved by different religious concepts etc.
"Conflict is no respecter of location" (Alonzo C. Addison, 2007), in fact, everything can be destroyed and stolen during a war: forest, monuments, holy temples, and religious statues etc., which represent important values for the societies. The war leads to the poverty and the poverty leads to the looting, which increases the decay of the sites.
During these conflicts, in fact, the heritage is most of the time damaged, because it represents the identity of a population and for this reason, destroying an important

monument is the same as destroying and despising another culture, which is often erroneously considered as a dangerous reality.
The conservation of the sites is very difficult under conflicts.
The damage is quite always heavy and lots of times irreparable. In this case we cannot speak anymore about rehabilitation or conservation activities on a monument, but we can operate a reconstruction intervention or treatment to improve the stability of the remains.

This is what is happening in the **Bamiyan Valley**, in Afghanistan (Fig. 4.49).
In this valley there were the colossal standing Bamiyan Buddhas, realized by carving the mountain rocks, and fortified traditional earthen houses made by several building technologies: adobe, rammed earth and wattle and daub.
The Buddhas were hewn in the stone and covered by details made with earth, straw and horsehair. These details were attacked to the stone by wooden pegs, further covered by stucco and fine painted. The decorations of the details were probably realized with gold and jewels.

Fig. 4.49. Bamiyan Valley (Afghanistan) in recent times

During the time the valley was more and more abandoned and the decay of the sites increased due to the lack of maintenance and to a series of several conflicts.
The last conflict concerns the civil war with the Taliban.
In 2001, the Buddhas were destroyed with dynamite by Taliban forces, which considered the two statues as un-Islamic idols.
After this tragedy, the state of decay of the valley and its cultural landscape increased enormously.
For this reason in 2003, the valley was inscribed on the WHL and, at the same time, on the WHLD, as **the Cultural Landscape and Archaeological Remains of the Bamiyan Valley.**
Nowadays the WH Centre is working with a big campaign in order to safeguard the cultural landscape of this site and stabilize the remains of the Buddhas niches.

Fig. 4.50. Bamiyan Valley (Afghanistan), the Eastern Buddha statue before its destruction

Fig. 4.51. Bamiyan Valley (Afghanistan), the reinforcement of one of the niches, after the dynamites

Related to the conflicts is the development of the looting. The needed to have some money to buy food etc. increases the **theft** of the antiquities, paintings etc. from the monuments. These art works are, in fact, further sold illegally to tourists as souvenirs or to the collectors who operates illegally.

Fig. 4.52. The Great Wall in China with thousands of tourists

The **Great Wall** in China, inscribed in 1987 on the WHL, is subjected to a dangerous phenomenon of decay.
The tourists are destroying big portions of this famous monument year by year due to the theft of stone bricks, which characterize the sections near Beijing. The rest parts of the Great Wall are in adobe and rammed earth.

Fig. 4.53. The Great Wall in China, adobe and rammed earth sections

The growing request of **tourism** facilities like flight routes, railways and roads to go easily to visit the site, new comfort and expensive hotels, restoration points etc., can cause a development of the decay of the heritage.

An overall tourists numbers should in fact be limited and controlled by some guides standing on the sites, in order to avoid looting phenomena or the passage of the people on very fragile section of the property.
The tourism, in itself, is not a dangerous thing, when it is regulated and controlled by a management plan, which takes into account the sustainability of the number of the tourists, who want to visit a site, and not only the economic interest.
A conservation policy of the site should promote a sustainable tourism, which is respectful of the heritage, which means that the construction of new roads should rise only in strategic points, without disfiguring the landscape, and new hotels should be authorized and built harmonically with the property and its buffer zone.

The increase of tourism is a mirror of the **urban development**, which requests more and more new infrastructure for living, working, shopping, playing sport, travelling, etc. The pollution grows because of these new infrastructures, lots of times characterized by uncontrolled new road tracks. It is not only air pollution but also regards very bad smells, big noise etc.
If we consider the situation of **Ancient Thebes with its Necropolis,** inscribed on the WHL in 1979, the uncontrolled urban development is damaging the site and its boundaries.
Modern buildings contrast with the original landscape, characterized by traditional earthen houses made by adobe. New farms are rising along the Nile, causing the relocation of lots of inhabitants in other villages. The farms also pollute the river and when it rises, the water, absorbed by the sandstone temples, can damage them. When the adsorbed water evaporates, it leaves very dangerous crystallized salts inside the porous sandstone, which can flak. The dirty water can also favour the proliferation of pests, which can attack the monuments.

Fig. 4.54. The ancient Thebes in Egypt

The **pollution** is a product of the human activities and also one of the main causes of degradation of the monuments. The use of pesticide, fertilizers in the fields, the use of not renewable energies like petrol and its derivates, develop and favour the pollution of the waters and the air. Lots of monumental as well as archaeological sites are very damaged by acid rains or by chemical agents, contained in the air.
The increase of the pollution year by year has been taken to a change of the climate.

The effects of the **climate change** are many and very dangerous for the conservation and preservation of the monuments. Among the effects, we can cite the increase of the heavy rainfalls, which can also happen in unexpected, seasons and erode the earthen structure. The air temperatures are also getting higher, favouring the desertification and the consequent silting of the sites.

In Mauritania, the **Ancient Ksour of Ouadane, Chinguetti, Tichitt and Oualata**, inscribed on the WHL in 1996, are threatened by the desertification, which are going to cover these quarters. The structures present in these towns are made by stone, sometimes plastered with earth, while other houses are built with adobe.
The sand dunes have already covered a great part of the ancient quarter of Chinguetti, which is considered the one more in danger.
Because of the encroaching desert, lots of houses are progressively abandoned. For this reason, the lack of maintenance of these constructions is a serious problem, which ties itself to a progressively loss of the traditional building as well as conservation technologies. All these factors affect the safeguard of the authenticity of the site and consequently its OUV.

Fig. 4.55. Chinguetti (Mauritania), the mosque

The climate change is also the responsible of terrible disasters, like floods, which destroy the monuments and obviously the earthen architecture, which is very vulnerable to the moisture.
The archaeological site of **Moenjodaro** (Pakistan), inscribed on the WHL in 1980, was destroyed at least seven times by floods and then

Fig. 4.56. Moenjodaro archaeological site in Pakistan

rebuilt. In 2010 the site risked again because during the summer a terrible monsoon trigged Pakistan, causing hundreds of causalities and devastating villages. The Indus River was swollen and threatened to destroy Moenjodaro. Fortunately the interventions on the riverbanks, promoted by WH Centre-UNESCO, and completed in 1997, could avoid the effect of the flood on this protected area.

Other natural **disasters**, which can affect the architecture, are: hurricanes, tornadoes volcanic eruptions, earthquakes, tsunamis, mass movements, etc. These calamities create several damages, most of all on the vernacular architectures, which usually do not have sufficient resistance and stability against these catastrophic events.

In 2003 **Bam and its Cultural Landscape** were tragically destroyed by an earthquake of magnitude 6.5. The Bam earthquake killed more than 26000 people. Houses, religious buildings and bazaar were totally reduced to ruins. For this reason, in 2004, the WH Committee decided to inscribe the site was on the WHLD.

Fig. 4.57. Bam (Iran), after the 2003 earthquake

Bam is considered to be the largest fortified medieval town built in adobe. Nowadays some campaigns for the rehabilitation, stabilization and reconstruction of the citadel are still ongoing.

Fig. 4.58. Bam (Iran), after the 2003 earthquake

Fig. 4.59. Bam (Iran), the actual state of conservation

In the next chapter we focus on the pathologies, which affect the earthen architecture Further, some conservation and reinforcement building technologies are exposed, able to preserve the earthen constructions or limit the damages to the structures, during calamities like earthquakes and floods.

Notes Chapter Four

1. Compressed Earth Block (CEB) are earthen bricks compressed with a mechanical press which can be a machine can be a hand-operated or motorized hydraulic machine.

2. Lots of Information about the WHEAP is available at the site http://whc.unesco.org/en/earthen-architecture.

3. *Ibidem*

4. *Ibidem*

5. Jukka Jokilehto and Joseph King (2001). *Authenticity and Conservation: Reflections on the Current State of Understanding*. In: Galia Saouma Forero (ed.), Authenticity and Integrity in an African Context. Expert Meeting, Great Zimbabwe, 26th-29th May 2000, p. 33.

6. See the essay *Conservation of Conservation Methods*. In: Conserving the Authentic. Essays in Honour of Jukka Jokilehto (2009), p.117-123.

7. About the argument, see:
   Stovel H. (2000). *"Nara" Revisited: the Impact of the Nara Document on Understanding and Use of the Authenticity Concept*. In: Cristinelli G. and Foramitti V. (eds.). (2000). *Il restauro fra identità e autenticità*, proceedings of the conference "I principi fondativi del restauto architettonico", Venezia, 31 January – 1 February 1999. Grafiche TPM, Padova (Italy), Marsilio Editori, Venezia (Italy). p.243-250.

8. World Heritage Committee (2011), Operational Guidelines for the Implementation of the World Heritage Convention, *Integrity and/or authenticity*, chap. 2, par. E, November 2011, Paris (F).
   http://whc.unesco.org/archive/opguide11-en.pdf.

Chapter Five: Conservation Building Technologies for Earthen Architecture: Traditional and "Modern" Solutions and Critical Factors

The earthen architecture is subjected to several pathologies, most of them related to an inappropriate choice of the material and a wrong implementation of it, a lack of maintenance together with climatic factors, like rain and snow or natural calamities, like earthquakes and floods.

The climate change is becoming more and more a reality, which is strictly related to the increase of the disasters. The number and the power of rainfalls, for example, is growing up very fast in areas absolutely not used to this kind of harsh weather.
In 2010 for example, the monsoons came to Pakistan and then they invested and destroyed a great part of the North India. Lots of persons died and thousands lost their own houses, most of them made in earth.

In 2002 the Global Assessment Report on Disaster Risk Reduction[1] gives a definition of disaster, which is considered to be "a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses, which exceeds the ability of the affected community or society to cope using its own resources". For these reasons, the disasters are among the main causes of the increasing poverty around the world.
"Disaster risk is a product of hazard and vulnerability"[2] (World Heritage Centre-UNESCO, 2010). The first concept, the hazard, is related to the calamities, which most of the time cannot be foreseen, while the second concept, the vulnerability, is referred of a specific characteristic of the buildings.
For example if we consider the seismic risk R = D x E x V of a specified zone, we should study some values:

- D, dangerousness is related to the possibility that an earthquake happens; it is measured in Peak Ground Acceleration[3] (PGA).
- E, exposure estimates the possible seismic effects on the human and economic factors (number of inhabitants, the economical state etc.)
- V, vulnerability is related to the structure of the building in itself. Usually properties, sited in Least Developed Countries[4] (LDC), which are most of the time realized with vernacular poor technologies, are more vulnerable.

The vulnerability can be modified and reduced, safeguarding also the life of its inhabitants during catastrophic events.

For what said above, in this context, we consider some preventive conservation and reinforcement measures, able to maintain the cultural properties and limit the possible effects of natural calamity on the earthen structures. Other methodologies are to be implemented in order to restore or rebuild a property after a heavy earthquake or flood.
The technologies, which will be showed, should be improved the durability and stability of the structure, managing and reducing the vulnerability of the property.

"The heritage if well maintained can positively contribute to reduce disaster risks" (Francesco Bandarin, 2010).

5.1. Human and Natural Factors Which Affect the Structure

The earthen structures are really affected by several pathologies, which concur to the decay and/or collapse of the buildings. In these paragraphs we focus on three main factors related to the human construction activities and the natural events.
These factors, which affect the earthen buildings, are:

1. the inadequate choice of the building materials and their implementation;
2. the scarce or totally lack of maintenance of the buildings;
3. the climatic factors, like rain, snow, ice and wind but also more relevant event like earthquakes and floods.

These factors are strictly related to each other and responsible for the decay of the buildings.

5.1.1. The Inadequate Choice of the Building Materials and their Implementation

The pathologies, which affect the earthen structures, are mainly the results of problems related to construction material implementation defects. The building technologies as well as the choice of the material can favour, in fact, the beginning and the development of the pathologies tied to the water infiltration and moisture.
Most of the time the building technologies defects regard: the choice of the appropriate material (Fig. 5.1), the content of the water in the earthen mixture and its implementation, the insufficient linkage among the walls, the inadequate roofing overhang, the lack of foundations etc.

Fig. 5.1. Province of Cagliari in Sardinia (Italy), a sand cement plaster can get separated from the earthen walls because of the vapour pressure and the low cohesion between the two materials

It is necessary to remember that the vernacular earthen architecture does not follow any kind of "paper" project during the realization of traditional buildings.

Only few countries like India, Pakistan and New Zealand provide in the national construction standards, some empirical criteria in order to build non-engineered constructions, considered vernacular. These buildings belong most of the time to the private rural architecture, which is usually damaged and destroyed by climatic disasters.

Paying attention to the choice and implementation of the earth material can help to avoid the collapse of the structure during a seismic event. For example, sometimes the preparation of the adobe, is approximate and realized very quickly without taking care if, during the production, the earth fills entirely the mould and, above all, its angles. The lack of earthen mortar along the vertical joints between the adobe has also been observed (Fig. 5.2). These phenomena lead to a low resistance of the wall in itself, because the earthen blocks are not well connected to each other and for this reason, they cannot resist together against a wall oscillation due to a seismic event or a flood.

Fig. 5.2. Kanji, Ladakh (North India), the lack of earthen mortar along the vertical joints

5.1.2. The Scarce or Totally Lack of Maintenance of the Buildings

Another very recurrent problem is due to the lack of periodic maintenance of the structure. A non-engineered earthen building, not subjected on cyclical maintenance, during the time, it will be attacked by degradation phenomena.

For example, in lots of earthen architectures, the earthen plasters should be maintained each year.

The moisture can penetrate inside the earthen plaster by capillarity, through out cracks generated by the freeze-thaw phenomena, by an insufficient drainage of the roof, by an inappropriate dimensioning and positioning of the slopes. Further the water infiltrations can cause the removal and the loss of great quantity of construction material (Fig. 5.3).

A cyclical maintenance can avoid these pathologies, and as consequence, block or limit the water infiltrations through out the architectural elements. The moisture can also corrode the earthen masonry internally, modifying the stability of the structure, causing a loss of resistance as well as the collapse of the construction.

Fig. 5.3. Kanji, Ladakh (North India), wall erosion due to the water from the slope

For this reason, a non-engineered structure, like most of the earthen vernacular constructions, if subjected to preventive maintenance activities, risks less to collapse during an earthquake or a flood. In this way the future reconstruction interventions can be deeply reduced.

5.1.3. The Effects of Climatic Factors, like Rain, Snow, Ice and Wind but also More Relevant Events like Earthquakes and Floods

The climatic factors, as said before, are strictly related to the others two factors like: the inadequate choice of the building materials and their implementation and the scarce or totally lack of maintenance. This third factor is considered as an external cause, which can affect the earthen structure.

Fig. 5.4. Leh (North India), the disaster after the flood in 2010

Some persons think that the vernacular buildings were and are still built following traditional oral rules, which can safeguard the life of the inhabitants during earthquakes or floods, better than "modern" technologies. The traditional constructions, in fact, are related to the context in which are sited. For this reason, the architectural characteristics and the use of a specific construction material reflect the climatic aspects of a particular area. On the other side, the problem of the natural disasters is increasing and not always predictable: seismic events of an unexpected power, terrible floods in areas, not considered so rainy till some years ago. The inhabitants are not used to live with this "new climatic factors" and as consequence, their dwellings, are not suitable for this "always changing" climate.

Fig. 5.5. Leh (North India), the South part of the city was totally destroyed by the monsoons in August 2010

5.2. How to Choose the Appropriate Preservation Treatment?

Before choosing the right methodologies to adopt for the conservation of a site, it is important to carry out a multidisciplinary research, analyzing the history of the building, the traditional construction technologies, the used materials and obviously the pathologies to which it is subjected, the climate and not less important, the ground in which the property is located.
It is really necessary studying the site area because it can be a seismic zone or the ground may not favour the drainage of the water far from the earthen construction.

5.2.1. General Pathological Formwork of the Earthen Architecture

In this chapter some of the most frequent pathologies, which can affect the property, are identified.

5.2.1.1. Dampness as Cause of the Pathologies

The earthen architecture is very sensitive to the dampness, which can cause severe damages on the structures.
The **direct action of the rain** on surfaces not protected with appropriate roof overhangs or totally uncovered, such as in the archaeological sites areas, may cause a great loss of construction material. The water, in fact, falls on the earthen surface and penetrates inside the structure by capillarity, decreasing the resistance and the cohesion of the masonry, which start to crumble.

Fig. 5.6. Uch Kulakh (Uzbekistan), a room of the earthen castle in 2006

Fig. 5.7. Uch Kulakh (Uzbekistan), a room of the earthen castle in 2007

Fig. 5.8. Uch Kulakh (Uzbekistan), South-East bastion of the earthen castle in 1999

Fig. 5.9. Uch Kulakh (Uzbekistan), South-East bastion of the earthen castle in 2008

Fig. 5.10. Djenné (Mali) the Youth House: the water stagnation on the roof

Fig. 5.11. Sankoré (Mali), the erosion of the mosque roof after the water stagnation

The capillarity action is another of the main causes of the pathologies, which affect the earthen structures. From the ground the water can penetrate along the walls and trigger a process of internal erosion, which can lead the structure to the collapse. In such cases, when the plaster on the walls is waterproof, like the cement-type render, it does not permit the moisture inside the masonry to evaporate. The volume of humidity grows more and more inside the wall. At this time, different damages can occur: first of all cracking, separation and falling of the plaster which cannot protect the structure anymore, then if the problem persists, the masonry can be filled by an excessive quantity of humidity and further collapse.

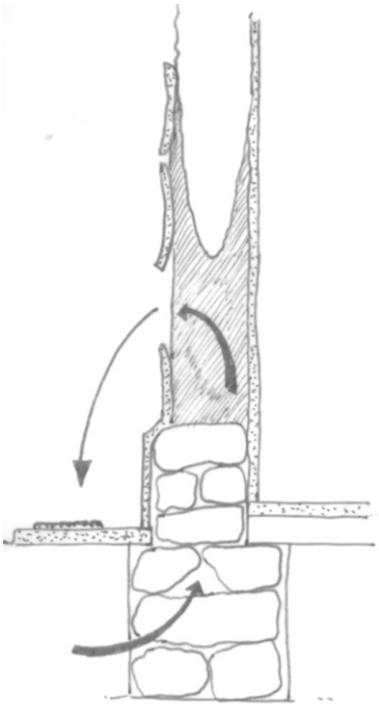


Fig. 5.12. The capillarity action in an earthen wall and its effect on the plaster

Fig. 5.13. Timbuktu (Mali), decay of an earthen house due to the direct action of the rain and the stagnation of the water at the basement

The direct action of the rain, together with the water capillarity from the ground, can cause the basal erosion of the walls, not supported and joined with an appropriate basement, which may avoid the effect of the splashing rain.
This phenomenon might appear also between the connection earthen wall-basement in stone/terracotta bricks. For this reason an appropriate implementation of the external plaster is necessary.

Fig. 5.14. Abomey (Benin), the basal erosion of the wall due to the direct action of the rain as well as the capillarity

Fig. 5.15. The splashing effect of the rain along the joint wall-basement, already damaged by the capillarity

Related to the direct action of the rain and the capillarity, there are the problems of the **dissolvable salts**. The salts, which are mainly responsible of the surface erosion of the external coat of the earthen walls, are nitrates, chlorides and sulphates. On the surface of the structure, the water may evaporate and the salts begin to crystallize in the pores of the earth material, increasing more and more in volume. Subsequently after a following rainy period, the salts might dissolve. These continuous cycles favour a loss of the resistance as well as the cohesion of the material.

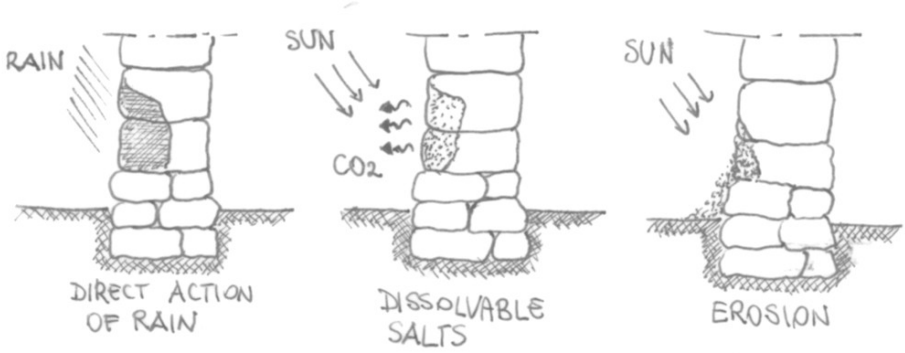


Fig. 5.16. The action of the dissolvable salts on the earthen walls

Fig. 5.17. Djenné (Mali) the Youth House: the basal erosion of the wall due to the dissolvable salts

Fig. 5.18. Djenné (Mali) the Youth House walls in Sankoré road: the basal erosion of the wall due to the dissolvable salts

In areas, characterized by very cold winters, the phenomena of contraction-expansion of the building coat can create severe cracks, which can pass through all the thickness of the walls and the roof.
During the rainy season the water may penetrate the plaster, in the masonry, most of the time between the joints among the walls.
During the wintertime, the water freezes and increases in volume, creating cracks, which weaken the building. During the following springtime, when the rainfalls are more frequent, the water can easily go inside the structure, through these gaps and seriously damage all the building. These **freezing and thawing circles** can deeply affect the earthen architecture.

Fig. 5.19. Bukhara (Uzbekistan), the swelling and the loss of the earthen plaster which is subjected to harsh winter and hot summers

Some pathologies are born as a consequence of **humid and dry circles**. The coat absorbs the water but when the warmer time comes, the evaporation of the moisture generates strain and then cracks related to the "withdrawal" of the earthen plaster. This phenomenon can appear inside and outside the structure, eroding the material.

Fig. 5.20. Mali, the water infiltrations through out the roof

Fig. 5.21. Timbuktu (Mali), the roof degradation due to rain and wind

When a wall is not covered anymore by protecting coat, which is not restored because the lack of maintenance some **vegetal or animal organisms** can **attack** the structure. Moss and lichens can easily grow on the earthen buildings because the natural construction material favours their development. These vegetations catch hold of the earthen walls; limiting the evaporation of the moisture and, in some cases, can penetrate with the roots inside the structure, among the joints, damaging the bonds, weakening the building.
Bird or insect nests may be built in holes of the masonry, belonging most of the time to abandoned buildings.
A cyclical cleaning maintenance of the structure can limit these biological attacks avoiding the risk of localized deterioration.

Fig. 5.22. Varakhsha (Uzbekistan), the archaeological site is totally covered by plants and bushes

Fig. 5.23. A rammed earth wall affected by parasites like moss

5.2.1.2. Structural Defects as Causes of the Pathologies

A structural analysis of the building is deeply important before choosing the conservation interventions. The earthen buildings can be really damaged by violent earthquakes, like in Chile in 2010 and in Lima in 2007. For a MSK Intensity of VI the structure can be lightly damaged, for a MSK intensity of VII, the structure starts to present more and wider cracks and some parts can collapse, for a MSK intensity of VIII, the earthen building may totally collapse5.
In order to improve the resistance of the earth material, its implementation and preservation should be carried out by conservation experts, but lots of times this does not happen. As said above, in fact, the local populations usually carry out the construction and the maintenance of many earthen building.
For this reason some irregularities in the implementation of the earthen material may occur and lead to several pathologies.

Gernot Minke in the "Construction manual for earthquake-resistance of earthen buildings – Guidelines" summarizes in ten points, the principal factors, which affect the life of an earthen building against the earthquakes:

1. Ring beam is lacking.
2. Lintels do not reach deeply enough into masonry.
3. The distance between door and window is too small.
4. The distance between openings and wall corner is too small.
5. Plinth is lacking.
6. The window is too wide in proportion to its height.
7. The wall is too thin in relation to its height.
8. The quality of the mortar is too poor, the vertical joints are not totally filled, the horizontal joints are too thick (more than 15 mm).
9. The roof is too heavy.
10. The roof is not sufficiently fixed to the wall.

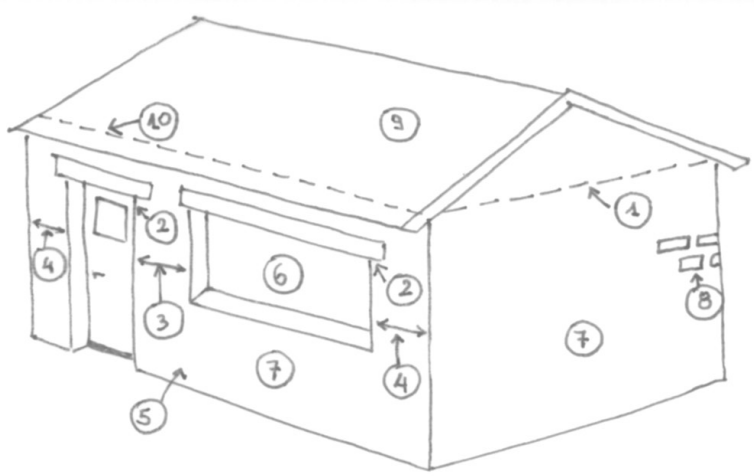


Fig. 5.24. Design mistakes in an earthen building

The guidelines presented by G. Minke are referred to new constructions, but they provide an idea to what has to be avoided or modified during the conservation activities in order to make the earthen buildings more resistant.

5.2.1.3. Brief Analysis on the Structural Characteristics of the Earthen Buildings

The earthen buildings are characterized by several damage models, which can occur during an earthquake (Fig. 5.25).
The overturning is one of the main damages, which can happen during an earthquake. The seismic event produces out-of-plane ground motions, which favour the beginning of flexural cracks along the joints among the foundations, if they exist, the load-bearing walls and the roof (Fig. 5.26).
Unfortunately the **connections** among these architectural elements are most of the time insufficient and low resistant.
The consequence is the corner failure (Fig. 5.27) or the separation and the out-of-plane overturning of the entire wall. For these reasons, it becomes extremely necessary that the joints are assured in order to have a "**box-type**" layout structure, in which all the architectural elements can act together against any kind of external stress, like deformations due to the earthquake vibration (box effect).
Some interventions for improving the joints of wall-foundation, wall-wall and wall-roof of an earthen building, will be showed.

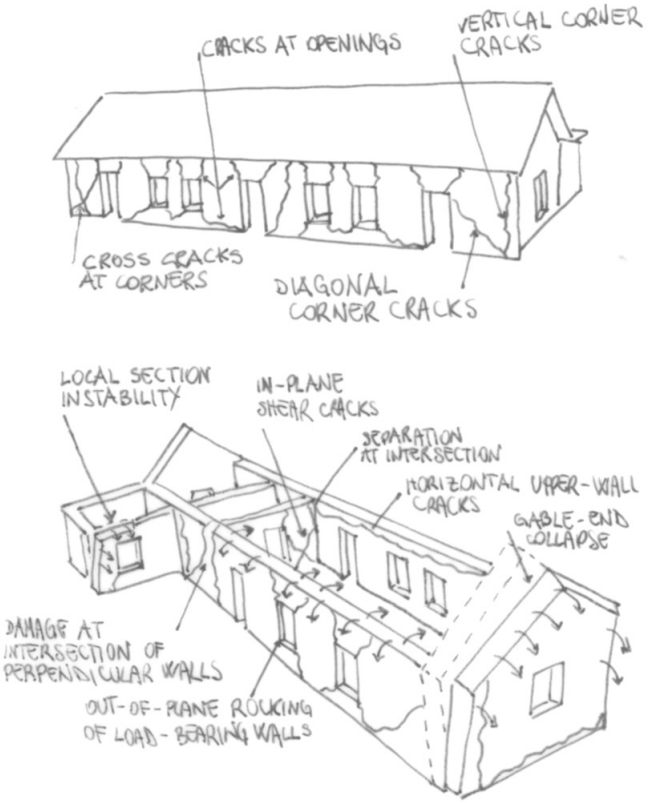


Fig. 5.25. Typical seismic damage models observed in one-floor historic adobe buildings

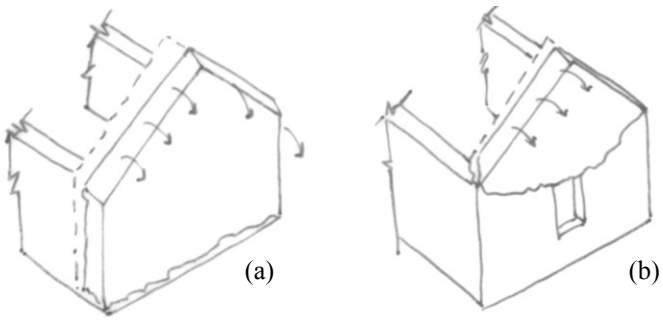


Fig. 5.26. Gable collapse: (a) the overturning at the wall base (b) mid-height collapse

A seismic retrofitting should be a part of the conservation activities but first of all, it is necessary to determine if the building needs to have previous conservation treatments, like filling the cracks along the joints and the masonry, reinforcing the basement etc.

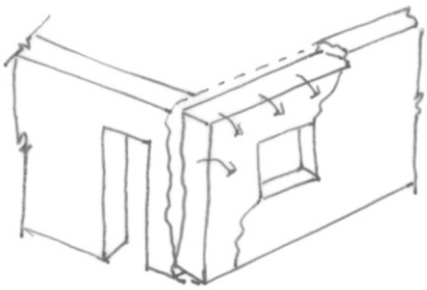


Fig. 5.27. The corner failure and overturning

The seismic retrofitting is an ensemble of activities carried out in order to improve the resistance of the buildings. These activities may concern the reinforcement of the bonds among vertical and horizontal structural elements, the introduction of ring beams etc. The reinforcement methodologies should be preventively analyzed and discussed in order to avoid the risk to threaten the authenticity of the building. These interventions are often subjected to ignited debates among the earthen architecture conservators, who discuss about the safeguarding of the original aspect of the construction as well as the introduction of new materials and technologies.

Other damages are related with the out-of-plane flexure and collapse of a part of wall, always due to the formation of several cracks along the structure (Fig. 5.28). A particular case occurs when the wall cracks are in the middle-height. In both cases, an improved masonry, maintained with some specific interventions, can avoid or limit these phenomena (Fig. 5.29).

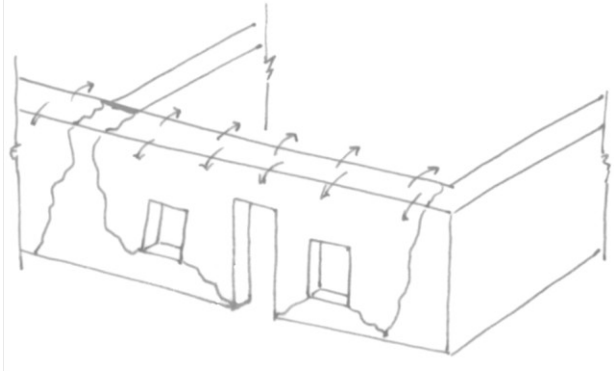


Fig. 5.28. Out-of-plane flexure cracks and collapse

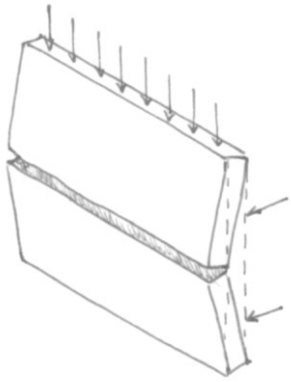


Fig. 5.29. Mid-height flexure crack

The conservation of the earthen masonry can help also to avoid the formation of in-plane shear cracks, called also X-shaped cracks (Fig. 5.30).
The opposite movement of the ground during an earthquake also causes the shear cracks near the openings.

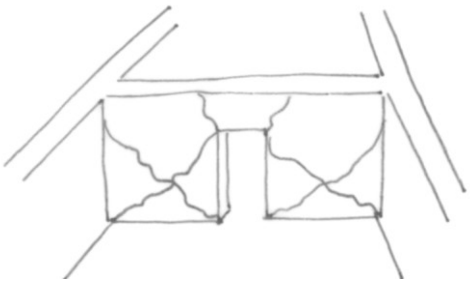


Fig. 5.30. X-shaped cracks in a partition wall

The openings are deep interested in the cracks phenomena (Fig. 5.31), most of all

if the earthen masonry, around these architectural details, is already compromised by the penetration of moisture from the ground or due to the rain, which falls directly to the walls. In these cases, a conservation activity on the walls should combine an improvement of the masonry, then covered with an appropriate plaster.

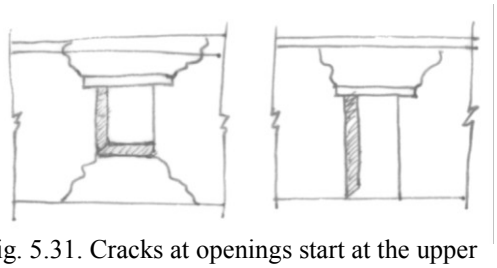


Fig. 5.31. Cracks at openings start at the upper part of the wall and then at the base

In order to limit the seismic damages, **the shape** of the building should be compact, like a cube or a parallelepiped with a rectangular base. Obviously the conservation activities should not do anything to change the shape of a construction. The authenticity of the historic buildings has to be respected and for this reason the aspect of the monument, after the intervention, should be much more possible similar to the original one.
From another side, during a reconstruction activity, it is possible to avoid to rebuild parts of building, added in recent times, which do not belong to the original form of the structure and can be dangerous during a seismic event. A regular shape, in fact, is less vulnerable rather than an asymmetrical one.

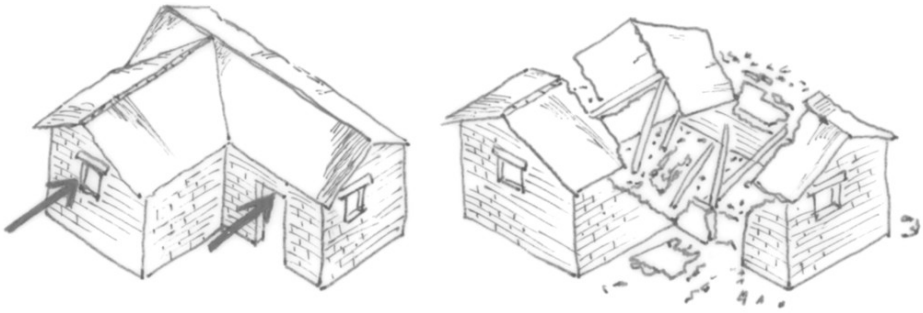


Fig. 5.32. Possible seismic effect on a L-shape building

The symmetry of **the façade** should be maintained during a conservation activity. In case of reconstruction, the original openings disposition should be restored, while windows or doors, not belonging to the traditional aspect of the building, should be closed. These openings might weaken the building, alter the loads distribution and, as consequence, favour structural damages. For this reason, if new openings are built, their positioning should be subjected to a structural analysis of the original building, safeguarding the traditional aspect of the property.

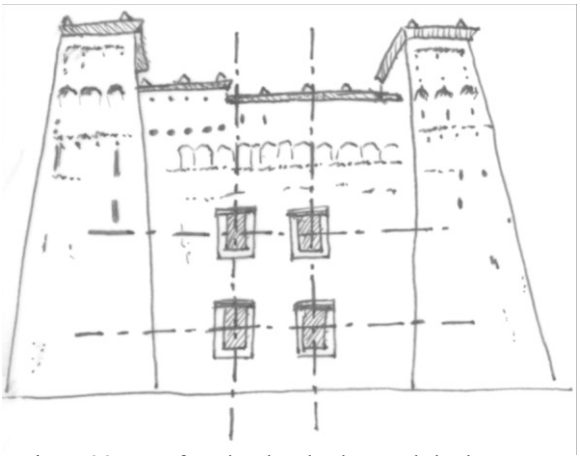


Fig. 5.33. In a facade, the rhythm and the harmony of the proportions should be maintained after the conservation activities

5.3. The Site Position: How to Improve the Subsoil Conditions

Sometimes the earthen sites are located in not suited areas, for its preservation, like riverbanks, among the trees, on a non draining soil. The presence of many trees, which surround too much close an earthen structure, does not let it "breath" in a sufficient way and consequently the moisture in the walls cannot evaporate, creating pathological effects. For this reason the trees should stay some meters away from the earthen walls.

Considering the subsoil conditions, obviously we cannot change the position of the building but we can operate in order to make the ground, where the construction is situated, "safer".
The irregular compaction of the ground creates zones of different load-bearing capacity. This phenomenon may cause serious cracks in the masonry.
The ground can be more compact and more resistant. The intervention consists in planting micro-piles, in reinforced concrete. These piles can improve the load-bearing capacity of a ground, which, after the intervention, can support heavy loads.
The improvement of the ground load-building capacity can be obtained also injecting in the soil appropriate chemical materials, like ethyl silicates.

A peripheral drainage can also be very useful in order to preserve the stability of a building, limiting the water infiltration, which may cause several pathologies on the structure (e.g. plaster exfoliation).
Below some drainage solutions are presented.

5.3.1. WATER PERIPHERAL DRAINAGE

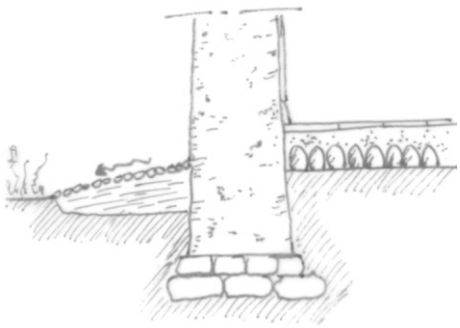


Fig. 5.34. Surface drainage

5.3.1.1. SURFACE DRAINAGE

The technology consists in realizing a slope of about 5% near the walls in order to make the water run away from the earthen surface, avoiding the stagnation and the subsequent risk of infiltrations.
The slope can be covered by stones or gravel, which prevents the formation of mud on its surface.
The water should penetrate in the ground at least 1 meter far from the earthen structure.

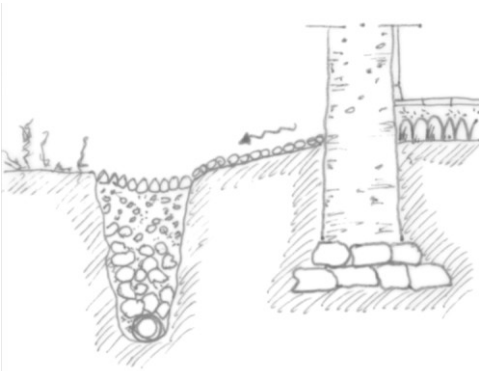


Fig. 5.35. Underground drainage

5.3.1.2. UNDERGROUND DRAINAGE

This is the same technology explained above but in this case, the water penetrates in the soil through out an underground drain, made by stones.
The underground drainage is realized in very humid areas, where, after the rainfalls, the water might reach the walls of the building.
The drain should be realized at least 1 meter far from the earthen structure and its depth should be lower than the base of foundations.

Fig. 5.36. Bahla fort (Oman) two different solutions of drainage with stones at the wall base and with stone and cement pavement

5.4. Conservation Technologies: between Tradition and Innovation

"All a house needs is a hat and a good pair of boots" (Welsh proverb)

In order to safeguard and protect the earthen heritage, it is necessary to study the properties of this living construction material, its durability and resistance as well as the main typical pathologies, which affect these "unconventional" structures.
The conservation technologies for the earthen structures are a lot. Some of these techniques respect, more the others, the principle of the authenticity of material and technology (see Chapter three).
As described before, in fact, the building technologies adopted for the conservation of the earthen architecture as well as in wood, stones, bricks etc. are divides in techniques, which use only traditional construction materials, techniques, which use only "modern" or chemical materials and techniques, which can represent an innovative approach, able to mix traditional and modern materials.

Now some preventive technologies are presented. These methodologies aim at improving the durability, the stability as well as the resistance of an earthen building. We provide some observations for each conservation treatments, following the principles of the authenticity of material, techniques and form of a building.

The preservation building technologies are divided in categories:

1. interventions on foundations
2. interventions on vertical elements (load-bearing walls and partition wall)
3. interventions on horizontal elements (floors and roof)

The described technologies are general explanations of conservation methodologies to reinforce the earthen structures and improve their durability. It is important to underline that these interventions should be adapted to each different circumstances.

5.4.1. INTERVENTIONS ON FOUNDATIONS

The foundations play a very important role for the stability of a building. They have to bear all the loads of the structure and distribute them to the ground. The foundations are considered the connections between the structure and the ground.
For this reason the foundations should protect the walls from the attack of the moisture.
The earthen walls, instead, are sometimes directly in contact with the ground or the foundations are not appropriated. In these cases, the moisture can go, through capillarity, from the ground to foundations, up to the walls. This process can deteriorate all the structure, causing a loss of stability of the building, making it vulnerable during a flood or a seismic event.
In order to avoid these kinds of situations, it is possible to reinforce the existing foundation or build an improved new one, if it is not originally present.
If a foundation is partially damaged, it is possible to rebuild the part subjected to decay. The suggestion is to implement, during the interventions, the same original material, in order to avoid different reactions in the construction, during a seismic event.
In this context, we speak about the interventions for improving or realizing continuous foundations.
First of all, it is important to evaluate and further, if necessary, dimension the surface (S) of the foundation, analyzing the loads related to the foundation and to the structure (W_T) and the bearing capacity of the ground (σ).
The formula used for the foundation dimensioning is $S = W_T / \sigma$.

Before starting the intervention on the foundations, it is important to know all the pathologies, which affect the structure and then eliminate the related causes.

The foundations can be reinforced injecting hydraulic and natural lime grout in the existing basement. Sometimes also cement is used for stone basement.
Below some interventions are presented, concerning the construction or the extension of foundations, implementing stones, terracotta bricks, stabilized compressed earth blocks and concrete.

5.4.1.1. INSERTION OF A STONE/TERRACOTTA BRICK FOUNDATION

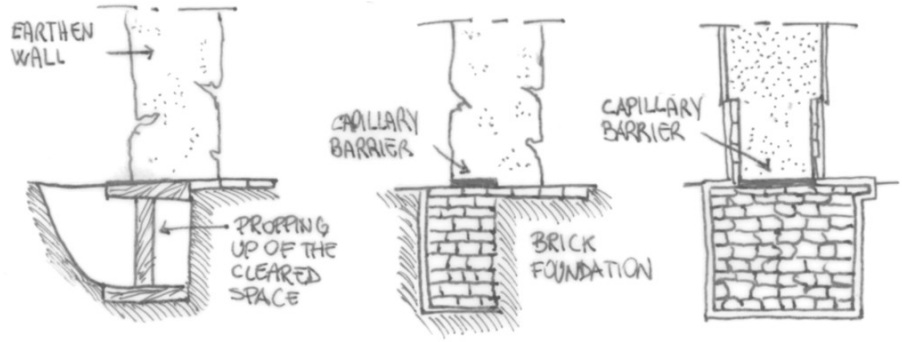


Fig. 5.37. Insertion of a stone/terracotta brick foundation

The insertion of a stone foundation needs to operate in small sections of maximum 1 meter wide at a time. Longer sections may cause the collapse of the building.
The work is divided in two parts: it is necessary to work on two sides of the foundation, but not at the same time.
A small excavation under the wall should be deep as half of the wall thickness and only 1 meter wide.
Then the structure has to be propped out by a wooden support for example, in order to ensure the protection of the workers, during the interventions, and to avoid other possible damages.
A stone/brick foundation can be built, introducing a capillary barrier under the wall.
This implementation should be repeated on the other side of the foundation.

Fig. 5.38. Bahla (Oman), realizing a stone basement to stabilize the wall

Observations

- This intervention should be carried out during a dry period, in order to avoid phenomena of stress in the structure, which may become unsafe for the workers.
- The stones should be positioned on their flat side, in order to avoid cracks on the walls.
- The water infiltration at the base can be prevented, laying the stones or bricks, following the vertical surface of the wall.

- The materials like stone and terracotta can be considered compatible with the earth: the connections between stone/fired brick foundations and the earthen walls as well as the behaviour of the structure during a seismic event do not give particular problems.
- In this intervention, the authenticity of the original aspect of the building can be considered safeguarded. The foundation seems to be realized as a construction part distinct from the rest of the original structure, but, at the same time, is strictly connected to the building and supports it.
- This intervention can be used in order to improve an original stone basement (Fig. 5.39).

Fig. 5.39. Kanji, Ladakh (North India), the earthen buildings in this area are characterized by a stone basement without foundations

5.4.1.2. INSERTION OF A FOUNDATION MADE BY STABILIZED COMPRESSED EARTH BLOCKS[6] (SCEB)

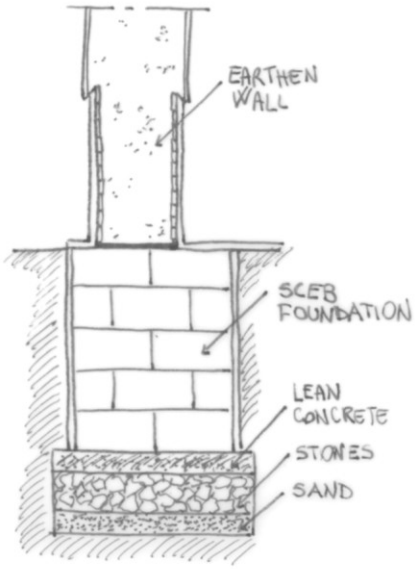


Fig. 5.40. Insertion of a SCEB foundation

The process of digging follows the same criteria explained above (see "Insertion of a stone/ terracotta brick foundation").
Before implementing the foundation, a first layer of sand should be realized.
Then a second layer made by stones should be spread.
The third and last layer consists in a lean concrete; upper a foundation made by SCEB can be built.

Observations

- Compressed earth block (CEB) should not be used for the foundations, while SCEB can be implemented for this treatment.
- The CEB can be stabilized with cement or lime. The introduction of cement and lime make the block stronger and waterproof.
- The mixture of the SCEB can be made implementing cement and earth (1:12).

5.4.1.3. WIDENING A FOUNDATION WITH CONCRETE OR TERRACOTTA BRICKS

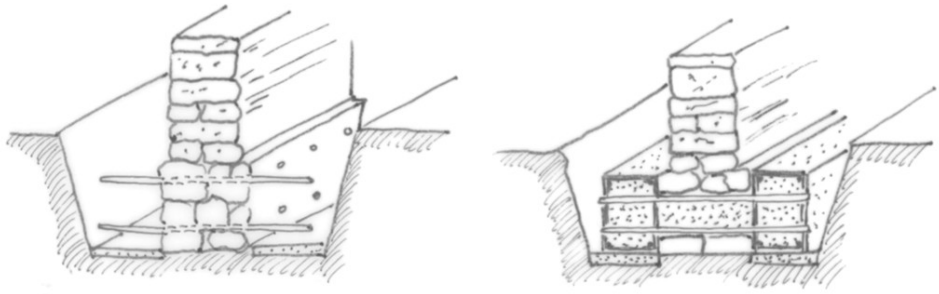


Fig. 5.41. Widening a foundation with concrete or terracotta bricks

First of all it is necessary to evaluate the existing foundations, their surface and load capacity and the resistance of the ground.
In case of "weak ground", before starting the conservation treatment we should operate a reinforcement of the soil (piles, injections, etc).
When the ground has a good bearing capacity, the foundation surface may be widened.
The intervention consists to enlarge the original foundation surface, introducing fired brick/concrete beams on both sides of the base.
The beams are connected to each other and with the existing structure, thanks to transverse steel bars.
A widened foundation may improve the load distribution of the upper structure but the old foundation and the new one must be jointed and "work together".

Observations

- The use of concrete is sometimes criticized by a part of earthen constructions conservators. This material is not considered "natural" at all, respect to the earth and for this reason it should be avoided. Some alternative solutions, like the use of terracotta bricks should be preferred and adopted.
- The use of terracotta bricks is considered more compatible with the earth, because they share some similar properties, like porosity, breathability, etc.
- In this treatment, the authenticity of the aspect of the property can be considered safeguarded, while the authenticity of the materials is not preserved, because of the use of concrete, which does not belong to any vernacular earthen building technologies.

5.4.2. INTERVENTIONS ON THE VERTICAL ELEMENTS

The reinforcement of the masonry and its joints can deeply improve the resistance and the stability of a building during seismic events or floods.

The treatments are more or less heavy in relation to the different kind of damages. Some small gaps or holes can be filled by adobe, stones or terracotta bricks.
Some interventions are related to the reparation of the cracks (vertical, elbow-shaped, 45° angled), present along the walls. The cracks can be "living" or "dead". In the first case, the damages may cause the collapse of the structure, while in the second case, they do not carve the stability of the building. In order to check if a crack is living or dead, and study its evolutions, a plaster pad should be placed over it and monitored for some months.

Fig. 5.42. Bahla (Oman), Harah quarter, cracks along the walls

Fig. 5.43. Sankoré (Mali), a big crack at the wall corner

Fig. 5.44. New Gourna (Egypt), cracks along the walls and at the openings

Fig. 5.45. Mali, Djing quarter, cracks along the walls

The joints of the walls should be reinforced because these architectural elements are most of the time subjected to stress phenomena during an earthquake.
The corner walls, in fact, can be invested by shear and flexural cracks, which can lead the building to the collapse.

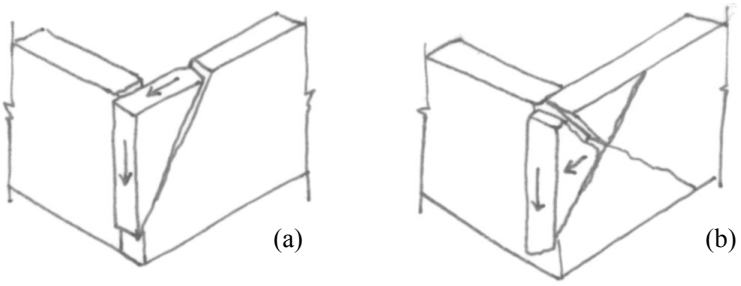


Fig. 5.46. Damages of the corner wall sections after an earthquake: (a) vertical downward and horizontal displacement, (b) shear and flexural cracks

The separation among loading walls and partitions occurs very frequently during an earthquake. This phenomenon can appear between in-plane and out-of-plane walls (Fig. 5.47 (a)) or in other cases, the cracks can develop in the intersection between out-of-plane walls and the orthogonal in-plane walls (Fig. 5.47 (b)).

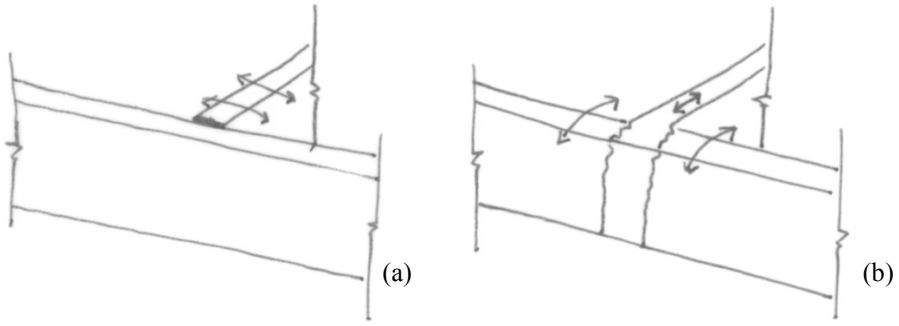


Fig. 5.47. Cracks along the joints of loading walls and partitions: (a) damages between in-plane and out-of-plane walls, (b) damages between out-of-plane walls and the orthogonal in-plane wall

If a beam is attached to the edge of a wall, its movement during an earthquake can cause the formation of cracks which run horizontally along the upper masonry area.

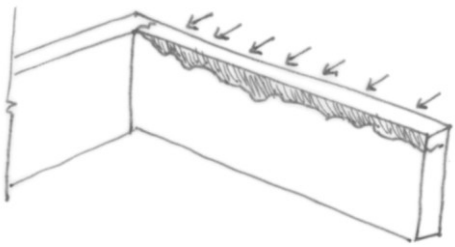


Fig. 5.48. Horizontal cracks in the upper masonry area due to lateral forces

In order to reinforce the walls and their joints, different kind of mesh can be used: a "natural" one, a stainless-steel wire one, a synthetic one etc.

Other interventions concern the introduction of ring or tie-beams inside the building in order to border the structure, improving its performances during a seismic event.
The interventions on the walls may be followed by plastering, implementing several layers of different earthen mixtures.
Other techniques concern the improvement of the resistance of the masonry injecting or spraying chemical products on the existing wall structure.
The interventions should be implemented using compatible materials, which can be placed in contact to the earth. Some problems, in fact, related to the galvanization of the wire meshes placed on an earthen masonry, can appear, together with different structural behaviours of the two components.

Below some interventions to carry out during reconstruction and/or conservation activities, are presented. The methodologies implement the use of natural as well as "modern" materials.
Some of the treatments take inspiration from traditional building technologies or can be implemented during emergency conservation activities.

5.4.2.1. DISMANTLING AND RECONSTRUCTION OF ADOBE MASONRY

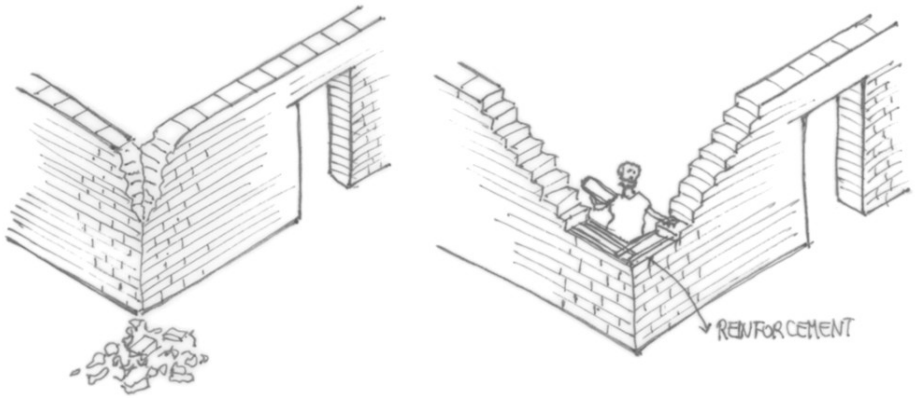


Fig. 5.49. Dismantling and rebuilding collapsed sections in adobe masonry

This intervention is adopted during the reconstruction activities of adobe walls, which are deeply damaged or partially collapse.
The dismantling of the damaged sections and corners follows a form of "staircase" on both sides. All fragments are removed and the surface is cleaned and dampened before placing the new adobe or some of the old ones, if still in good conditions.
The corners can be improved with some reinforcement technologies, using wooden frames, bamboo etc. (some examples are explained below).
The rebuilt structure should be covered by earthen plaster.

Fig. 5.50. Nisa (Turkmenistan), archaeological site made by earthen blocks, partially rebuilt with the same technology

Observations

- During the process of reconstruction, the adobe should be placed, paying attention to create joints between the paraments of a wall and among the walls (wall corner).
- The technology and the material used for the reconstruction should be compatible with the earthen bricks. The strength of the building materials, in fact, should be similar, in order to

have the same behaviour of the whole structure during a seismic event or flood. For this reason cement mortar should be avoided.

Fig. 5.51. Bahla (Oman), North West Tower of the Fort under reconstruction and after the intervention

- Sometimes this intervention is implemented not only to rebuild some parts of walls but also to reconstruct an entire room of a building. In this case the authenticity of the original aspect of the property cannot be safeguarded and satisfied by this treatment (Fig.5.52). The reconstruction of a small part of a property, in order to provide it a good stability, is accepted; while, the whole reconstruction of big sections of a structure can be subjected to some adverse opinions and not approved.

Fig. 5.52. Kanji (North of India), a house wall totally dismantled and rebuilt

5.4.2.2. DISMANTLING AND RECONSTRUCTION OF RAMMED EARTH/COB WALL

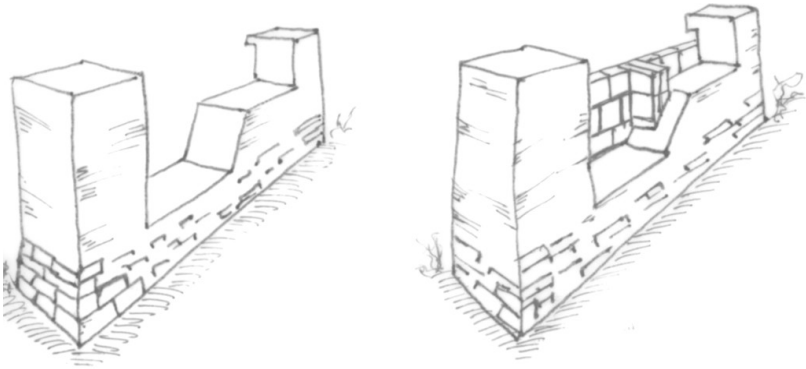


Fig. 5.53. Dismantling and rebuilding collapsed sections in rammed earth or cob

The rammed earth or cob structure consists of mono-bloc walls, which can be in part dismantled and rebuilt without creating phenomena of stress.
After removing all the fragments, it is necessary to clean all the surfaces.
For what a rammed earth structure concerns, it is necessary to cut the remaining wall at 45° angle in order to improve the adhesion of the new rammed earth material.
A formwork is installed and the existing surface is dampened before the application of the new layers of rammed earth, which should be about 10 cm maximum each.
For what a cob structure concerns, it is not necessary to cut the cleaned surface but only to implement a dedicate mixture of new cob.
In both cases, the reconstruction can be also implemented with mud bricks.
All the final structure should be covered by plaster.

Observations

- The dismantled material can be reused for the reconstruction.
- For repairing rammed earth or cob walls, it is necessary to adopt the same original technique and material: rammed earth, cob or adobe. For this reason the use of terracotta bricks is not recommended.

5.4.2.3. REBUILDING THE WALL JOINTS: THE CORRECT PLACEMENT OF THE BRICKS

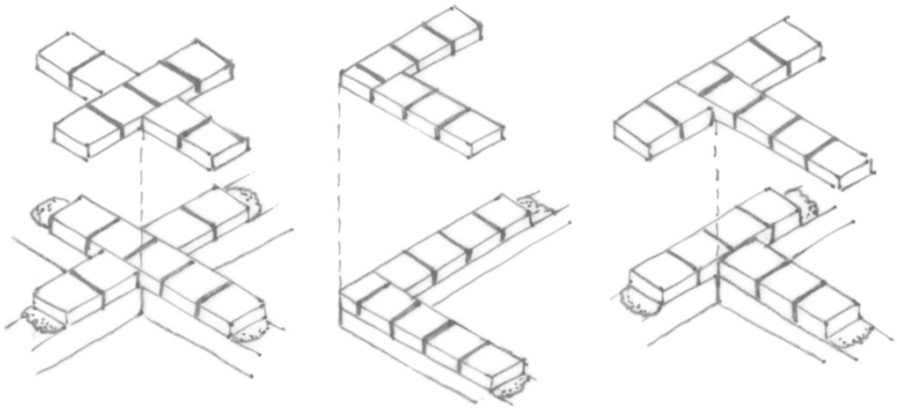


Fig. 5.54. Manner to place the mud bricks: I-shape, L-shape, T-shape, first and second rows in an earthen masonry

During a reconstruction activity, there is the possibility to improve the placement of the adobe in

the joints of the walls. Often the traditional structures consist of orthogonal walls not bonded to each other. In other cases the wall itself is made by two masonry faces, built separately, without any kind of connections.
During a seismic event, these structures are subjected to serious damages: the box-type behaviour is not satisfied because of the lack of joints, and the walls may be divided in two masonry faces and collapsed.

Observations:
- It is necessary to pay attention to the implementation of the earthen mortar, which must be spread, along vertical and horizontal joints among the mud bricks.

5.4.2.4. FILLING GAPS AND HOLES WITH NEW ADOBE, FIRED BRICKS OR STONES

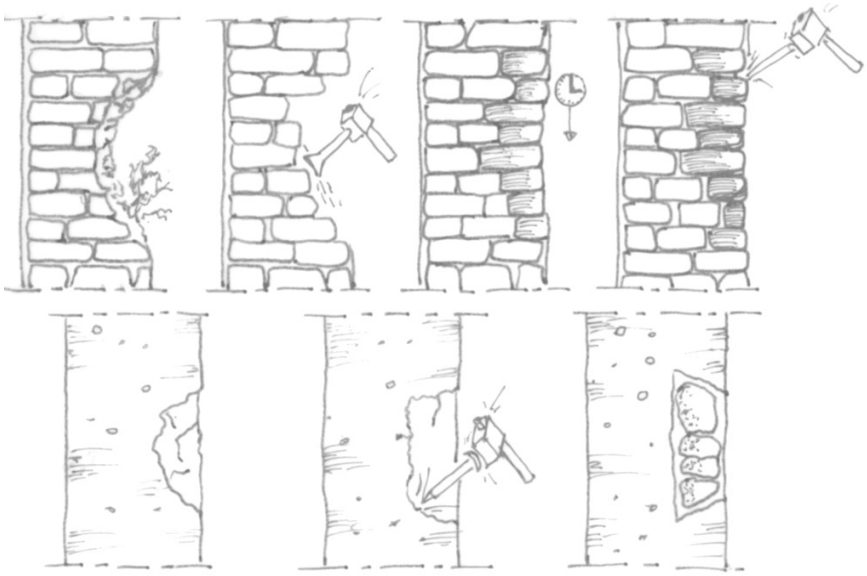


Fig. 5.55. Filling gaps and holes in earthen walls

For what concerns the repairs of small cracks and holes, the use of a dedicate mixture of earthen traditional mortar should be preferred, using pressure pups or manually.
The mixture can be additivated with some chemical products like hydraulic lime rubber, in order to improve its resistance and durability.
If the gaps are quite big, but still not deep, it is better to fill them with some new adobe, terracotta bricks or stones, implementing them using a specified earthen mortar with minimal shrinkage.
First of all, the hole should be cleaned, eliminating all the fragile parts, then, after an attentive humidification of the wall, the "new masonry" should be built following a regular course.
Subsequently it is strictly suggested to reinforce all the structure, using an adequate technology like the implementation of synthetic or natural mesh etc. After this reinforcement, the wall should be plastered.

Observations
- The use of chemical additives, like hydraulic lime rubber or synthetic resins, may be not always approved in order to respect the authenticity of the traditional material, in this case the earth. Some conservators think that the earthen mortar should be maintained "natural", improving it only with other "natural" additions such as lime.
- The implementation of cement or concrete blocks is wrong, because these materials are not compatible with the earth. The earth has a totally different strength respect to the cement and for this reason they cannot react coherently against phenomena of stress.
- The earthen mortar can be added with sand and gravel in order to limit the shrinkage phenomena.

- In order to safeguard the authenticity of the aspects of the property, it is better to hide the repair with earthen plaster. The repair, in fact, cannot match the existing colour of the wall and for this reason it is better to render it. Other conservators suggest to leave the repair very distinguished to the original structure, using a different colour of plaster, which should be spread in order to protect the walls from the moisture.

5.4.2.5. FILLING GAPS AND HOLES WITH STRAW-LOAM

Fig. 5.56. Uch Kulakh (Uzbekistan), the preparation of the mixture: loam and dry palustrine cane

Fig. 5.57. Uch Kulakh (Uzbekistan), the implementation of the mixture

The gaps can be filled by straw-loam.
First of all, little wooden sticks are introduced on the surface to repair. These elements should provide a support for the following implementation of the straw-loam.
The mixture of straw-loam is made with a small quantitative of earth, water and lots of vegetal fibres, like straw, hay etc.
The mixture should rest for about 7 days in order to increase the amount of cellulose. Then the straw-loam can be implemented on the surface.
In the end several strata of plasters of different mixtures should cover the wall.

Observations

- This technology is strictly related to traditional conservation methods and, for this reason, it is implemented, most of all, by local populations.
- It can be adopted by the technicians, during emergency conservation activities, which happen when the implementation of other techniques are not so simple, because the lack of material, workers or time for the preservation of a site.
- It is important to underline that the straw-loam has a minim shrinkage effect as well as a lower mechanical resistance respect to adobe, fired bricks and stones.

5.4.2.6. FILLING "DEAD" OR DORMANT CRACKS

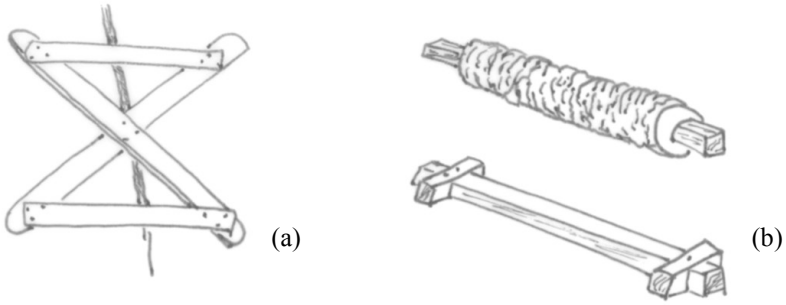


Fig. 5.58. Wooden keys to fill the dead cracks: (a) the X-shaped key, (b) the horizontal keys

The intervention consists in cleaning the cracks and removing all fragments.

Then the X-shaped wooden keys are positioned on the wall or the horizontal wooden keys are introduced into the structure at least 15 cm deep.
The use of the X-shape wooden keys can further damage the earthen structures, destabilizing it, creating structural deformations.
Nowadays the horizontal wooden keys are more used. They can be made in wood or in wood covered by straw-loam. The implementation consists in positioning the keys every 50 cm outside and inside along the wall crack, connecting them to the existing structure with gypsum or earthen mortar.

Observations
- It is important to understand the causes and the reasons of the formation of the cracks in order to avoid them and further implement the right and durable treatment on the structure.
- The original or similar earth material should be implemented.

5.4.2.7. FILLING "LIVING" OR ACTIVE CRACKS

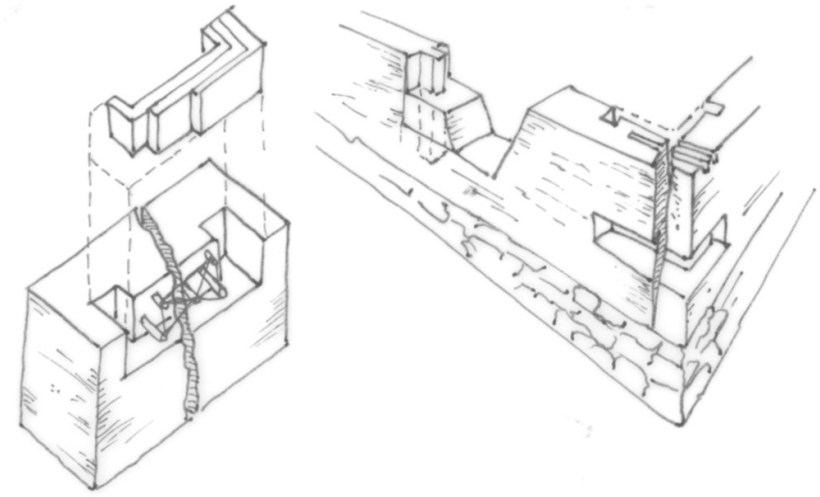


Fig. 5.59. Solutions to fill the living cracks

These cracks are very dangerous and can make the structure collapse. For this reason this intervention should require a deep treatment in order to stabilized the building.
First of all the intervention consists in cleaning the cracks and removing all fragments.
The new filling earth material may be installed, modelled in building elements, which should exactly fix the shape of the existing section of the wall, preventively and properly cut.
The new section of the wall can be anchored to the original structure with wood sticks positioned in the wall thickness.

Observations
- This heavy intervention aims at repairing cracks and reinforcing the structure, adding on its surface, also synthetic, stainless-steel or natural mesh in order to limit the shrinkage phenomena.
- The new sections should be clearly visible in order to recognize the reconstruction activities and implementations. In case of reinforcement of the structure with meshes, the whole building should be plastered.

5.4.2.8. REINFORCING STRUCTURE: APPLICATION OF NATURAL MESH ON ADOBE/RAMMED EARTH WALLS

Fig. 5.60. Peru, implementation of natural mesh made by bamboo and rods

This treatment reproposes the use of natural and traditional materials, implementing them in a "modern" reinforcement technology for the earthen walls.
After filling the gaps and the holes of the structure, it is possible to implement a natural mesh on the walls in order to reinforce the building.
Bamboo canes may be used as vertical reinforcement and ropes, spread horizontally, connect them to each other.
This treatment is placed on both side of the wall. The two reinforced faces of the masonry are tied through the thickness of the wall, by small thread, made by vegetable fibres (e.g. Cabuya in Peru).
After this intervention all the structure should be covered by earthen stucco.

Observations

- The implementation of natural materials in the conservation treatments, is deeply supported by lots of earthen conservators. In this intervention the earthen wall and the mesh are totally compatible and for this reason there should be no risks to observe some chemical dangerous reactions between the materials. If we consider the technology implemented for this intervention, some objections can be raised by some conservators. The application of natural mesh is a non-traditional intervention which can be considered not appropriate for the safaguarding of the authenticity of the traditional building thecnologies.
- The implementation of bamboo canes renforces the structure but it may modify too much the form of the building. For this reason, the authenticity test of the form may be not satisfied.
- The natural mesh is less effective than a syntetic mesh, because the natural one presents large spaces between vertical and horizontal elements and this charachteristic leads to a decrease of the confinement effect of the structure.
- The application of the mud plaster is stricklty suggested because it prevents the formation of severe and extended cracks, improving the initial shear strength and and the stifness of the wall.

5.4.2.9. REINFORCING STRUCTURE: APPLICATION OF STAINLESS-STEEL WIRE MESH ON ADOBE MASONRY

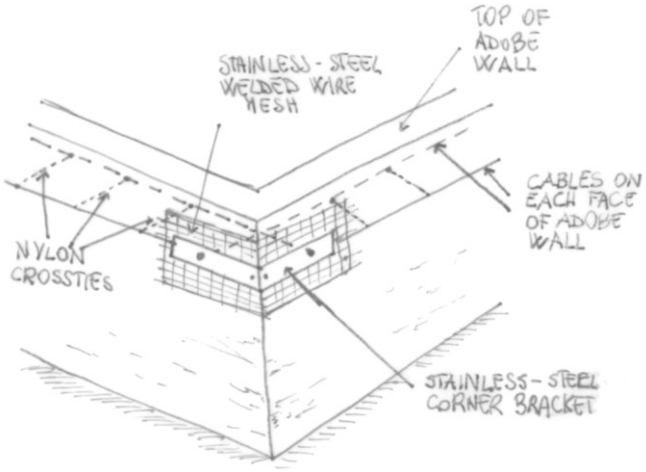


Fig. 5.61. Stainless-steel wire mesh and horizontal cable with steel-end-plates

Stainless-steel welded wire mesh is spread along the corners, in order to reinforce them or to repair the cracks.
Then stainless-steel cables are bolted to each other by steel-end-plates. The cables as well as the plates are positioned horizontally along each face of adobe wall.
The plates should be fitted at 5 row intervals.
The internal cable and the external one are connected to each other with heavy and solid nylon crossties at intervals of about 1 meter along the lengths.
After this intervention, the whole building should be plastered.

Observations

- The implementation of a wire mesh can help to reduce localized stresses in the adobe wall. It can be spread not only on the corners but also along the entire wall in order to reinforce the structure.
- Stainless-steel welded wire mesh should be choosen in order to avoid the risk of the contact between the highly alkaline of the lime mortar with galvanized materials. A galvanized material, when wet, may react chemically with the earthen walls.
- The steel-end-plates should be designed to distribute stresses and ensure the ductility of the corner joints.

5.4.2.10. REINFORCING STRUCTURE: APPLICATION OF SYNTHETIC MESH ON ADOBE/RAMMED EARTH WALLS

Fig. 5.62. Reinforcement of adobe wall with a synthetic mesh

First of all it is necessary filling all the gaps and holes of the walls, implementing a dedicate methodology, like injection of hydraulic lime rubber or ethyl silicates.
Then a synthetic mesh (0,8X0,6 mm) is spread along the entire walls.
The mesh may be in polyurethane or in glass fibre. It should have a great malleability in order to fit easily the irregularities, belonging to the surface of adobe/rammed earth walls.
PVC angular elements and PVC rolled sections are applied on all concave parts of the wall.
The fixing system consists in plastic hooks, and in heavy nylon wires, which "sews" all the elements to the masonry.

Fig. 5.63. Lima (Peru), type of Geo-grid applied on adobe wall and its fixing system

After this intervention the entire wall should be plastered.

Observations

- The great malleability of the syntetic mesh is very usuful to cover correctely all the wall sections, without deeply modifying their original forms, which may further pass the test of the authenticity.
- The synthetic mesh presents good characteristics of resistance and improve the durability and stability of the earthen structures.
- The synthetic mesh is more compatible than the steel mesh, because the problems related to the galvanized material and the lime mortar, do not exist.
  A synthetic mesh can also cost less then a stainless-steel mesh.
- Nowadays the use of geo-meshes is developing. They improve the resistance of the adobe/rammed earth walls as well as their ductility.

5.4.2.11. RETICOLATUS TECHNOLOGY: APPLICATION OF "CABLE-MESH" ON ADOBE/RAMMED EARTH MASONRY

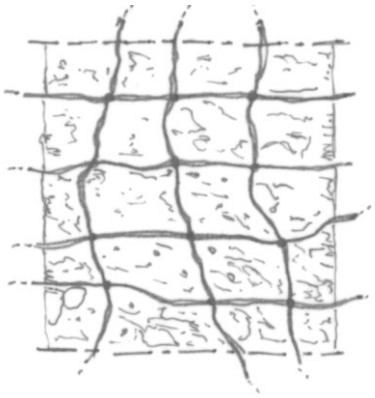


Fig. 5.64. Reinforced wall with "cable-mesh"

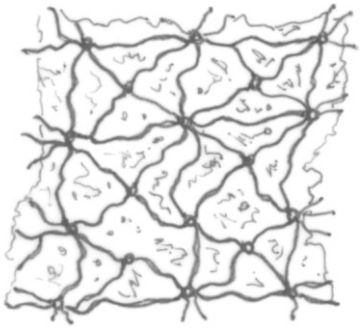


Fig. 5.65. Reinforced wall with "cable-mesh" (other texture)

Little polyurethane cables, fixed on masonry through heavy nylon wires and/or plastic hooks, realize the mesh.
The polyurethane cables have reduced dimensions; therefore they can fit the mortar joints among the adobe or the irregularities of rammed earth masonry.
Further all the joints should be covered by new earthen mortar.

Observations

- This treatment provides a high adherence and compatibility between the cables and the earthen mortar, guaranteeing a great mechanical behaviour of the ensemble "adobe-cable-mortar".

5.4.2.12. REINFORCING STRUCTURE: INSERTION OF TRANSVERSAL TIES AND RING BEAMS

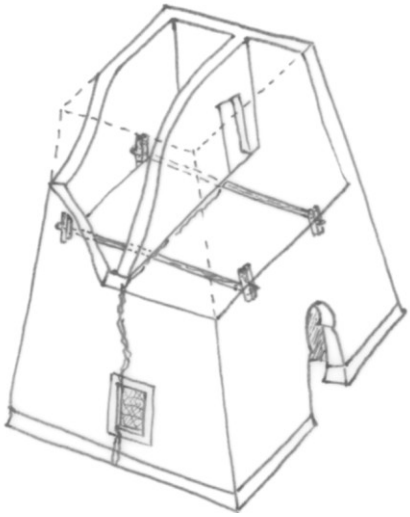


Fig. 5.66. Tranversal ties to join two divided parts of a building

Fig. 5.67. Tranversal wooden ties

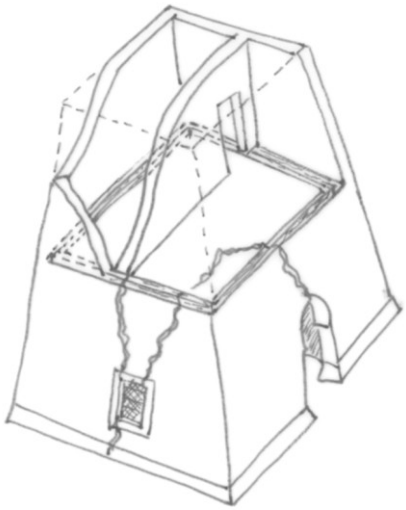


Fig. 5.68. Ring beam to clamp several divided parts of a building

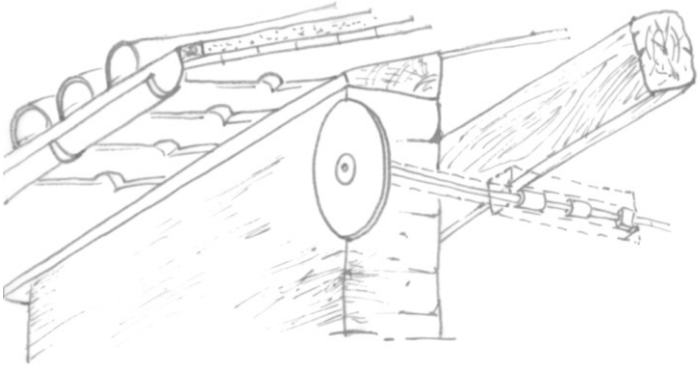
The walls should be first stabilized, eliminating the cracks and the damage causes.
If the building is divided in two parts and only one is deformed, the insertion of wood transversal ties should be implemented, in order to avoid the risk of structural collapse (Fig. 5.66).
If the building is fragmented in several critical deformed parts, the insertion of a wood ring beam should be implemented, in order to join all the wall sections and redistribute the loads, avoiding the risk of structural collapse (Fig. 5.68).
In order to realize a ring beam, all the constituted elements should be joined at the angles. An open ring beam should not be implemented, because it does not satisfy the criteria to have a box-type reaction of the structure during an earthquake. An open ring is not effective.

Observations

- The insertion of poles should be avoided because it can be considered too invasive and may damage the monolithic structure.
- The transversal ties as well as the ring beam should be in wood, which is more compatible with earth rather than concrete or cement. The insertion of concrete elements can produce contradictory structural behaviours in the same building.
- A ring beam should have a square or a rectangular shape.
- A ring beam should encircle each room of the building.
- To avoid the risk of overturning of a wall, the use of buttresses can be also justified.

Fig. 5.69. Kanji, Ladakh (North India), two earth/stone buttresses avoid the overturning of a load-bearing wall in a private temple

5.4.2.13. REINFORCING STRUCTURE: INSERTION OF TIE-BEAMS



5.70. Insertion of tie-beams

The intervention consists in connecting the vertical walls through a horizontal steel tie-beam.
The tie-beams are not integrated into the masonry, except for the end part, which is placed inside the walls and connected to external metal clamps.
The masonry should be damped before the process of digging starts.

Observations

- The introduction of tie-beams into the masonry requires to realize quite large holes in the masonry, which should be further filled with stones or pieces of terracotta, mixed with earthen mortar.
- The traditional facades of the building can be changed, implementing the clamps. Inside also the presence of the tie-beams may disturb the original aspect of the property. For these reasons, this intervention should be implemented when the visibility of the steel elements inside a traditional earthen building is not a relevant factor.

5.4.2.14. REINFORCING STRUCTURE: INSERTION OF WOODEN BEAMS AND THEIR CONNECTIONS AT WALL CORNERS

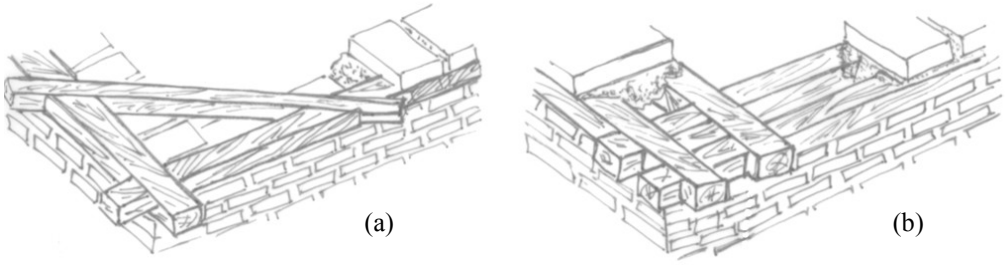


Fig. 5.71. Improved corner joint: (a) with single timber and diagonal members for bracing at corners; (b) with two timber in parallel

In case of reconstruction interventions, it is possible to strength the structure and improve the wall corners, introducing some elements inside the masonry.
A methodology concerns the placement of a simple structure constituted by a band, realized with a single wooden beam and diagonal elements for bracing at corners.
Another solution can be constituted by a band realized with two wooden beams positioned in parallel.
In both cases, the beams are connected to the masonry and at the angles with iron-straps.

Observations

- These reinforced beams should be placed coinciding with lintels of the openings and just below

the roof. The introduction of the wooden beams can be avoided at the lintels, if the height of the building is not more than 2.5 meters.

5.4.2.15. APPLICATION OF PROTECTIVE PLASTERS

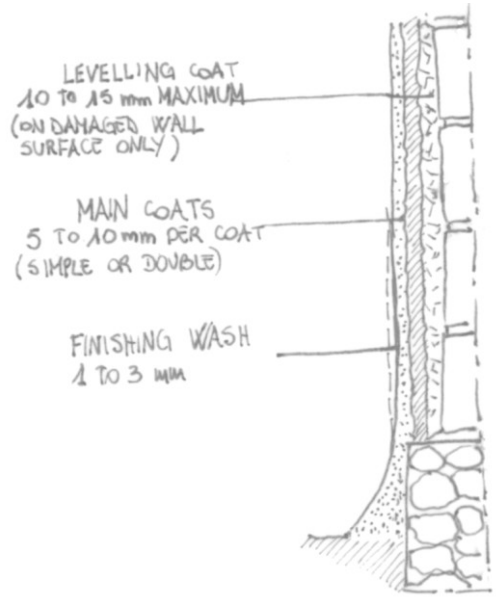


Fig. 5.72. Implementation of earthen plasters

First of all it is necessary cleaning the surface of the masonry and filling their cavities.
The surface should be levelled but remain rough in order to provide the right adherence for the implementation of the following plaster.
The masonry surface should be humidified and then covered by strata of plaster.
The first stratum should be the levelling coat (10 to 15 mm maximum), made by only earth, earth and sand or earth, sand and chopped straw, which enriches the adherence.
The second stratum is considered the main coat (5 to 10 mm per coat), which can be simple or double and realized with a mixture of earth, sand and lime.
A third and last stratum, the finishing wash (1 to 3 mm), can be made with earth, sand and lime, in different proportions. The finishing coat, in fact, should be very fine for an esthetical reason and also because the mixture should be filled the entire small cracks along the surface.

Observations

- Lime or gypsum coatings are compatible with earthen structures, because their porosity and adherence to the earthen walls, due to their physical and chemical properties.
  These materials can improve the erosion resistance of the earthen plasters.
- The final coating thickness should not exceed 15÷20 mm at maximum, because it risks to become too much heavy for the earthen structure, which has to support it.
- The application of the layers of plasters should be implemented under the shadow, in order to avoid the risk of fast drying, which favours the appearance of the cracks.
- The finishing stratum can be added with some fine cut straw, which is water-repellent, and for this reason it can limit the water infiltration due to the rainfalls. In order to obtain the same effect, other fiber materials, like manure and hemp, can be introduced in the earthen plaster mix.
- Another methodology foresees the addiction of casein in the mixture of the finishing plaster. This natural material provides a kind of waterproofing to the wall, because its content of fat, which is water-repellent.
- It is important to underline that earthen plasters should be periodically maintained in order to avoid the risk of pathologies related to the moisture.

- The implementation of sand-cement plaster should be avoided. The mixture, in fact, provides only a temporary protection of the earthen walls against the water infiltrations. If the water penetrates in the masonry by capillarity, cannot run out, because the sand-cement plaster is not so porous and it does not allow the structure to breathe. For this reason, the water, remaining inside the wall, may increase its volumes and cause severe damages of the walls, till its collapse.

Fig. 5.73. Timbuktu (Mali), the periodical plastering of the mosque

Fig. 5.74. Timbuktu (Mali), cement plaster does not allow the wall breathe, causing the stagnation of the water infiltration and the collapse of the structure

- The joint between the last stratum of plaster and a sufficient high stone/brick basement (30÷50 cm) should be carefully realized. The implementation of the plaster should follow the vertical surface of the basement.
  This treatment can protect the structure from the splashing rain (Fig. 5.75).

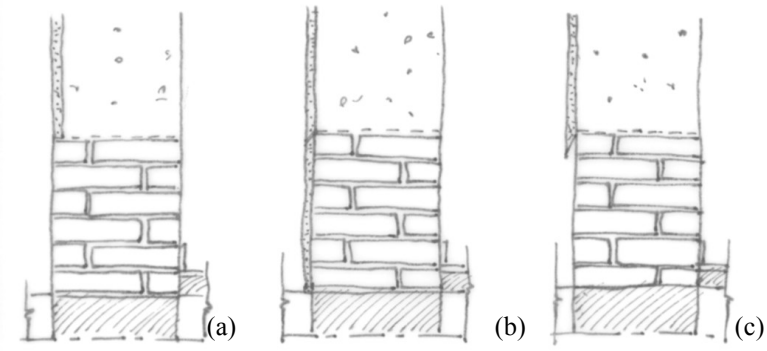


Fig. 5.75. Solutions for implementing plaster: the joint between the finishing plaster and the basement

The first solution (a) can be adopted in not rainy areas, the second one (b) is common and the third one (c) may be considered the best design to avoid the splashing rain.

5.4.2.16. APPLICATION OF INTERIOR PLASTERS

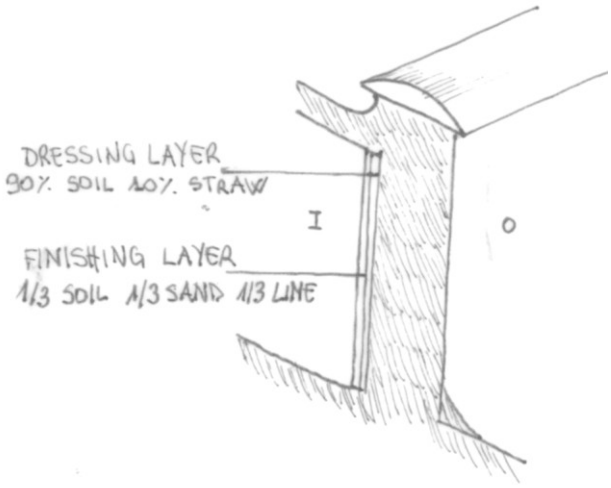


Fig. 5.76. Application of two strata of plaster on the internal surface of a wall

The internal surface of the masonry should be cleaned and all the cavities should be filled.
The first stratum of plaster should be the levelling coat, made by earth with sand and some chopped straw.
The second and last stratum, the finishing coat can be made with earth, sand and lime, in different proportions.

Observations

- The finishing coat can be stabilized with lime in right proportions respect to the other components.
- The internal coats can be applied in one or also two layers.

5.4.2.17. INJECTING OR SPRAYING CHEMICAL PRODUCTS ON THE EXISTING WALL STRUCTURE

Fig. 5.77. Seville (Spain), ethyl silicate injection thought an aerosol gun on a rammed earth (*tapial*) wall

This conservation technology operates, introducing a chemical product on the external surface of the wall in order to improve the cohesion and the adherence of the earthen building material. This procedure improves the durability of the earthen walls and limits the water infiltrations.
The appropriate product should be absorbed and penetrate very fast in the masonry.
Among the chemical materials, we can cite:

- ethyl silicate, implemented by an aerosol gun, spread by a paint-brush or injected under controller pressure
- lime,
- acrylic resins.

Observations

- The use of these chemical materials is deeply controversial.
- On one side the authenticity of the form of the building is safeguarded because the results of these injections do not modify the original aspect of the heritage but, on the other side, during the conservation activity, the authenticity of the use of traditional material is not safeguarded at all. For these reasons the debate on the use of materials like ethyl silicate and acrylic resins, is very ignited.
  It is important to underline that this technology is not infallible because each section of an earthen wall, can react in different ways after the treatment. In some cases, it is demonstrated that some earthen masonries, after ethyl silicate injections, can deteriorate faster than without any kind of conservation intervention.

5.4.3. INTERVENTIONS ON THE HORIZONTAL ELEMENTS

The interventions on the horizontal elements concern the conservation of the floors and the roof together with the improvement of their connections with the whole structure. All the floors and the roof should be connected to the vertical walls in order to obtain a box-type behaviour of the building during a seismic event.

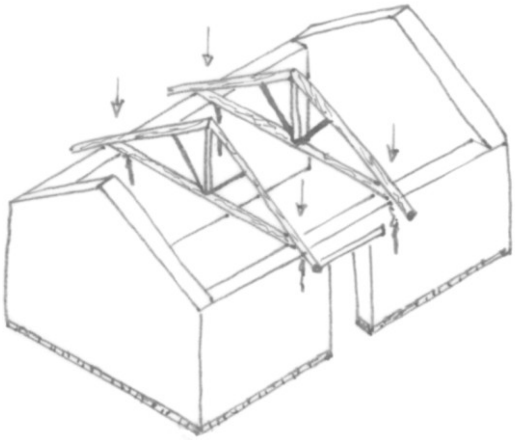


Fig. 5.78. Incorrect distribution of the roof loads can damages the under structure

The treatments consider two different typologies of roofs: the one with pitches, present most of the time in more rainy areas, and the flat roof, which usually belongs to dry climate zones.
In the first case, during an earthquake some cracks can appear in the upper part of the walls, which sustain the roof (Fig. 5.78). An intervention of introducing a ring beam can improve the situation, distributing the loads along the whole horizontal surface.
A correct overhang of the roof can also protect the under structure from the rain and, as consequence, from the water penetration.
The gable wall is also an architectural element, which can be seriously damaged and collapse, during an earthquake. In these cases, the gable may be rebuilt and sustained by buttresses or the cracks may be repaired with keys.

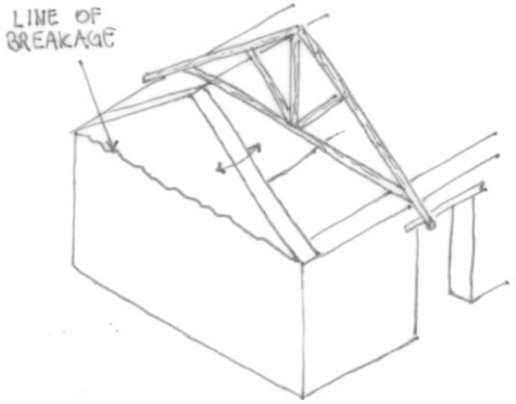


Fig. 5.79. Cracks on a gable wall

The second type of roof, the flat one, is very exposed to atmospheric agents and if the roof is a terrace, it is also subjected by abrasion due to human tramplings.
In both cases, the natural and human agents may deeply damage these structural elements.
Some interventions concern the reconstruction of the entire roof, spreading new earthen layers, paying attention to provide an appropriate slope.
The degrading action on raw earth structures, produced by meteoric waters during the rainy season and by freeze/thaw cycles during the winter-spring time, becomes particularly evident along the connecting edges between the horizontal plane of the roof and the vertical plane of the external walls.
For this reason, in a roof terrace, the connection between the horizontal element and the parapet walls should be protected and improved in order to avoid the water infiltration inside the masonry.
Another intervention concerns the protection of the tops of parapet walls with caps or sacrificed layers.
The interventions on the terrace roof should be followed by cyclical cleaning maintenance of water shoots for evacuating meteoric waters, in order to avoid the water stagnation, which generates a “roof-pond” effect.
Lots of times the earthen terrace roof are very heavy and can have several damages or collapse during a seismic event. For this reason, during a reconstruction intervention, it is important to try to build, if possible, a lighter roof connected to the rest of the under structure, in order to distribute the loads properly.

5.4.3.1. REINFORCING THE CONNECTIONS FLOOR-WALL

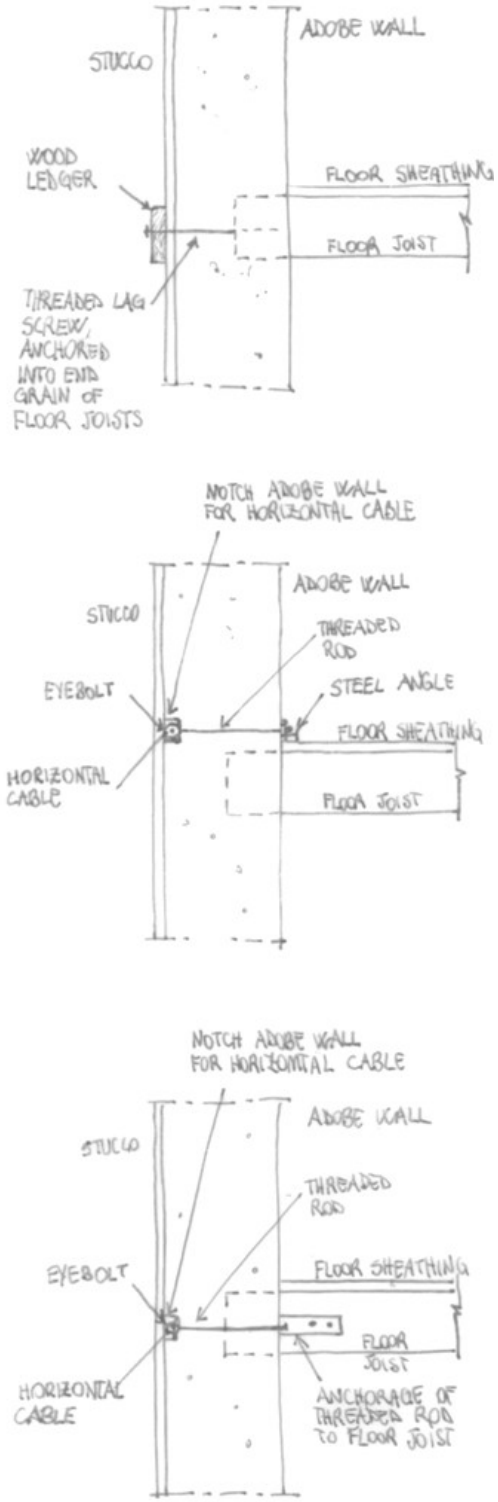


Fig. 5.80. Solutions for connecting floor-wall

The interventions consist in introducing a lag screw, anchored to the end of the wooden floor joist and to an external wooden continuous ledger.
A second intervention can consist in introducing a perimeter horizontal cable.
Eyebolts can be implemented on the external surface of the masonry. The horizontal cable is placed inside the eyebolts and connected to steel angles anchored on floor sheathing and joist.
The connection between the horizontal cable and steel angles can be implemented through a steel rod, which penetrates in the masonry.
The steel rod can be connected to the floor, also thanks to another rod, placed on the external surface of the joist. In this case the joists should not be visible from below.

Observations

- These interventions can reinforce the structure, improving the box-type effect of the building.
- These interventions might safeguard the authenticity of the form of the building. Each of them, in fact, is implemented inside the structure. For this reason, these treatments, not visible outside, do not modify the original aspect of the structure, reinforcing it.
- Objections can be made respect to the use of the materials, like steel, which is not so compatible with the earth and is not “natural”.

5.4.3.2. ROOF WITH PITCHES: INTRODUCTION OF RING BEAMS AS ROOF SUPPORT

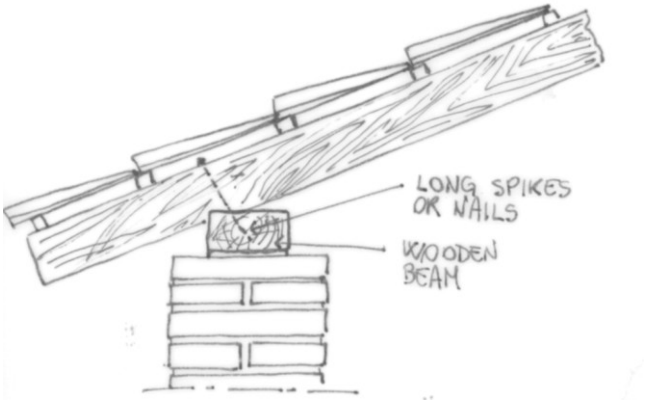
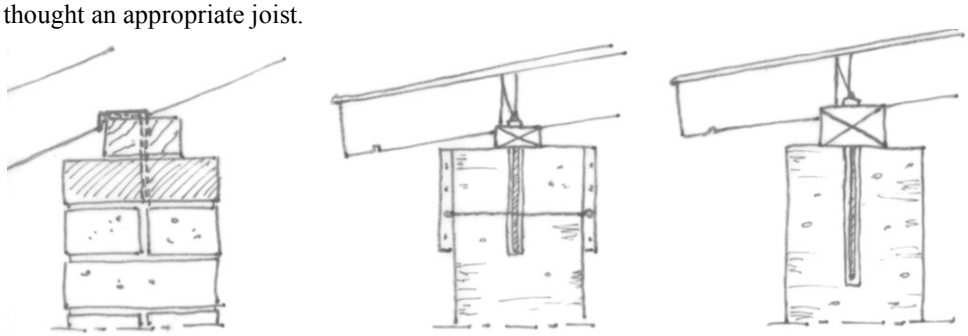


Fig. 5.81. The connection between the roof and the beam

The intervention consists in introducing master beams, preferably made of wood, connected to each other (ring beams), to the roof beams and to the vertical walls in order to bear and distribute the loads and have a box-type behaviour of the building. The ring beams should be joined at all angles. The ring beams should be positioned centrally on the top of the wall. The connection between the beams, the roof rafters and the vertical walls should be made, implementing long spikes or nails.

Observations

- Sometimes before laying the wooden ring beams, a terracotta or concrete layer is realized in order to better distribute the stress on the top of the wall during a seismic event.
- The introduction of the terracotta plate is implemented most of the time on the top of adobe structure in order to avoid the possible break of the edge of the wall during an earthquake.
- Wedges of wood can realize the connections between roof elements and the walls, passing thought an appropriate joist.



(a) (b) (c)

Fig. 5.82. Solutions for roof-wall connections: (a) wooden ring beam positioned at the centre of the top of the wall, on a terracotta plate; (b) reinforced band beam for existing construction; (c) heavy wooden beam with frequent anchorage extending down into the wall

- The anchorage should penetrate into the masonry for a length, equal to the thickness of the wall.
- The anchorage should be placed at no more than six times the wall thickness (for medium seismic risk), and no more than three times the wall thickness (for high seismic risk).
- The roof beams should be not positioned above doors or windows lintels, which in that case, should be reinforced.
- It is necessary to realize an adequate roof slope and overhang, following the climatic conditions of the specific areas. In rainy and snowy sites, the overhang should be about 50÷100 cm.

5.4.3.3. ROOF WITH PITCHES: CONSERVING THE GABLE (1)

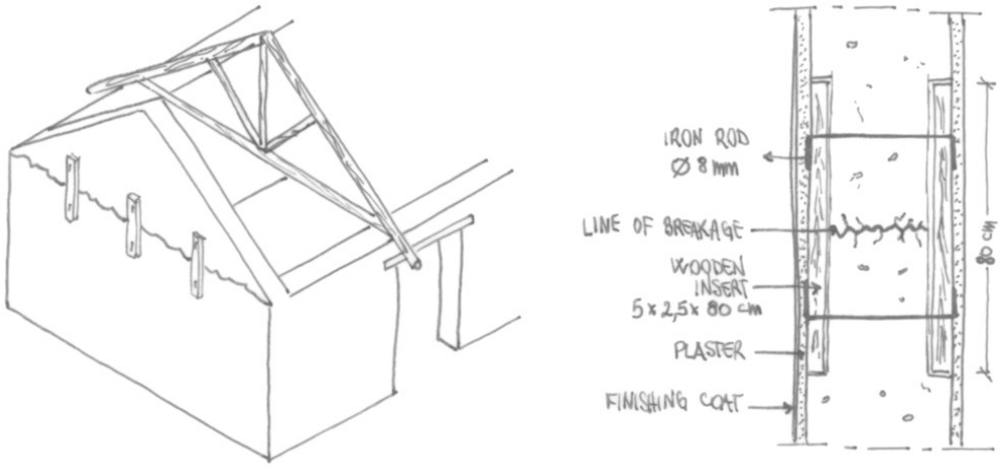


Fig. 5.83. Repairing the gable cracks

The interventions, carried out in order to repair a gable, are almost similar to the ones implemented to reinforce the masonry (see above).
For example, if an earthquake damages a gable but it still conserves its stability, it is possible to repair the cracks with wooden keys, connected to each other by iron rods and then plastered (Fig. 5.83).
Another solution can be the implementation of a wire mesh on both faces of the gable. The wire meshes should be connected to each other and plastered.

Observations

- The holes for the iron rods should be made in the mortar joints of an adobe wall in order to avoid damaging the earthen mortar.
- If the gable is seriously damaged and/or partially collapsed after an earthquake, it is better to rebuild it completely, improving its resistance.
- The authenticity of the aspect of the property can be considered safeguarded after this intervention.

5.4.3.4. ROOF WITH PITCHES: CONSERVING THE GABLE (2)

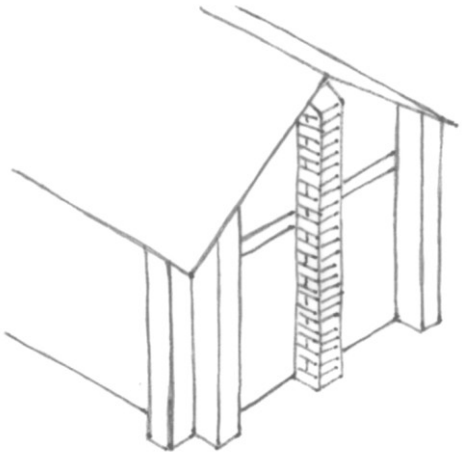


Fig. 5.84. Reinforcing the gable

The intervention consists in rebuilding the gable of the building and realizing buttresses to reinforce it. The buttresses should be realized at the angles and at the middle of the gable facade, along all the height of the wall.

Observations

- The buttress should be realized in earthen blocks or in stone or with terracotta bricks.
- This intervention modifies the original aspect of the building and for this reason it may be subjected to discussion because the authenticity of the form is not safeguarded.

5.4.3.5. PLANE ROOF: REBUILDING TERRACE ROOFS

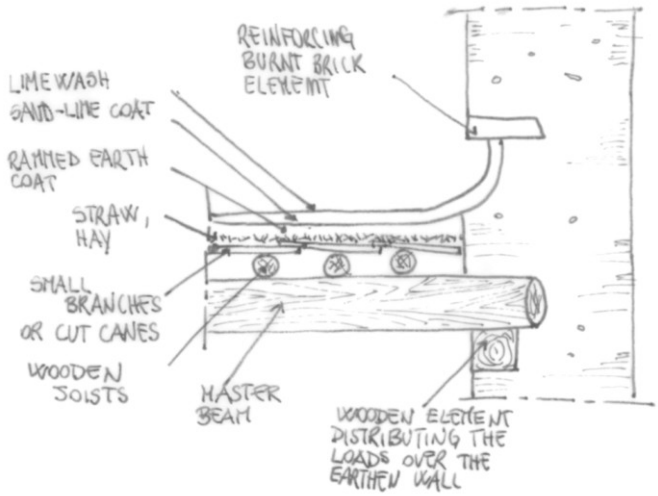


Fig. 5.85. Conservation of terrace

The intervention consists in introducing a ring beam
Upper the ring beam, a layer of wooden joists may be built.
A secondary framework is generally realized, using wooden planks, small branches or cut canes.
A third layer can be made by palm tree leaves, hay, straw or pieces of cardboard.
Upper some strata of an earthen mixture can be spread in order to provide an insulating and protecting coat.
Then a subsequent layer of sand-lime coat can be spread.
The last and finishing coat of the roof should be made with very clayey earth like lime, in order to limit the cracking phenomena along the surface due to strong variations in temperature between day and night or to freeze-thaw cycles.
The addition of chopped straw in the last layer may be also very useful, most of all for the joints flat roof-vertical walls (see below).

Fig. 5.86. Kanji, Ladakh (North India), the implementation of the roof

Observations

- The roof terrace should be cyclically maintained. After each rain season, the flat roof should be cleaned, possible cracks should be filled and the drainage system should be controlled. All these interventions should avoid the water stagnation on the roof and the subsequent infiltrations inside the building.
- The evacuation points should be checked in order to avoid blockages (accumulation of fibre and detritus, small bird's nests) with consequent roof flooding and penetration of water in the joints through capillarity.
- During the realization of the roof, it is deeply important to create a gentle slope of the roof plane in order to have a rapid evacuation, towards the outside, of meteoric waters or those resulting from snow melting.
- The upper edge of the parapet walls should be protected by the atmospheric agents (see below).

5.4.3.6. PLANE ROOF: IMPROVED PROFILE OF PLANE ROOF-WALL CONNECTION

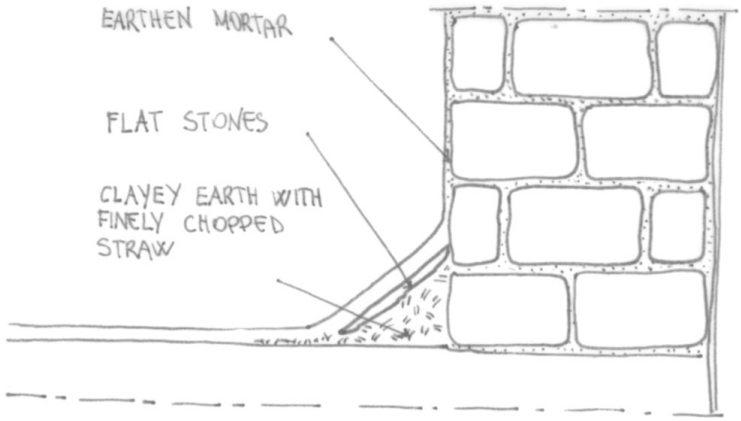


Fig. 5.87. Improving connection joints between plane roof and vertical walls

The terrace roof has a particular vulnerability in the connection joints between the roof mantle and the parapet walls, with the consequent possibility of penetration of water or melted snow along the joining line between the two perpendicular planes.
The intervention consists in creating a dedicated mixture of clayey earth, containing finely chopped straw, which is spread along the plane roof-vertical wall joints.
On top of the earthen layer, another coat of flat stones is created and then covered with earthen mortar.

Fig. 5.88. Kanji, Ladakh (North India), creating improved joints, using earthen mixture and finely chopped straw with stone joint cover

Observations

- The earthen mixture, added with straw, can resist better to "withdraw" phenomena, limiting the formation of cracks along the connections.
- The roof terrace should be cyclical maintained.
- The lack of sufficient drainage and discharge of meteoric water and melted snow in a roof-terrace, may favour the water infiltrations, nullifying the positive performance of the "improved plane roof-wall joint".

5.4.3.7. PROTECTING THE TOPS OF PARAPET WALLS

Fig. 5.89. Protecting the top of the walls with caps

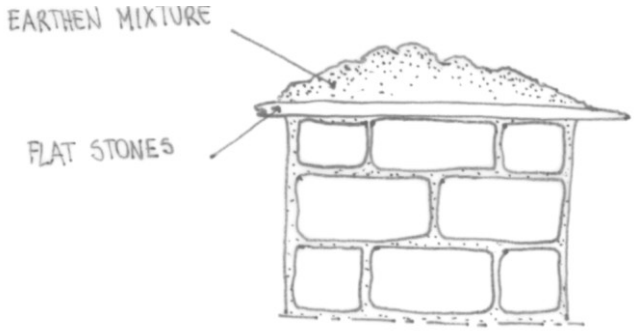


Fig. 5.90. Protecting the top of the walls with sacrificed layer

An elaborate treatment concerns the use of a "continuous cap" made by cement, stone or terracotta (Fig. 5.89).
This kind of hat should have the slope as well as the water drop in order to limit the running of the water along the wall surface.
The cap in itself should protect the top of the walls against erosion caused by rain and wind.
A second intervention, which involves the perimeter masonry, foresees the modification of the upper profile of walls, implementing flat stone slivers and another layer made by earth, with a curved section (Fig. 5.90). With these elements it is possible to build a sacrificial layer in order to provide a first level of protection for the upper edge of the parapet walls, during the atmospheric events

Observations

- Stone or terracotta, more compatible materials in contact with earthen structures should make the cap for the first intervention.
- The sacrificed layer is a more traditional techniques respect to the stone/terracotta/concrete cap.
- For the realization of the sacrificed layer, it is possible to implement a first stratum of tarred paper, then covered with earthen blocks and plaster (Fig. 5.91).
- In any cases the sacrificed layer should be repaired regularly.

Fig. 5.91. The posistioning of tarred paper (a) and the final sacrificied layer (b)

5.5. Reflections and Recommendations

The conservation and maintenance of the buildings would preserve the cultural identity of the populations and at the same time limit the disaster effects due to calamities.
Since 2006 the WH Committee has been supporting the managers of cultural and natural sites in order to reduce the risk related to environmental disaster as well as conflicts[7].
The WH Centre-UNESCO provides some guidelines, in order to prepare Disaster Risk Management of the interested zones.
The WH Centre wants to "demonstrate that heritage can play a positive role in reducing risks from disasters and so help to justify the conservation of World Heritage properties"[8] (World Heritage Centre-UNESCO, 2010).

For what concerns the conservation or rehabilitation of "non-engineered" or rural building, some guidelines should be drafted and provided to the populations. These instructions should be drawn up, considering case by case, focusing on each traditional technique, which presents its own strengths and weaknesses.
Following these guidelines, the local workers can decrease the vulnerability of the building, making them be safer against natural calamities and reducing the number of causalities.
Some countries, like India and Pakistan, etc., have already supplied or are going to provide some codes regarding the construction and/or the preservation of the rural buildings.

At a local level, before starting the conservation activities, some workshops with the local population can be held. The lessons should be focused on the choice of the right material and the implementation of the more appropriate conservation technologies. The objective should be to train specialized workers for maintaining rural buildings as well as realizing new constructions, which can satisfy the requests of a supervisor or a project manager.

The regular maintenance of the earthen architecture is deeply important in order to preserve this particular heritage, also during catastrophic events.
The conservation building technologies should take inspiration from the local methodologies, improving them with some innovations. These innovations should implement construction materials, compatible with the traditional ones.
If it is possible, the interventions should be somewhat reversible and meet the criteria of the authenticity. Lots of time, in fact, after an intervention the final aspect of the building is not the original one and for this reason the authenticity of the form of the heritage is not safeguarded. The same happens with the choice of the construction materials, which sometimes are cement, concrete, totally different from those, traditionally present in the property, like earth, wood, stones etc. In this case the risk is not to meet the criteria of the authenticity of the material and the techniques.
For these reasons the implementation of the conservation technologies should be preceded by a wide study of the site, which concerns the economic and social policies, the human activities, the traditional culture, the climate, the structural defects etc.

It is also necessary improving the awareness of the population concerning the importance of the preservation of the heritage in which they live. For this reason the promotion of a culture of prevention and maintenance of the site should be intensely developed and supported, in order to avoid situations like in the fig. 5.92 below.

Fig. 5.92. Bahla parking fort (Oman), the area is in a bad state of decay, the rubbish is spread all around and it is not cleaned periodically

Notes Chapter Five

1. The United Nations Secretariat prepares the Global Assessment Report on Disaster Risk Reduction (GAR) for the International Strategy for Disaster Reduction (UNISDR).
   The objective of this report is to improve the international awareness on the problems related to the disaster risk, trying to reduce it, consolidating the political as well as economic support.

2. ICCROM in collaboration with IUCN, ICOMOS and WH Centre UNESCO (2010). *Managing Disaster Risks for World Heritage*, World Heritage Resource Manual, p. 8
   ISBN 978-92-3-104165-5

3. PGA Peak Ground Acceleration is a measure of the earthquake acceleration on the ground.

4. The United Nations defines Least Developed Country (LDC) a country which meets the lowest indicators of socioeconomic development, listed in the Human Development Index. The index considers all the countries in the world.

5. Joaquin Paul, Chapter 7 "Earthen Buildings", (draft).

6. Stabilized Compressed Earth Blocks (SCEB) are earthen bricks compressed with a mechanical press and stabilized with cement or lime.

7. WH Centre UNESCO, 2006, Section A.5, paragraph 19.

8. Cit. WH Centre UNESCO (2010). *Managing Disaster Risks for World Heritage*, p. 6.

Chapter Six: Case Studies

Some of the previous interventions, presented in the Chapter five, were applied during missions on the field, carried out by the PhD candidate.
For this reason, the PhD candidate, implementing some conservation methodologies, had the opportunity to observe their real effectiveness and evaluate possible critical elements.

In this chapter we present the results of the conservation projects, reporting the scientific papers, presented during international conferences, which were focused on the conservation of the earthen architecture.

The first case study presents the preventive conservation work carried out in Uch Kulakh, a fortified site, located in the western borders of the Bukhara Oasis (Uzbekistan).
The article discusses the importance of the preventive maintenance as an appropriate practice of conservation of earthen archaeological sites, describing some preservation treatments carried out on some sections of an earthen castle (IV-VIII century).

A second case study concerns the missions hold in Kanji, a village on the Ladakhi mountains (North India), which is characterized by a fine earthen architecture.
Referring to these experiences, we present some papers, which consider and explain the main activities, carried out for this area: the maintenance interventions, the drafting of a "conservation manual" of the village earthen architecture and the organization of workshops for selected groups of young community leaders, artists and monks, in order to improve their knowledge regarding new safer building as well as conservation technologies.

The last paper presents a future project, which foresees the conservation of the vernacular earthen architecture of the Siwa Oasis and the improvement of the people's living conditions of this area, introducing a new solar system, able to produce electricity, heating and cooling/freezing.

OLTRE IL MEDITERRANEO: DAL DROMEDARIO AL CAMMELLO ARCHITETTURA DI TERRA E STRATEGIE DI CONSERVAZIONE IN UN SITO ARCHEOLOGICO FORTIFICATO LUNGO LA VIA DELLA SETA

Mauro Bertagnin, Désirée De Antoni, Anna Frangipane, Silvia Pozzi

In: *1st Mediterranean Conference on Earth Architecture - Mediterra 2009* (proceedings).
Italy, Cagliari 13-16 March 2009

ABSTRACT IN ENGLISH
Uch Kulakh is a fortified site, located in the western borders of the Bukhara oasis (Uzbekistan).
This territory, belonging to the ancient Sogdiana, was an important cultural and economic area, lying along the Silk Road, historical connection between the sub-Saharan Africa, the Mediterranean Sea and eastern territories, and, therefore, a traditional gateway to the Asia.
Starting in 1997 an archaeological mission of the University of Roma 'La Sapienza', under the direction of Chiara Silvi Antonini opened a surface of about 3000 m², bringing to light again a remarkable earthen fortified architecture. The excavated area consists on a castle and its outbuildings, dating the pre-Islamic period. In 2008 a team of the University of Udine was requested to set up a conservation plan for the site, under the direction of Mauro Bertagnin.
Vernacular Uzbek architecture as well as the ancient structures of archaeological sites, are the result of a relevant earthen building culture. Mainly due to the weathering effect of heavy rains and winds, they are today affected by several pathologies, such as erosion and decay.
The paper relates about both the archaeological excavations carried out in the past decade and the conservation strategies set up to maintain their revealed earthen structures. The results of the emergency field works undertaken in the site are presented in detail.

ABSTRACT
Uch Kulakh è un sito archeologico fortificato in terra cruda collocato nell'oasi di Bukhara (Uzbekistan), importante centro carovaniero lungo la Via della Seta. I manufatti del complesso, messi in luce dagli scavi, presentano situazioni di degrado causate, principalmente, dall'azione degli agenti atmosferici.
La relazione presenta la strategia conservativa di emergenza adottata in questo sito e i risultati ottenuti. Gli interventi, realizzati nel rispetto del criterio di reversibilità e compatibilità tecnologica e materica con l'esistente da conservare, rispondono ai principi consolidati di conservazione dell'architettura di terra. Le tecniche applicate possono essere impiegate in simili contesti archeologici a rischio, in assenza di elevate risorse economiche.
In questa prospettiva il convegno rappresenta un'interessante opportunità per testare gli effetti delle tecniche di conservazione messe in atto a Uch Kulakh e per individuare le eventuali consonanze con le strategie adottate nei siti archeologici dell'area del Mediterraneo.

1. QUADRO DI RIFERIMENTO DELL'INTERVENTO DI CONSERVAZIONE

Il sito di Uch Kulakh si trova ai confini occidentali dell'Oasi di Bukhara, nel distretto di Varakhsha[1], e dal 1997 è oggetto di indagini archeologiche da parte della missione italo-uzbeka diretta da Chiara Silvi Antonini dell'Università degli Studi di Roma 'La Sapienza'[2]. I siti archeologici presenti in questo territorio, solo in parte indagati, testimoniano il ruolo cruciale che questa parte dell'Asia Centrale ha svolto per secoli. Infatti, la Via della Seta che includeva nella sua importante rete carovaniera questo territorio, collegava l'Asia Centrale con il bacino del Mediterraneo.

La missione archeologica ha aperto fino ad oggi circa 3000 m² di superficie, riportando alla luce costruzioni in terra cruda, identificate principalmente in un Castello e nelle sue strutture abitative annesse, risalenti al IV-VIII secolo (Fig. 1). Ad Uch Kulakh, come d'altra parte in tutti i siti archeologici in terra cruda dell'Asia Centrale e del Mediterraneo, la conservazione e la manutenzione delle strutture esposte durante lo scavo sono due questioni decisamente urgenti e problematiche. Generalmente i siti archeologici presentano livelli diversi di degrado a causa delle azioni distruttive legate alla storia del sito stesso o a eventi seguiti all'abbandono. L'intervento degli archeologi contribuisce, per ragioni intrinseche al lavoro stesso, a un ulteriore avanzamento del degrado, dal momento che lo scavo stratigrafico rimuove necessariamente accumuli di terreno che proteggono le strutture sottostanti. A ciò si aggiungono piogge e venti, i principali fattori di degrado rilevati sul sito.
La necessità d'intervenire quanto prima, in modo tale da arrestare il deterioramento delle strutture emerse ad Uch Kulakh, ha portato alla realizzazione di un *progetto di conservazione di emergenza*, che ha inteso rappresentare un primo modello di intervento per la futura conservazione e valorizzazione di simili aree, di rilevante valore storico-culturale, considerate a rischio.

Fig. 1. Mappa del sito di Uch Kulakh e individuazione dell' intervento di conservazione 2008. (Gennadi Ivanov)

Il degrado delle architetture in terra cruda portate alla luce durante uno scavo archeologico costituisce, in primo luogo, un danno per la comunità scientifica di riferimento. In aree come quella indagata, economicamente svantaggiate, inoltre, si configura un ulteriore duplice rischio. Se da un lato, la mancanza di interventi di conservazione e valorizzazione rende vana la possibilità di fruizione turistica in chiave sostenibile, potenziale fonte di reddito per le popolazioni, dall'altro, l'incuria e il progressivo oblio del passato determinano nelle comunità locali il venir meno della consapevolezza delle tradizioni culturali ed architettoniche, connesse storicamente alle culture costruttive della terra cruda.

Le costruzioni in terra cruda costituiscono, tutt'oggi, un elemento caratteristico dell'architettura vernacolare uzbeka. Tale architettura si fonda sull'impiego di materiali di facile reperibilità, come il legno, la terra, la paglia, impiegati per la loro appropriatezza e disponibilità a basso costo. La terra cruda è ancora utilizzata in diverse aree rurali della regione come materiale da costruzione, nelle due principali varianti tecnologiche dell'*adobe* (*kirpichnie*) e della *struttura intelaiata lignea riempita di mattoni crudi e intonacata* (*chupkhorie*).

L'intervento di manutenzione e conservazione messo in atto ad Uch Kulakh, utilizzando i materiali presenti in loco, si ricollega alle tecniche edilizie tradizionali e rappresenta dunque un modello di *procedura d'emergenza* compatibile con le problematiche del contesto locale. Le strategie adottate sono attuabili anche in presenza di una limitatezza di risorse economiche, come di frequente avviene nella maggior parte delle missioni archeologiche, tanto di medie che di piccole dimensioni. Il modello di intervento, con i dovuti adattamenti, è dunque esportabile anche in altre simili realtà, presenti lungo le coste del Mediterraneo, che necessitano un intervento di manutenzione immediato.
Oltre a contenere valenze di carattere scientifico, la conservazione e manutenzione dei beni archeologici di una comunità può costituire una preziosa occasione di valorizzazione della cultura locale, rendendo consapevole la popolazione delle proprie tradizioni. Tale consapevolezza si rende indispensabile in un eventuale piano di intervento turistico ed economico, auspicabile nel distretto di Varakhsha al fine di valorizzarne il suo patrimonio storico-artistico e in prospettiva migliorare la qualità di vita dei suoi abitanti.

2. OSSERVAZIONI SUGLI INTERVENTI DI PROTEZIONE ATTUATI NEL SITO DI UCH KULAKH

Al termine di ogni campagna di scavo sono state sperimentate, nel corso degli anni, alcune *misure conservative di carattere temporaneo*, volte a proteggere le opere in terra cruda esposte durante i lavori. Il primo metodo adottato è stato quello della *ricopertura delle strutture con stuoie di paglia intrecciata*, accuratamente protette e nascoste da uno strato di terra. Questo sistema si è rivelato inadeguato, in quanto, durante il periodo di chiusura dello scavo, le protezioni sono state spesso asportate o, in alcuni casi, mangiate dalle greggi di capre pascolanti nell'area.

Un altro sistema impiegato, che ha dato un risultato migliore, è stato quello della *protezione del basamento delle strutture in elevazione mediante strato di canne, coperto nuovamente da terra di riporto*.

Va osservato che tali misure di conservazione preventiva non hanno evitato l'impatto negativo degli agenti atmosferici sulle strutture esposte, alcune delle quali sono in luce da più di un decennio. Su tali strutture si sono verificate patologie quali *l'alterazione e la perdita degli intonaci di rivestimento* e *l'erosione delle superfici murarie per alcuni centimetri di spessore*.

Il processo di erosione si è, talora, manifestato in forme gravi, che hanno portato alla perdita della conformazione originaria delle strutture murarie.
Ad esempio, il margine superiore del bastione sud-est del castello ha subito negli anni notevoli trasformazioni. Le intemperie hanno prodotto un'erosione consistente, facendone franare una parte (Fig. 2).

Fig. 2. Processo di erosione subito dal bastione sud-est dal 1999 al 2008.
(Franca Filipponi, Désirée De Antoni)

3. STRATEGIE DI CONSERVAZIONE DEL SITO ARCHEOLOGICO DI UCH KULAKH

Lo scavo di Uch Kulakh è tuttora in corso e i punti nei quali si è intervenuto con la Campagna 2008 risultano limitati alla zona meridionale del castello. Sono state identificate alcune strutture di particolare importanza, sulle quali si è agito attraverso *un cantiere di conservazione di emergenza*[3] (Bertagnin et alii., 2003). In particolare è stata individuata, quale area d'intervento, la principale linea di difesa del castello, caratterizzata da due imponenti bastioni, dal profilo a scarpa e muniti di feritoie. In tale zona l'intervento si è concentrato sul bastione di sud-est registrato come M4, nonché sul muro M5 che divide lo spazio interno del bastione in due vani (corridoio di tiro per le feritoie del lato est e ambiente A11) (Fig. 3a).

In sintesi, le procedure di conservazione sono state articolate in due macrofasi: (a) manutenzione e consolidamento del bastione sud-est del castello e del muro M5; (b) conservazione e protezione del profilo superiore dell'area bastionata e del muro M5.

Per quanto attiene al bastione sud-est del castello, va notato che esso è definito da un muro a scarpa costituito da blocchi di *pachsà* rettangolari o a sezione trapezoidale di diverse misure e da mattoni crudi di varie dimensioni[4] (Fig. 3b).

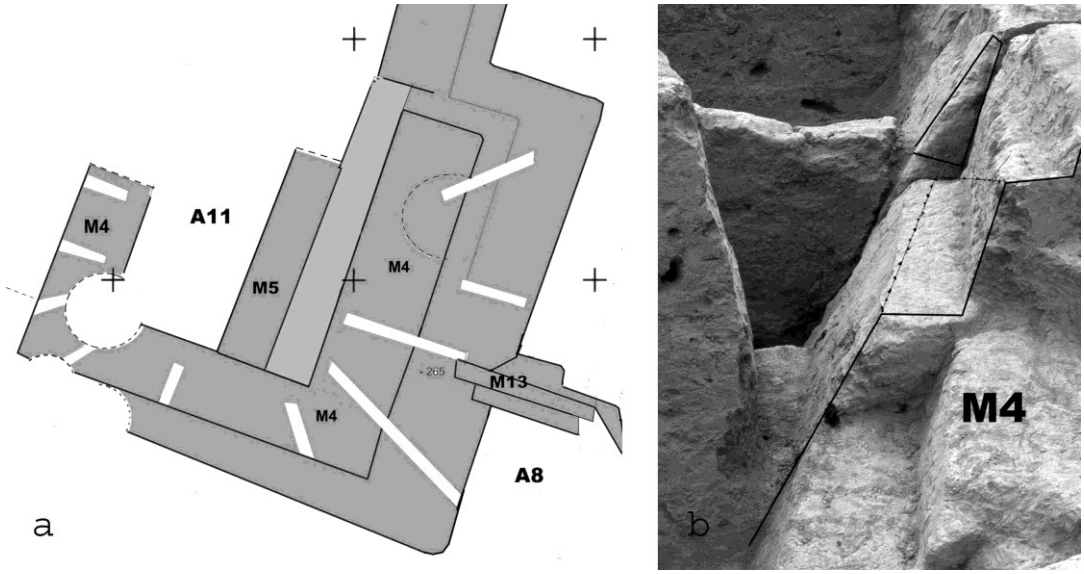


Fig.3. (a) Pianta del bastione sud-est (M4) e del muro M5; (Gennadi Ivanov) (b) ricostruzione schematica dei blocchi di pachsà franati sul lato est del bastione. (Franca Filipponi)

Le parti danneggiate dagli agenti atmosferici di tale struttura sono state oggetto di un'azione di manutenzione, durante il cantiere 2008, con due modalità differenti. La prima ha riguardato il risarcimento delle fessurazioni attraverso l'impiego di un impasto di *terra-paglia*, opportunamente concepito (Fig. 4a). La seconda modalità seguita nel percorso di manutenzione, ha previsto l'impiego di *adobe* o *pachsà* e malta di terra. Nel caso di cedimenti significativi si è cercato di limitare il progressivo degrado intervenendo sulla cortina muraria esistente, con l'impiego di *adobe* o *pachsà* di dimensioni originali, recuperati dagli scavi realizzati nel sito. Una volta terminata l'operazione di risarcitura si è proceduto alla stesura di un manto protettivo esterno, costituito da un *intonaco di sacrificio* a due strati, realizzato con diversi impasti di terra-paglia-acqua secondo la composizione originale osservata nel sito (Fig. 4b).
L'intonacatura prevista ha teso a riprodurre, migliorandole, le modalità tradizionali rilevate nella struttura esistente, limitando i danni da erosione e da pioggia.

Fig. 4. (a) Preparazione dell'impasto impiegato per la risarcitura delle fessurazioni e sua posa in opera; (b) manutenzione della sommità del bastione mediante l'impiego di *adobe* o *pachsà* e stesura finale dell'*intonaco di sacrificio*. (Désirée De Antoni)

Un altro importante intervento ha riguardato la ricomposizione delle feritoie, parzialmente alterate dai processi erosivi. Nell'intervento su tali elementi costruttivi si è proceduto secondo tre modalità, rispettivamente: mediante il risarcimento delle superfici interne, la ricomposizione del profilo esterno e la protezione superficiale (Fig. 5).
L'intervento di consolidamento del muro M5 è stato realizzato mediante la seconda modalità d'intervento in modo da evitare ulteriori cedimenti (impiego di *adobe* o *pachsà* e malta di terra).

Fig. 5. Stesura dell'*intonaco di sacrificio* a protezione della zona delle feritoie. (Désirée De Antoni)

Per quanto attiene alla conservazione e alla protezione del profilo superiore dell'area bastionata e del muro M5, si è previsto uno *strato di muratura di sacrificio*, rimovibile all'inizio del futuro scavo del 2009, che è stato realizzato con la posa in opera di due corsi di *adobe* sovrapposti, separati dalla muratura originale da uno strato di carta catramata isolante.
Ciascuna feritoia è stata preventivamente ricoperta da uno strato di rami di legno, canne e malta di terra, secondo il tradizionale metodo di realizzazione dei tetti degli edifici in terra cruda della zona. Tale strato si è reso necessario al fine di proteggere le feritoie e creare una superficie di sostegno adeguata per la messa in opera degli adobe sulla carta catramata (Figg. 6a-6b).

Fig. 6. Manutenzione preventiva: gli interventi di protezione superficiale provvisoria. Sequenza di posa in opera degli strati di protezione sul margine superiore del bastione: (a) rami e paglia; (b) malta di terra e carta catramata. (Silvia Pozzi)

Tutti gli interventi realizzati sono volti al rispetto del *criterio di reversibilità* e *compatibilità tecnologica* e *materica* con l'esistente da conservare, rispondendo, in tal modo, ai consolidati principi di conservazione dell'architettura di terra.

Secondo quanto stabilito da studi preliminari finalizzati alla pianificazione del cantiere di conservazione[5], gli interventi sono stati realizzati con il seguente ordine:

- Identificazione del sito per la produzione degli impasti e lo stoccaggio dei materiali quali la terra, le canne ed i rami d'albero impiegati nel cantiere.
- Reperimento nel sito della terra e degli altri inerti.
- Reperimento della paglia, delle canne e dei rami d'albero.
- Predisposizione delle malte in terra per l'esecuzione dei vari strati d'*intonaco di sacrificio* previsti e la loro messa in opera.
- Stoccaggio degli *adobe* e dei *pachsà* recuperati durante lo scavo.
- Stesura dello strato di carta catramata sul profilo superiore delle strutture, oggetto dell'intervento di manutenzione preventiva
- Predisposizione dello strato superiore di *muratura di sacrificio* costituito da *adobe* posizionati sopra il piano protetto dalla carta catramata.

4. IL REPERIMENTO DEI MATERIALI LOCALI

Il reperimento dei materiali da costruzione impiegati nel cantiere di conservazione è avvenuto in loco.

Come terra è stata impiegata quella di risulta dello scavo. Tale terra non ha necessitato di vagliatura data la sua granulometria fine.

L'approvvigionamento dell'acqua è risultato essere uno dei maggiori problemi riscontrati durante il cantiere del bastione, dal momento che la fonte più prossima distante circa 300÷400m dal sito, ha costretto l'impiego permanente di due operai, durante tutto l'intervento.

Per la preparazione dell'impasto impiegato per la risarcitura delle fessurazioni, sono state utilizzate canne presenti nel sito, opportunamente sminuzzate ed essiccate.
Per quanto riguarda le fibre da usare negli impasti degli *intonaci di sacrificio* è stata impiegata paglia di mais proveniente da un campo antistante il sito.

5. STRATEGIA DI PARTECIPAZIONE E DI SENSIBILIZZAZIONE: VERSO LA REALIZZAZIONE DI UN PIANO DI GESTIONE DEL SITO

All'interno delle attività di conservazione svolte nella campagna di lavori 2008 vi è stato un primo tentativo di coinvolgimento della popolazione locale, realizzato attraverso una serie di incontri volti a sondare il grado d'interesse verso i siti archeologici dell'oasi di Bukhara[6]. Nel quadro di tale strategia partecipativa, attuata attraverso la distribuzione di un questionario mirato, è emerso che la regione, pur essendo un luogo di notevole rilevanza storica e culturale, non è percepita come una reale fonte d'interesse turistico né per la comunità locale, né per il turista. Tra i fattori che contribuiscono alla scarsa conoscenza e fruibilità della zona vi sono la carente manutenzione delle aree archeologiche, la mancanza di adeguate infrastrutture, nonché la limitata promozione turistica.

Da ciò s'intuisce l'importanza di avviare quanto prima, cominciando dal sito di Uch Kulakh, un *piano di gestione* e *salvaguardia*, a medio e lungo termine, dei siti archeologici in terra dell'oasi di Bukhara. Partendo dal concetto di "manutenzione / conservazione preventiva" (Bertagnin, 2008) e alla sua rilevanza in termini di approccio coerente alla gestione di un sito, si può auspicare per il sito in oggetto, la messa in essere di un percorso in tale direzione. L'avvio di un piano di *manutenzione preventiva* potrebbe, infatti, aprire la strada ad una più estesa pianificazione di una conservazione integrata della regione, che potrebbe suscitare un maggiore interesse da parte della popolazione locale ed un più concreto flusso di turismo sostenibile.

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NOTE

[1] La rilevanza mondiale di questa regione è stata evidenziata anche dall'UNESCO-CPM/WH Centre il quale ha inserito il sito di Varakhsha nella 'Tentative List 2008', sottintendendo così la necessità di urgenti interventi di conservazione e valorizzazione di tale area.
[2] L'equipe archeologica responsabile degli scavi di Uch Kulakh opera sotto la direzione della prof.ssa Chiara Silvi Antonini ed è composta dal dottor Fabrizio Crusco, dalla dott.ssa Franca Filipponi, dal dottor Ciro Lo Muzio e dalla dott.ssa Silvia Pozzi.
[3] Il modello è stato, peraltro, adottato, su indicazione del prof. Mauro Bertagnin, in altri interventi di conservazione dei siti nei quali hanno operato ed operano equipes archeologiche dell'Università di Udine. Si tratta dei siti di Tell Soiukh el Fawqani (1991) e Tell Soiukh el Mishrife (1999 - in corso) in Siria, diretti rispettivamente dai proff. Frederick Mario Fales e Daniele Morandi Bonaccossi.
[4] Le strutture in terra cruda del sito sono costruite in *adobe* di dimensioni medie 35x25x10, e in *pachsà*, blocchi di terra e paglia di dimensioni medie 50x30x15.
[5] Le fasi preparatorie, gli impasti per la risarcitura delle fessure e la realizzazione degli *intonaci di sacrificio* sono stati oggetto di sperimentazione preventiva presso il Laboratorio LATERIS – Architettura di terra e sostenibilità del Dipartimento di Ingegneria civile e Architettura dell'Università di Udine.
[6] Le interviste con la popolazione e gli incontri di sensibilizzazione sono stati realizzati dalla dott.ssa Silvia Pozzi.

KANJI: THE CONSERVATION MANUAL

Mauro Bertagnin, Désirée De Antoni, Giulia Bravo, John Harrison,

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ABSTRACT
This paper introduces the results of the first phase of a preparatory field research carried out over the past two years, aiming to produce a manual for the conservation of a small Himalayan village, Kanji, in the Indian Ladakh Region.
Kanji has an earthen architectural heritage that is now involved in a slow process of architectural transformation due to a new road reaching the village, the recent construction of tourism facilities (camping) and a new public school. Some changes are also affecting the environmental as well as the socio-economic structure of the village.
In order to ameliorate any damaging effects of these changes upon the traditional local architecture, it was considered important to produce a *conservation manual* to promote the maintenance of the existing vernacular architecture.
Since summer 2008 a team from Udine University - School of Architecture, with Giulia Bravo and Désirée De Antoni under the scientific direction of Mauro Bertagnin, and with the participation of John Harrison - has been carrying out research and field work aimed at producing a *conservation manual* for the community of the Kanji village.
This research work continues the conservation approach promoted by Achi Association, which for more than a decade has been actively involved in the conservation of Kanji's Buddhist temples.
The operational scheme of the research work has as its main goals: a basic classification of the Kanji urban fabric; the understanding of local building culture; the surveying of architectural typologies and related building construction details; knowledge of the technology of earthen vernacular architecture.
The research is also considering, in the first phase of the *conservation manual*, the decay processes affecting the vernacular architecture as well as the transformations of the existing urban fabric due to the impact of modernity on the village. In the second phase, the *conservation manual* will include the results of the research on more appropriate best practices and on suitable modifications related to the maintenance and conservation works concerning the small village to be protected, a fine Himalayan earthen architectural heritage.

1. INTRODUCTION

This paper introduces the results of the first phase of a preparatory field research carried out in the past two years that aims to produce a *manual* for the conservation of a small Himalayan village, Kanji, in the Indian Ladakh Region.
The *conservation manual* is also the outcome of a long term research programme carried out over the past decade concerning the impact of global warming on earthen architecture conservation in Ladakh[1].
Kanji is a fine example of earthen architectural heritage (Fig. 1a) that is now involved in a slow process of architectural transformation due to the impact of modernity as well as to the processes of decay and renewal. These changes are also affecting the environmental as well as the socio-economic structure of the village.
The operational scheme of the research work deals with a basic classification of the Kanji urban fabric. In the first ongoing phase, the main goals of the *conservation manual* research include the understanding of history, the environment, the local

building culture, the surveying of architectural typologies and the related building construction details and an understanding of the technology of earthen vernacular architecture. The research in the first phase is also considering the decay processes affecting the vernacular architecture as well as the changes of the existing urban fabric due to the impact of modernity in the village. The second phase will provide the guidelines for an appropriate process of conservation.

2. KANJI INTRINSIC VALUES (ENVIRONMENTAL, TOPOLOGICAL, MORPHOLOGICAL, HISTORICAL, ARTISTIC, INTANGIBLE): A BRIEF OUTLINE

2.1. Environmental, topological and morphological values

Kanji, a village in the Leh district of Ladakh (Jammu & Kashmir State, India, 232.864 inhabitants), is situated on an altitude of 3.875 m. Ladakh is divided in two districts: Kargil and Leh. Leh, the former capital of the Kingdom of Ladakh, is today its largest town. The region, known as Ladakh, is situated between the Karakoram mountain range in the north and the main Great Himalayas to the south.
The Western Kargil district (14.086 km²) shares the extremely cold winters and temperate summers of the Himalaya region. The Kanji landscape is scarcely vegetated. On the fields along the river that borders the village, only a few crops are grown, as result of the oasis agriculture system typical for high mountainous areas.
The village and its environment can be considered a "cultural landscape" being the typical result of "combined works of nature and man" designated in the first article of the Word Heritage Convention (1972).
The village's morphology is characterized by two settlement areas divided by a dry river bed (Fig. 1b). The general plan of Kanji village clearly explains the morphological structure of the settlement sloping towards the central axis, the dry river bed. The morphology also shows a scattered settlement along the borders, composed of isolated houses of different types while the old village core is a dense homogenous cluster of tall buildings. This is what makes Kanji a unique survival.

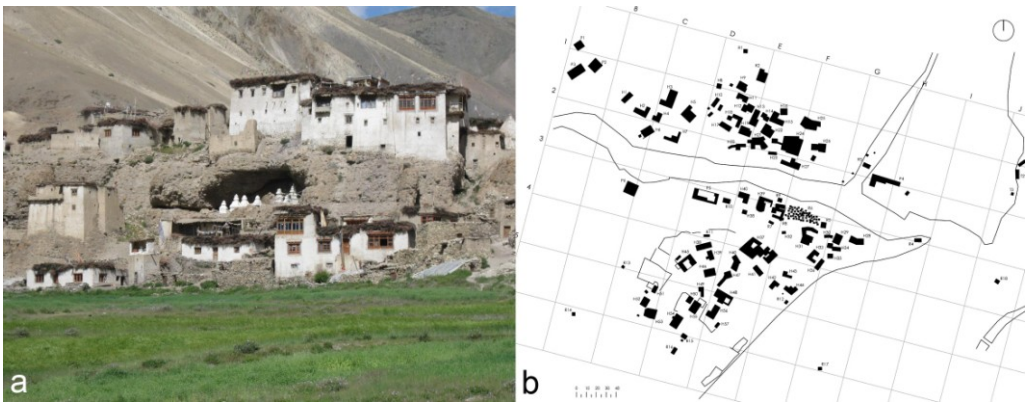

Fig.1. Kanji: a little gem of Himalayan earthen architecture (a) and the plan of the village (b) (credits: Giulia Bravo, Désirée De Antoni)

2.2. Historical values

A precise documentation about the history of Kanji village is lacking and the oral tradition of its inhabitants is almost the sole source available. The first settlement seems to date back to the 13th/14th century A.D. It is said to have been made by a population penetrating from an area to the west, in today's Pakistan, stranded here in the wake of the migration of their yaks, their main source of livelihood.

2.3. Artistic values

Ladakh is sometimes called "Little Tibet" because it shares with Tibet such characteristics as: the Buddhist religion; the partially related ethnicity; the language (Ladakhi is, in fact, a particular Western Tibetan dialect pronounced in an archaic way and influenced by other non-Tibetan languages); the architecture (building typologies); and artistic features such as paintings, decorations and sculptures typical of the Buddhist religious tradition.

2.4. Intangible cultural values

As well as in the architectural and artistic values, the influence of Tibetan Buddhism can be found also in the village culture and traditions, including the old Ladakhi dances and chants which are very important in the community life (Fig. 2a). During religious ceremonies and seasonal festivities, such as harvest, ritual dances and traditional songs animate the life of the village and contribute to social cohesion. This intangible heritage also represents potentially an important tourist attraction.

Fig.2. Promoting the intangible heritage (dances) (a) and improving the local awareness (the small exhibition in the school) (b) (credits: Giulia Bravo, Désirée De Antoni)

3. ARCHITECTURAL VALUES

3.1. Protecting a little gem of Himalayan earthen architecture through a *conservation manual*

In our opinion, according to the Word Heritage Criteria for the nominated properties, Kanji earthen architectural heritage might be considered a real "outstanding example of typologies, architectural and technological ensemble related to a peculiar landscape which illustrates a significant stage in human history"[2].
In respect of these criteria the conservation policies promoted by Achi Association emphasize the importance of an integrated strategy of protection that includes the production of a *conservation manual* for the village as an important tool for the maintenance of this fine heritage.
The integrated conservation strategy, promoted by Achi Association, is based on two main sectors, directly related to the "tangible" and the "intangible" heritage conservation. Concerning the protection of the architectural heritage, the Achi action includes an educational stream, some best practice workshops, related to the conservation strategies to be carried out, and the improvement of local awareness concerning the maintenance of the vernacular architecture. Of course, the conservation of the village cannot be implemented without the participation of the community.
Concerning the "intangible" heritage conservation, a special project is ongoing aimed at investigating and recording the local traditions (agriculture methods, vernacular artisanal tools, dances, chants, music and local tales).
Kanji is in fact an intact (for the time being) little gem of Himalayan earthen architecture and a precious heritage that should be preserved in its integrity[3].
The village, however, is undergoing a process of structural and architectural transformation. The first signs of this process are a new road reaching the village, the recent construction of tourism facilities (camping), as well as the new public school, which is the first building, constructed with mostly "modern" materials. These changes will affect the tradition of vernacular architecture and threaten its fine earthen architectural heritage.
Similar constructions and tourism facilities elsewhere must be analyzed in order to set up design guidelines for the future development in Kanji.

3.2. Architectural typologies: an ongoing research

Since 2007, within the framework of the activities of the Achi Association, the team of the Faculty of Architecture of Udine University (Italy) helped by the British architect John Harrison, is devising a conservation project for the whole village and the related *conservation manual*. The surveying and investigation campaign will be completed in about four years.
During the 2008 and 2009 summer missions, an extensive and detailed photographic documentation of the village and the assessments of the quality of some traditional buildings were carried out.

During the missions, the different building typologies of the village have been identified. These are basically three:
- buildings used as housing (Fig. 3a)
- buildings used for worship (temples and monasteries) (Fig. 3b)
- public buildings (schools and local meeting places) (Fig. 3c)

The buildings were then further distinguished according to their state of conservation.
The identified conservation categories are:
- building in a good state of conservation;
- building in a sufficient state of conservation;
- building in a poor state of conservation;
- building in a serious state of decay

For the buildings falling into the category of housing, further subcategories based on typological criteria and on the number of floors have been used.
Analyzing the historical development of the village, we can distinguish between the original dense defensive core on the cliff top and later expansion across the riverbed.
The vernacular tissue is an organic sum of common features characteristic of the typical Himalayan villages architecture and its formation obeys typological rules.
In fact, in the first area, the cliff top, we can observe some tower houses (Fig. 3a) which can reach the height of four floors, while in the second area, across the river bed, there are houses which are one or two floors high.
The buildings dedicated to worship, the temples and the monastery, are distinguished from other buildings by a range of features characteristic of Buddhist construction practice, such as the red colour of the roof parapet. The well-conserved monastery presents the front porch plastered in ochre yellow and red. The colour blue is used for the decoration of the wooden capitals.
In the interior, all the religious buildings are decorated with statues and paintings and further enriched by painted scrolls, called *thangka*, which all display sacred images of Buddha, Bodhisattvas and other cult objects, occasionally, Buddhist stories.
Of the public buildings, a part of the older village hall, the new public school falls outside any traditional type of construction. Materials alien to the traditional context have been used for its construction, such as stone and cement for the walls and iron sheet instead of wooden roof.
Vernacular technology displays the typical features of earthen architecture. Over a stone base, the bearing masonry of the walls is normally made of earthen blocks, called *pakbu* (Fig. 4). The earth used for *pakbu* and the subsequent layer of plaster, is very clayey.
In the interior, the vernacular buildings have a wooden structure serving as the support for the roof.
A first technical observation concerns the lack of straw or other strengthening vegetable fibres, in the *pakbu* production. The addition of sand and stones in the *pakbu* and the earthen roofing is a normal practice.
A series of sketches and drawings representing the doors, windows, capitals etc. were plotted during the survey campaign. Those drawings were aimed at

understanding the architectural details (Fig. 5a-b-c) found in the vernacular buildings of Kanji. The drawings, made by hand and subsequently transferred to the computer, will also be an important part of the *conservation manual* of the village.

Particular attention, for example, was devoted to the graphic representation of the roofs and to the investigation of their particular arrangement in layers (Fig. 6).
The vernacular roofs have a first structure, generally consisting of round section poplar trunks, which support a second structure of wooden boards, small branches, or cut willow sticks. Successive layers of earth and *markallak* are spread on that second structure, in order to form a stratum of insulation and surface protection.

Fig.3. Identifying the basic architectural typologies: (a) tower house and two floors house, (b) monastery and temple, (c) camping facilities and the new public school
(credits: Giulia Bravo, Désirée De Antoni)

Fig.4. Studying the vernacular building technologies: production of the the *pakbu*, the local mud brick (credits: Désirée De Antoni)

Fig.5. Understanding the architectural details: (a) doors, (b) windows, (c) capitals

(credits: Giulia Bravo, Désirée De Antoni)

Fig.6. Details of the vernacular roofs (credits: Désirée De Antoni)

4. IMPROVING LOCAL AWARENESS

During the 2009 mission a small exhibition was produced with pictures of the village. Meetings between the conservation team and the local community were also held (Fig. 2b). The purpose of those activities was to stimulate awareness about opportunities for architectural heritage conservation within the community.
For that reason, the drafting of the *conservation manual* should be a process involving the participation of the local community in order to:

- improve awareness of vernacular architecture as a treasury which must be protected, reflecting or rediscovering its value for actual life;
- analyse (SWOT - Strengths Weakness Opportunities Threats) the perspectives of this community in regard to the pressure of tourism, the needs deriving from building activities of new inhabited nuclei, the needs following restructuring, etc.;
- prepare tools promoting the long-term preservation of the local heritage through a sustainable local management programme.

The *conservation manual* is intended to, and hopefully will, contribute to a village development which combines:

- the respect for important cultural heritage, which must be protected and maintained;
- the possibilities offered by modern building technology to make life more comfortable;
- the respect for nature and the benefits of local building materials.

5. THE DRAFTING OF *THE CONSERVATION MANUAL*: THE EXPECTED RESULTS

Once the analysis of the whole architectural heritage of the village is completed, the ensuing *conservation manual* will be a review of the architecture of Kanji and it will report analyses and pictures of all surviving architectural typologies, as well as of all the building technologies and the vernacular architectural details employed.

The manual will provide a large number of pictures and drawings, illustrating the written comments on examples of doors, windows, various construction details, colours, plasters, and so on. These should be able to represent visual guidelines for the future construction of new buildings appropriate to the surrounding context or for the conservation and maintenance of the existing traditional buildings.
The manual will contain:

- the different building typologies of Kanji village;
- the state of conservation of the buildings;
- a proposal about which buildings of Kanji should be preserved as important specimens of cultural heritage;
- suggestions for conservation, restoration, maintenance;
- recommendations about how to improve the local building technology and materials;
- recommendations about which modern materials, the village development could take advantage of and which should be avoided and why;
- recommendations, guidelines and best practices about suitable solutions to be adopted when changes related to contemporary living standards occur, during the maintenance and restoration works.

The final version of the *conservation manual* first phase is still in progress.
Following the last phase of investigation and measurement of the buildings in the village (June 2010), a presentation of the first steps of the conservation project and the manual, within the framework of the activities of Achi Association, will be offered to the village and its inhabitants. An expert of Achi Association will accompany this presentation phase, and will ask for feedback from the community.
The *conservation manual* will help to raise the awareness of the local community for a better sustainable development and an appropriate process of maintenance to avoid the effects of decay in the vernacular architecture.
It will be a guide for any maintenance and restoration work in the existing urban fabric and at the same time it could also help the appropriate design and construction of new housing in the village. Therefore the *conservation manual* will also consist in "good practices" including ethical principles of conservation, guidelines on use and function and construction materials, management and planning recommendations for better monitoring, action planning and recording and documentation activities. Guidelines on homogeneity of materials, temporary protection, insertion of foundations, drainage, monitoring and treatment of cracks and reinforcement of the walls, exterior and interior wall-coatings and flat roof finishes, will be included in the *conservation manual*.
Beside this tool, a final exhibition will complement the *conservation manual*, contributing to improving the local community's awareness of the quality of its environment and vernacular architecture. A well-conserved and maintained vernacular architecture, a balanced development of new construction with a well-preserved landscape in a sustainable environment can be, in fact, a real resource for the villagers in the future.
Therefore the final outcome of the *conservation manual*, of the exhibition as well as of the awareness process promoted by Achi in the Kanji village, is a part of the Achi

goals for a conservation programme involving the local community in an increasing process of awareness of their heritage through a participative approach. The *Conservation Manual* of Kanji represents also an experiment to test its impact, as a protective tool, on the real conservation process of a small Himalayan earthen architecture heritage. If hopefully the result will be positive, Achi Association intends to promote similar experiences in other small Himalayan villages of the region such as Wanla and Skurbuchen to improve the conservation of the earthen architectural heritage in the Ladakh region.

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[1]Cfr. Bertagnin M. (2005). Cantieri di conservazione di emergenza dei monasteri buddhisti del Ladakh, in: *Luci tra le rocce* (proceedings). Salerno, 29-30 April 2004, Firenze (I): Alinea Editore. Ribera F. (a cura di), vol. 2, pp. 99-102.
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[2]Cfr. UNESCO, Word Heritage Centre, Operational Guidelines for the Implementation of the Word Heritage Convention, II.D Criteria for the assessment of Outstanding Universal Value, (iv).
[3]Cfr. UNESCO, Word Heritage Centre, Operational Guidelines for the Implementation of the Word Heritage Convention, II.E Integrity and/or authenticity, Integrity.

A PREVENTIVE MAINTENANCE WORK SITE AT KANJI AND OBSERVATIONS ON THE DEGRADATION OF EARTHEN ARCHITECTURE

Mauro Bertagnin, **Désirée De Antoni**

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ABSTRACT
Kanji, a village in the Leh district of Ladakh (North of India), is involved in processes of decay which invest some dwellings and religious buildings. The architectural pathologies develop themselves faster because of the climate change.
Since the last decade in this Himalayan area, the number of the rainfalls has been growing up with an exponential increase. The dampness and the freeze-defreeze phenomena affect the stability of the earthen structures which can also collapse.
The paper refers to observations on the degradation which has taken place at a small Buddhist private temple in Kanji.
The paper focuses on the experimental techniques of improved protection used for conserving the roof of the temple and the under-structures.
The water, in fact, going thought the roof, had begun to destroy the internal decorated plasters and to damage the Buddha statues. The methods, carried out to rehabilitate the temple, take inspiration from the vernacular building technologies.
This work is strictly related to the conservation approach promoted by Achi Association, which for more than a decade has been actively involved in the conservation of Kanji's Buddhist temples.

1. Global warming: the challenge for conserving earthen architecture

This work is part of a wider research framework aimed at defining the specificity of earthen architecture degradation in relation to the emergency linked to global warming /1/. It draws from infield observations matured with regard to the activities of conserving the Buddhist cult architecture of Ladakh, promoted by the activities of the Achi Association /2/.
Specifically, the article refers to observations on the degradation which has taken place at the small temple of Kanji and the solutions actuated in order to eliminate damage connected to the erosive and destructive action on the architectonic asset made of raw earth, following the action of atmospheric agents.
At the time of conservation work on Kanji temple it was possible to observe certain phenomena strictly connected to the degradation induced by atmospheric agents on the earthen structures of the village and particularly on the small temple (figure 1).

Fig.1. Tsuglag-Khang, the small Buddhist temple in Kanji.

Incredibly such phenomena, linked to the Himalayan climate, are comparable, by the degrading impact on raw earth structures, to others already observed in extreme hot climate realities, such as those recorded on the vernacular architecture of Timbuktu in Mali /3/.
Found to be particularly damaging for earthen architecture is the progressive concentration and increased intensity of rainfall in a more restricted period, also against more limited relative rainfall (rain tropicalisation).
Highly intense rainfall and freezing and defrosting cycles create in built structures, especially in raw earth roofs, phenomena of stress which must be controlled and governed by protective actions.
In particular, during the *preventive conservation* /4/ work initiated in Kanji, it was observed how the combined action of freeze/defreeze, melting snow during springtime and the following torrential rain were responsible for the penetration, along the line of the flat roof and perimeter protective wall, of damp and water of pluvial origin capable of damaging the internal walls of the temple plastered in earth and painted.
However, we tried to understand the reasons for such phenomenology and run some technological tests able to demonstrate some of the results of the observations on site and the validity of some hypotheses for improving the constructive details in the important horizontal closure – vertical closure.
Furthermore, technical solutions were completed, that were extremely simple but able to limit such degrading phenomena and, at the same time, create a reference for successive actions of *preventive conservation* to be realised on other raw earth buildings protected by Achi.

2. Traditional methods of protection on the flat raw earth roofs and observations on the pathologies found

Firstly, particular value was attributed to the traditional method of executing the flat roofs in earth of the Ladakhi vernacular architecture.
Such investigation was functional to understanding the structure in order to identify its features with regard to the technology of the constructive elements.
The vernacular roofs present primary framework, built by trunks, usually with a round section, of poplar wood, the most widespread wood in the region, which in turn supports a secondary framework generally realised using wooden planks or by using small branches or cut willow sticks. Onto such secondary framework, for the purpose of building an insulating layer giving surface protection, successive strata of *markallak* are spread, which is a particularly clayey earth used in the region both for plastering and mixtures for producing *pakbu*, the earthen blocks dried in the sun of the Ladakhi area.
An initial technical observation concerns the absence of the use, in the local building culture, of straw or other vegetable fibres for the execution of earthen roof mantles and production of the traditional *pakbu*.
Such absence deprives the mixtures of *markallak* realised of the necessary "elasticity" able to absorb or limit phenomena of normal "withdrawal" of the protective surface mantle above all at the joining point between the flat roof and perimeter wall and the consequent cracking phenomena.
Apart from such technical findings, the investigation led to the composition of an articulated pathological framework, characterised by the following phenomena:

- presence of deep cracking in the roof mantle;
- particular vulnerability in the connection joint (joint broken in several places) between the roof mantle and high walls, with the consequent possibility of penetration of water or melted snow along the joining line between the two perpendicular planes;
- insufficient sloping in the roof plane for rapid evacuation, towards the outside, of meteoric waters or those resulting from snow melting;
- insufficient ratio between the surface of the roof and the number of water evacuation points (water shoots);
- insufficient maintenance of the evacuation points to avoid blockages (accumulation of fibre and debris after the snow mantle has melted, small bird's nests) with consequent roof flooding and penetration of water in the joints through capillarity.

Also observed was how the degrading action on raw earth structures, produced by meteoric waters during the summer and by freeze/defreeze cycles during the winter-spring, became particularly evident along the connecting edges between the horizontal plane of the roof and the vertical plane of the external walls.
Penetrations, along such edge, of damp and scouring water, originating from the cracking phenomena described, have caused the underlying paintings in the temple to be particularly damaged (figures 2-3).
It is on such pathologies that we intended to concentrate our efforts for creating suitable *preventive conservation* solutions which have given interesting results.

Fig.2-3. Degrading action on the earthen wall decorations caused by infiltrations of water inside the temple.

3. Observations on the site preventive maintenance interventions

During the 2005 campaign, we intervened on the temple of Kanji with a series of small correctives able to improve the global behaviour of the connection between the horizontal structure and the vertical walls. After which, a reduced-scale model was completed of the upper part of the small temple in order to test the results of the validity of installing an "improved profile of roof plane-wall connection" able to optimise the performance of upper roof protection for a better air- and watertight behaviour of such constructive elements.
Parallel to such intervention, we actuated the modification of the wall profile at the top of the temple.
Since the presence, all along the internal edge of the perimeter walls of the roof-terrace, of protruding wood elements, installed during previous restructuring work on the temple, contributed to possible water infiltration, an initial intervention performed concerned their removal in order to prevent further infiltrations (figures 4-7).

Fig.4-5. Cutting the protruding wooden elements along the perimeter wall.

Fig.6-7. Plastering and correction along the line.

A second intervention which involved the perimeter walls of the roof-terrace concerned modifying the upper profile of such walls which allowed an improvement in defence against erosion caused by rain and wind (figures 8-9).
The intervention consisted of adding flat stone slivers and another layer made by earth with a curved section. With this elements we were able to build a sacrificial layer in order to permit a first level of protection during the winter period for the upper edge of the joint.

Fig.8-9. Creation of the protective stone cap and upper part in earth along the external edges of the perimeter wall.

The third intervention concerned the creation of an "improved roof plane-wall joint" (figures 10-11). This was realised by creating a dedicated mixture of *markallak*, containing finely chopped straw, able to resist the phenomena of contraction-expansion connected to the frequent freeze/defreeze cycles which involve the earth roof mantles both in the houses of Ladakh and the small temples such as those of Kanji and Wanla. On top of the layer of *markallak,* another layer of flat stones was created and then covered with earthen mortar.

Fig.10-11. Creation of the improved joint using *markallak* mixture and finely chopped straw with stone joint cover.

4. Studies on a reduced scale model

In order to verify the results of certain technological choices such as the positive impact of the use of straw in the mixture for creating the *improved joint* of the roof plane-wall, a reduced scale model of the upper part of the temple of Kanji was realised.
In the laboratory we studied samples of *markallak* used in the maintenance work on the temple roof and we discovered their strong withdrawal and the consequent cracking thereof following repeated freeze/defreeze cycles.
For these reasons we decided to perform a simulation on the scale model of the temple.
On the roof surface was spread a mixture of *markallak* and finely chopped straw in order to reproduce real conditions.
The model was then submitted to a set of five freeze/defreeze cycles (-20°/+5°) by means of insertion in a dedicated freezer for frost tests. The commonly used test of freezing and thawing at the temperatures -20 °C and +20 °C, was adapted to the reality to make the test more "appropriate" to understand of the behaviour of the earthen structures during the late winter-early spring season in Ladakh, when the pathologies happen. During the long Ladakhi winter, in fact, the temperatures are always under the zero and only in case of a sequence of some sunny days the temperatures can overcome the zero.
The results of the test of freezing and thawing showed how the “improved” solution (*markallak* mixture + fine straw) allows a good seal of the *improved profile* without cracks along the suture line between the roof and the perimeter wall.

5. Final observations: positive result of the realization of the improved profile

Despite the realization of the *improved joint* installed during the intervention campaign in the summer of 2005, during the following winter infiltrations in some points of the realised joint were recorded. These are to be attributed, in our opinion, to a combination of various factors.

In the first place, a defining role for water stagnation on the roof surface is attributed to the insufficient provision of water shoots for evacuating meteoric waters. Such situation certainly generated a "roof-pond" effect.
A further element which has favoured the insurgence of the pathological phenomena is probably due to a blockage in the sole expulsion conduit (water shoot) for rainwater from the terrace, probably caused by the presence within it of a bird's nest or alternatively to a block of ice containing vegetable fibres, the melting time of which was longer than that for the snow deposited during the winter on the roof cover which melted more rapidly by virtue of the sun's rays (*bouchon* effect).
A simple action of cleaning maintenance on the outlet for waste water, produced by melted snow and ice accumulated on the roof, would certainly have prevented infiltration and relative damage caused inside the temple.
The *improved profile* for the roof, the experimentation of which, also on the model, has demonstrated a good tightness, above all in relation to the ability to absorb expansions in the raw earth mantle linked to freeze/defreeze, was found to be an appropriate solution.
The lack of sufficient drainage and discharge of meteoric water and melted snow in the temple's roof-terrace, has contributed determinedly to the recorded infiltration, nullifying the positive performance of the "improved roof plane-wall joint" recorded in the model which underwent repeated freeze/defreeze cycles.

6. The realization of a second roof as a conservative option

Following the damage recorded due to the described water infiltrations, the Achi Association has realised (architect John Harrison) a further roof plane overlying the existing one (figures 12-13).
Such decision, a part from being justified by a probably many-centuries presence of such a roof removed only about 40 years ago, became necessary in order to limit maintenance and at the same time protect the original roof from the erosive action of atmospheric agents. Even though highlighting the inbred limits of the decision taken, the construction of a second protective roof has represented a practicable option.

Fig.12-13. Intervention of the realised counter roof

The choice taken certainly limits the possibility of obtaining the degree of formal authenticity inborn to the conservative interventions based exclusively on traditional methods, but presenting a character of reversibility has permitted and permits achieving additional protection which in the absence of ordinary maintenance in any case guarantees that the asset is safeguarded.

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/2/ www.achiassociation.org. The protected asset concerns small- or medium-sized temples which constitute, in villages such as that of Wanla, Kanji and Skuburchen, a point of reference for the local communities. The observations shown in this work refer to missions carried out on behalf of the Achi Association in the years 2005 and 2009.

/3/ In relation to the impact of climatic change on earthen architecture in the city of Timbuktu, protected by UNESCO, see:
UNESCO: Timbuktu Mali (2007), in Case Studies on Climate Change and World Heritage, (pp. 74-75), PARIS: UNESCO World Heritage Centre.

/4/ The first results of such observations were presented in:
M. Bertagnin: Monitoring et conservation préventive des architectures en terre au Ladakh (2008), in Conservation et gestion des Patrimoines. Le concept de conservation preventive (proceedings), ENSAG DSA-Terre.

NOTES

/1/ To such specific field of research some recent works must be attributed which tend to frame and define the specifics of degradation of earthen architecture in climactic areas very distant from each other in relation to the climatic emergency related to the matter of global warming.
See specifically on the argument: UNESCO: Climate Change and World Heritage. Report on predicting and managing the impacts of climate change on World Heritage and Strategy to assist States Parties to implement appropriate management responses (2007), in World Heritage Reports no.22, PARIS: UNESCO World Heritage Centre.

EARTHEN ARCHITECTURE AFTER DISASTER: INITIAL RISK-REDUCTION MEASURES IN KANJI VILLAGE FOR CONSERVING NON-ENGINEERED RURAL LADAKHI ARCHITECTURE

Mauro Bertagnin, Désirée De Antoni,

The article will be presented at Terra 2012, the XI[th] International Conference on the Study and Conservation of Earthen Architecture Heritage.
Peru, Lima 22-27 April 2012.

Abstract
Ladakh (North of India) is characterized by an elevated level of seismic risk, being part of the Jammu and Kashmir state, very close to Pakistan, where in 2005, a terrible earthquake destroyed part of the building stock and killed thousands of people. Over the last decade in these areas, the climate has changed: the amount of rainfall has experienced an exponential increase. In particular, in August 2010, the unusual heavy rainfall resulted in various related physical phenomena, such as floods and landslides.
Since the summer of 2008, a team from the University of Udine's School of Architecture has supported the Achi Association's activities in Ladakh. The Udine team is carrying out architectural research and fieldwork in this area, aimed at producing a *conservation manual* for the community of Kanji, a small Ladakhi Himalayan village.
During the summer of 2010, the Udine Unit mission in the field was involved with the catastrophe that occurred in August. This climate-related as well as geo-environmental disaster produced more than one hundred civilian casualties and associated damage to the existing urban fabric in Leh (the capital of Ladakh), in addition to rural settlements.
This paper analyzes the damage to traditional earthen buildings in Kanji, linked to climate change, and appropriate solutions adopted in order to build new safe construction, and preserve the existing architectural heritage in a sustainable approach, respectful of traditional typologies and technologies.

1. INTRODUCTION

Kanji, a Himalayan village in the Leh district of Ladakh (Jammu & Kashmir State, India), is characterized by a fine earthen architectural heritage that is experiencing deterioration of some dwellings and religious buildings. Currently, typical architectural pathologies develop faster because of climate change, which has resulted in a much more humid temperature during the summer.
At one time, extremely cold winters and temperate dry summers characterized the climate of this region. Over the last decade, instead, the amount of rainfall has experienced an exponential increase, and as a result, the damage to Kanji earthen architecture has been widespread. In 2010, the heavy monsoon made the situation worse, destroying a part of the city of Leh and many dwellings of villages all over Ladakh (Fig. 1).
For the above-mentioned reasons, the main objective of our missions in Ladakh focuses on the conservation and maintenance of the traditional earthen buildings, as well as the introduction of improved building-technology solutions aimed to enhance the stability of the non-engineered rural architecture, avoiding or reducing the risk of collapse due to seismic events or heavy monsoons. Therefore, this paper introduces the methodologies that the Udine Unit implemented in Kanji, to reduce climate-

change impact on earthen buildings, which resulted in the appearance of severe damage to structures, and even their destruction. These methodologies follow the conservation approach promoted by the Achi Association, which is actively involved in the conservation of Buddhist temples in this area.

The Udine Unit is promoting three directions:

- **Conservation activities on site:** the team works in the field on preventive-maintenance activities aimed to reinforce the structure of traditional earthen buildings against any possible environmental risk.
- **Draft of a *conservation manual*:** the team is preparing a *conservation manual* for Kanji, which can also be useful for nearby villages. The *conservation manual* will be a review of the architecture of Kanji, and it will include an analysis and photographs of the variety of surviving architectural typologies, as well as all of the various building technologies and the vernacular architectural details employed.
- **Organization of workshops:** the team organizes workshops with the local population and a selected group of young people, including community leaders, artists and Buddhist monks, in order to improve their knowledge regarding new safer building-construction technologies, which should be adopted to face climate-change issues.

Fig. 1. Leh, Ladakh: the destruction of the urban fabric after the heavy monsoon and related flood (credits: Désirée De Antoni, 2010)

2. KANJI'S TRADITIONAL EARTHEN HERITAGE AND RELATED PATOLOGIES

2.1. Vernacular earthen typologies and building-construction materials

Ladakh is sometimes referred to as "Little Tibet", because it shares with Tibet various similarities, such as the Buddhist religion, partially-related ethnicity,

language, and as well as vernacular architecture (building techniques and architectural typologies).

The architectural typologies of Kanji are characterized by the intensive use of earth, together with stone and wood, as basic building materials. The foundations of traditional buildings are built of stone; the load-bearing walls, as well as the internal framework, are executed with *pakbu*, the traditional earthen blocks. The floors and the roofs are constructed with poplar wood beams and willow sticks, vegetable fibers and a plaster mixture made of earth and water, called *markallak*.

Kanji architectural typologies are basically three: buildings used as housing, buildings used for worship (temples and monastery), and public buildings (schools and meeting halls) (Fig. 2). These structures, within the framework of the *conservation manual*, have been evaluated for their state of conservation (good, sufficient, poor, or totally insufficient, which equates to a serious state of decay).

Fig. 2. Kanji, Ladakh: the vernacular earthen architecture and the monastery (credits: Désirée De Antoni, 2010)

2.2. Pathologies and damage to earthen structures in Kanji

In the village of Kanji, earthen structures are really affected by several pathologies due to the inadequate choice of building materials, their implementation, and climatic factors such as rain, snow and ice. These three factors are related to each other and responsible for the decay of these buildings.

Field research demonstrates that sometimes the preparation of the *pakbu*, is approximate and realized very quickly without taking care if, during the production, the earth fills entirely the mould and, above all, its angles. Lack of earthen mortar between *pakbu* laid horizontally, or the absence of joints among the horizontal and vertical elements of the structure also has been observed (Fig. 3a). Furthermore, traditional *pakbu* masonry results in additional problems that can remarkably reduce

the stability of earth construction. The first case concerns a low resistance of the wall itself, because the earthen blocks are not well connected to each other, and for this reason, they cannot resist together against a wall oscillation due to a seismic event or a flood. In the second case, instead, the loss of resistance is related to the reaction of the whole building: it is extremely necessary, in fact, that the connections among walls, floors, foundations and roof are assured in order to have a ”box-type” structure in which all the architectural elements can act together against any kind of external stress, like deformations due to the earthquake vibration (*box effect*).

Another very recurrent problem is due to the absence of periodic maintenance of the roof drainage system (Fig. 3b). Rain can infiltrate from the roof, and the resulting dampness and the freeze/thaw phenomena can create serious problems for the buildings, eroding structures and joints at the walls, till separation occurs.

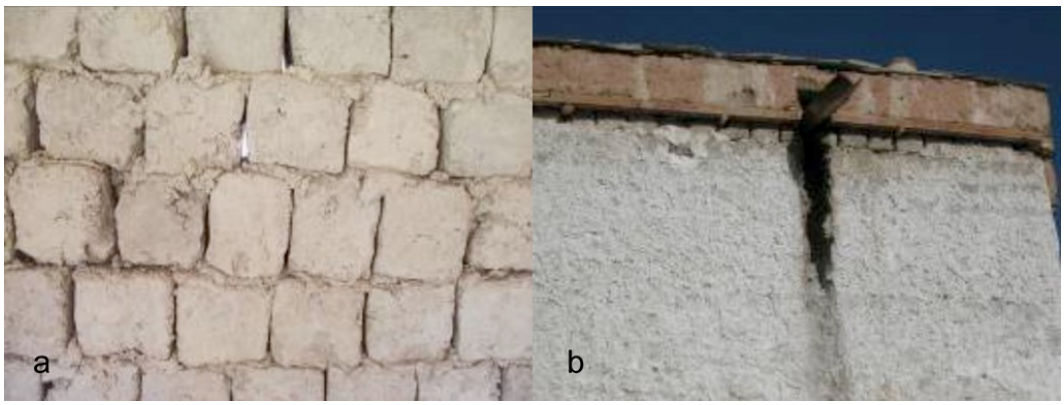

Fig. 3. Kanji, Ladakh: (a) the lack of earthen mortar between the *pakbu* laid horizontally with incorrect *pakbu* vertical-joint design and; (b) a roof-drainage system, which does not work correctly, damaging the wall surface (credits: Désirée De Antoni, 2010 (a) and 2009 (b))

3. MEASURES FOR RISK REDUCTION: THREE MAIN ACTIONS

The Udine Unit, within the framework of the Achi Association’s activities, contributes to climate-risk reduction in these areas, following an approach based on three main actions, which involve conservation activities to the site, drafting of a *conservation manual* of Kanji, and organization of workshops for selected groups of young community leaders, artists and monks.

3.1. Preventive-conservation activities on site

The Udine Unit with the Achi Association set up some conservation missions in order to preserve temples and monasteries of Kanji, Wanla and other rural villages of Ladakh. The approach was aimed at reducing damage due to climatic impact on local traditional architecture made of *pakbu*, the traditional earthen block.
One of the main conservation activities took place in 2005 and involved the maintenance of *Tsuglag-Khang*, the small Buddhist temple in Kanji, which consists

of a unique room in which there are three Buddha statues and wonderful paintings on the walls. Intense rainfall and freeze/thaw cycles resulted in severe damage to the structure: multiple cracks were present along the walls, the earthen roof was in a serious state of decay, and one of the four load-bearing walls exhibited movement towards overturning. For these reasons during the 2005 campaign, the Udine Unit experts, along with other members of Achi Association, implemented protective interventions able to conserve the roof of the temple, and the underlying structure. The methods carried out to rehabilitate the temple took inspiration from local vernacular building technologies.

For the repair of cracks, the team decided provisionary to fill these with *markallak* instead of reconstructing parts of the masonry, in order to preserve the decorations on the walls (Fig. 4a). The restoration of the interior paintings is still ongoing. Degradation action on the earthen-wall decorations was due to infiltration of water or melted snow through the roof. These phenomena were tied to the presence of several deep cracks in the connection joint between the roof and the upper walls, and the inadequate maintenance of drainage system, which lacked a sufficient number of water evacuation points (scuppers).

Regarding the penetration of damp and scouring water along the joint line between the two perpendicular planes, the conservation activity focused on the creation of an "improved roof plane-wall joint". First of all, the Udine Unit decided to prepare a specific mixture of *markallak*, containing finely-cut straw, which was subsequently spread at the joint line. On top of this first layer of *markallak,* another layer of flat stones was created and then covered with earthen mortar. This improved joint was designed to resist the phenomena of contraction-expansion due to the frequent freeze/thaw cycles impacting earthen roofs.

A second intervention involved the perimeter walls of the roof-terrace, and was related to the upper profile of these walls, which provided an improvement in defence against erosion caused by rain and wind. The intervention focused on the addition of a "*sacrificial layer"*, creating a first level of protection during the winter period for the upper edge of the joints. This *sacrificial layer* was made by adding slivers of flat stone and an additional layer made of earth with a curved section. Unfortunately, these experimental conservation techniques could not totally solve water infiltration issues, because of the lack of maintenance of the evacuation points, which allowed water to accumulate, generating a "roof-pond" effect.

For this reason, the team decided to build a second protective roof. This choice certainly limits the possibility of obtaining "authenticity of form" related to traditional conservation interventions. On the other hand, this intervention presents a character of "reversibility", providing additional protection. This second roof, even in the absence of ordinary maintenance, can guarantee complete safeguarding of the structure.
For the load-bearing wall that presented movements of overturning, the team took the decision to maintain the two existing buttresses, made with stone and clay-based

mortar, and to enlarge the foundations. These interventions allowed distribution of the load of the wall on a lager surface, avoiding a possible overturning of this part of the structure, as well as the destruction of the interior paintings (Fig. 4b).

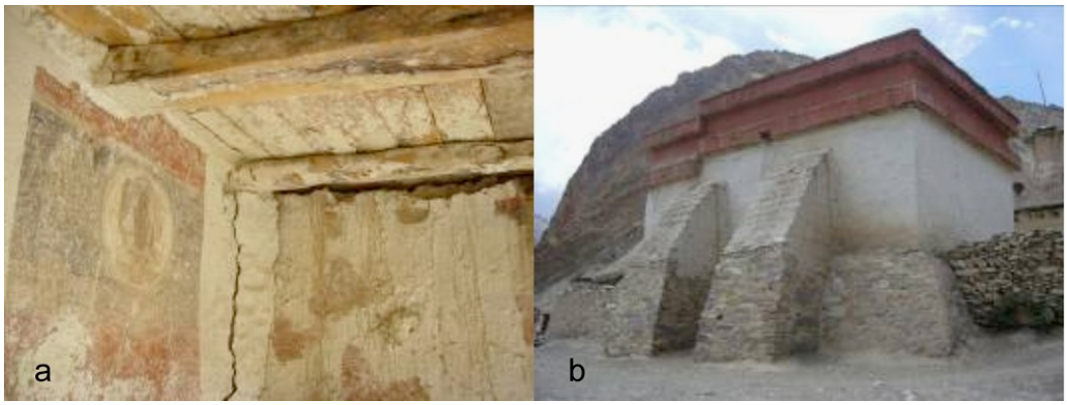

Fig. 4. Kanji, Ladakh: conservation of the *Tsuglag-Khang*,.(a) the interior damaged paintings; (b) the second roof, the stone buttress and the new foundations
(credits: Mauro Bertagnin, 2007 (a); Giulia Bravo, 2008 (b))

3.2. Draft of the *Conservation Manual* of Kanji

The 2010 floods produced related damage to the vernacular architecture of several small villages like Kanji. For this reason it became important to draft a *conservation manual* for Kanji, which can be promoted in other similar areas. The *conservation manual* can explain how to build new buildings and conserve the existing architectural heritage, and in particular, how to maintain traditional construction that may be increasingly exposed to serious environmental risk.

First, the *conservation manual* should incorporate a study of the Kanji context, which means: study of geographical location, environmental characteristics, climate and its changes, etc. During the 2010 mission, it was also possible to improve the team's knowledge through research on village history and traditions, concerning also the first settlements, the roles of women and men in society, the socio-economic as well as political activities, the building traditions (orientation, myths related to the house, etc.) The *conservation manual* should include the analysis of the architectural heritage as well, providing a distinction between houses, buildings for worship, public buildings and tourism facilities. The Udine Unit is also analyzing public buildings, just to make a comparison between the building technologies and materials used for these and those used for traditional structures.

During the final 2010 mission, an in-depth study of the vernacular building technologies used in Kanji was carried out, focusing on an analysis of the materials, their characteristics and function, and the methods used for their implementation. After this analysis, the architectural details related to some examples of roofs, windows, doors, capitals and columns will be included in the *conservation manual*. It is still necessary to study some of the main pathologies that affect the earthen

vernacular architecture of Kanji, indentifying the causes, such as inappropriate choice of the materials, application defects, dampness, climate-related alterations, and human factors.

After analyzing pathologies, the *conservation manual* will provide some guidelines for the conservation of traditional buildings and for the construction of new dwellings. The challenge for the conservation of Ladakhi vernacular earthen heritage is to identify new criteria for preserving the local earthen-building culture, while simultaneously improving existing building technologies in order to strengthen new earthen buildings. There is, in fact, a serious risk of a progressive loss of vernacular building know-how in local communities, and one of the main causes is climate change, which is modifying the local building construction at the expense of using *pakbu*.

Public buildings, built thanks to public money, are mostly made with stone and cement, providing better durability against climatic phenomena, but they are, at the same time, totally unsuited for the local climate (Fig. 5a). In addition, the use of these more durable construction materials produces an "imitative process", causing local people to privilege the use of stone, cement and concrete, instead of raw earth. Together with the new materials, a modification of the aspects of new buildings, as well as technical construction methods, is occurring. For example, the introduction of concrete curbs and beams are more evident, as well as concrete foundations in new construction (Fig. 5b).

For these reasons, it becomes important to provide a manual with visual guidelines illustrating appropriate construction technologies for building new structures in the surrounding landscape, and for the conservation and maintenance of existing traditional buildings. Therefore, the main purpose of the *conservation manual* is to contribute to village development, which combines respect for an important cultural heritage to be protected and maintained, the possibilities offered by modern building technology to make life more comfortable, and the respect for nature and vernacular architecture based on local building materials .

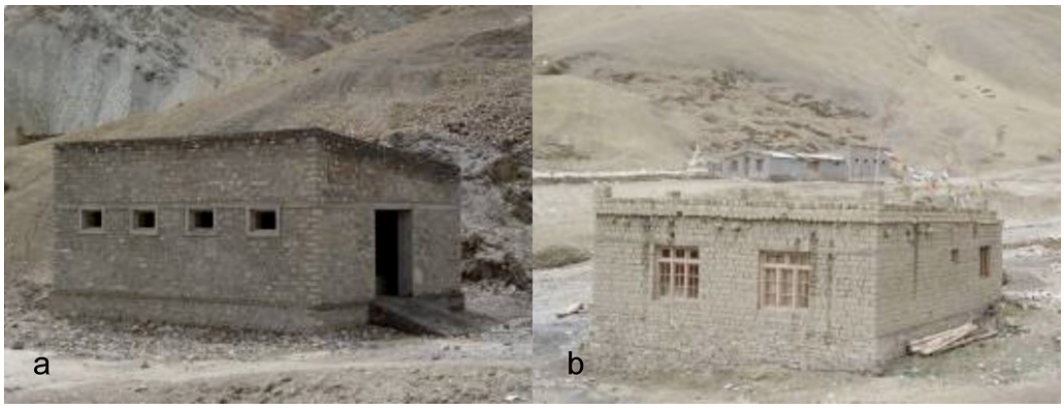

Fig. 5. Kanji, Ladakh: (a) a rice store built of stone, cement and concrete; (b) a new earthen house with a concrete curb (credits: Désirée De Antoni, 2010)

3.3. Workshops for the local community and Ladakhi Buddhist monks aimed to improve traditional earthen-construction patterns and techniques

In order to increase the awareness of local population on the necessity of improving traditional earthen-construction patterns and techniques, in February 2011, a special winter workshop was organized in Dehradun, India for climatic reasons by the Udine Unit, within the framework of the Achi Association's educational program in Ladakh. The workshop was conceived for a selected team of community leaders, young Ladakhi artists and monks. After attending the workshop, the participants have the responsibility of spreading updated know-how to Ladakhi villages and communities.

The winter workshop was a first step for a more complex and detailed educational program, aimed to create awareness for the necessity of improving traditional earth construction know-how to face the increasing issues related to the impact of global change on small Ladakhi rural settlements. The workshop was organized around themes, such as "Basic Knowledge of Architectural Conservation Principles", "Earthen Architecture in Ladakh", "Earth Construction Technology", "Basic Notions of Earthquake Resistant Earth Construction Design" and "Earth Construction Practice".

The "Earth Construction Practice" theme's basic goal was to provide initial practical experience on earth construction through a brief field exercise of earth material-identification basic tests, production of traditional Ladakhi *pakbu*, and preparation of earth-based mortars and plasters according to the vernacular building culture, as well as improved mixture recipes.

An awareness was also promoted on the importance of improving seismic strengthening of load-bearing walls, following the building technologies explained in the Indian Standards for earthen building. The Udine Unit, referring to the Indian Standards 13827/1993 - Improving Earthquake Resistance of Earthen Buildings, Guidelines, taught workshop participants, for instance, how to produce better quality *pakbu*, or how to create a correct *pakbu* masonry design, using appropriate improved mud-based mortars and plasters, and making sure of the correct distribution of the mortar in between two *pakbu* or in the laying of *pakbu* masonry (Fig. 6a). An improved corner joint for the walls, thanks to the introduction of a simple structure constituted by a band with two timbers in parallel and diagonal members for bracing at corners, was another important achievement of the "Earth Construction Practice" theme (Fig. 6b). This simple introduction to correct earthen-construction practices in seismic areas like Ladakh, supported by basic knowledge of architectural-conservation principles, will create a solid base for future improvements, included in the work-in-progress of the Udine Unit's action in Kanji.

Fig. 6. Dehradun, India, the winter workshop: (a) the production of different *pakbu* and; (b) the improved corner joint of the walls due to a simple structure constituted by a band with two timbers in parallel and diagonal members for bracing at corners (credits: Mauro Bertagnin, 2011)

4. IMPLEMENTATION OF ACTIONS AGAINST CLIMATIC IMPACT ON EARTHEN STRUCTURES: EXPECTED OUTCOMES

The winter workshop in Dehradun is part of an ambitious program of activities promoted by the Achi Association over the past decade, in order to reduce the climatic impact on Ladakhi earthen architecture. For what concerns the Udine Unit's action, the Dehradun winter workshop completed the threefold conservation program, including the monitoring and conservation activities on site and the drafting of the *conservation manual* of Kanji. The expected outcomes of these coordinated efforts are strictly related to the capability of Kanji inhabitants to understand the importance of preserving their identity, maintaining and improving their vernacular architecture in an era of global change.

The purpose of these activities was to stimulate basic awareness of opportunities for an architectural-heritage conservation shared by the villagers, as a main goal for the reinforcement of community identity facing globalization, and the struggle against global change, affecting year after year, small rural Ladakhi settlements. The idea of targeting "young" representatives of Ladakhi communities helped also a new vision, improving the expected outcomes for a better preventive conservation of the refined Ladakhi earthen-architectural heritage.

Helping improve community awareness of vernacular architecture as a treasure to be protected, and rediscovering its value for contemporary life, requires providing basic technical knowledge and tools to allow villagers to be active in the protection of their heritage. Furthermore, to overcome various issues related to the impact of global change and to preserve the non-engineered earthen architecture of the region, the multidisciplinary approach provided by the Achi Association, should be improved and adapted to continuous variations related to climate change. An example of these unexpected variations was clearly displayed by the dramatic environmental emergency, occurring in the summer 2010, which deeply shocked Ladakh.

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SOLAR MIRRORS FOR A SUSTAINABLE EARTHEN HOUSING IN THE DESERT VILLAGES
A VISION FOR A NEW SOLAR ADOBE AGE IN THE SOUTH OF EGYPT

Mauro Bertagnin, **Hans Grassmann**, **Désirée De Antoni**,

In: *Future Intermediate Sustainable Cities. A Message to future generation.* FISC2010 – First International Conference on Sustainability and the Future.
Egypt, El Cairo 23-25 November 2010.

ABSTRACT
A research team of the University of Udine is working on concentrating solar mirror prototypes for different housing purposes.
The Udine-unit, composed by Dr Hans Grassmann, physicist, prof. Mauro Bertagnin, architect (scientific director of the project), Désirée De Antoni, engineer, is actually working on different models and architectural options, to provide energy in various fields using solar mirrors.
One of the basic ideas is to produce different solar mirror systems that would turn useful for a sustainable earthen housing in the desert areas.
Currently various options are taken into account. The work team is, in fact, investigating some cheaper ways to produce small solar mirrors which would generate electricity as well as heating for low cost ovens which can be useful for rural villages in the desert areas.
The aim of the paper is to resume the state of art of the research, displaying the first results of the solar mirror prototypes produced up to now. The research proposal is also aimed at carrying out a pilot project in rural desert Egyptian earthen villages, in order to evaluate the positive fall out of the energy production through the use of solar mirrors.
During the '70s, in the southern desert states of the USA, the architects of the "solar adobe" generation built experimental houses, which are other important references for a new concept of an "integrated earthen and self sufficient energy housing" in the rural desert areas.

1. INTRODUCTION

On our planet there is no shortage of energy, rather a wrong management of the energetic resources (see Lantschner, 2007).
More than 1/3 of world's general energetic requirement is satisfied from oil. This resource achieves a progressive exhaustion of the "conventional" energetic sources and an increasing environmental pollution.
Therefore nowadays matters of great actuality are: the climate change (the global warming) caused by the issues of toxic gas; the exhaustion of fossil resources, for example the oil with its by-products and the continuous increase of their costs.
The possible remedies spring from a model of development based on the environmental sustainability, which implicates: the reduction of the consumptions; the energetic efficiency and the use of renewable sources.
Just following these principles, Dr Hans Grassmann has developed an innovative system of concentrating mirrors. The new system is called "Linear Mirror" and it is developed by Isomorph (www.isomorph.it), spin off company of the University of Udine whose Dr Grassmann is founder and director.
The "Linear Mirror" concept uses solar energy to produce clean energy: the machine

is absolutely innovative in the field of thermodynamic systems and green technologies. The system is, in fact, capable of producing a quantity of energy two or three times higher than that of a "classic" solar system (photovoltaic or solar panels) of equal size and cost. The solar mirror is able to carry out, in one device, functions which today we can find separately in solar and in photovoltaic panels. These functions are the production of electricity and the supply of heat.
The technological characteristics of the solar mirror make the product usable for both private and public utilities and agricultural enterprises etc., also in virtue of its price. The "Linear Mirror" system in fact makes available, at an affordable price, a source of clean energy, efficient and suitable for different applications. The experiment is taken place in Udine, where there are between 1500 and 2000 hours of sun for year.
The project also aims to analyze the solar mirrors' performances in the arid climate conditions and finally create new living units which can exploit the solar energy.
For those reasons the team is actually planning an energy-autonomous settlement in the desert, where solar radiation can reach about 4000 hours of sun.
In the mean time, the project would like to combine this new technology with the conservation of the vernacular earthen architecture in the rural villages.

2. DESCRIPTION OF THE PROJECT

The main idea of the team is to unify the vernacular tradition of earthen architecture with the appropriated technology for a sustainable living as to combine sun and earth to create a better housing. The expected result is the rehabilitation of architectural units in advanced state of decay, which belong to the earthen rural villages, and at the same time the introduction of small "Linear Mirrors" to obtain an energetic self-sufficiency for each housing.
Therefore it becomes important to consider:

- the careful positioning of some "Linear Mirror" systems in order to produce energy from the sun in a very sustainable way;
- the conservation and the maintenance of the rural earthen architectural buildings.

The new energetic self-sufficiency living units, situated in the desert areas, will contribute to a "new earthen housing age" like it was the "solar adobe movement" in the late '70s in the desert areas of the USA. Some villages of the desert area, such as Siwa Oasis, in Egypt, could be suitable to test the project.

2.1 "Linear Mirror": description and technology

The "Linear Mirror" consists of an array of mirrors (in our present experiment 24 mirrors with a total surface of 7,4 m^2). The mirrors are mounted into a common frame, which rotates about a horizontal axis (oriented in the east-west direction), where each mirror is mounted on an individual axis in such a way, that the east-west rotation around this axis causes also an up-down movement of the mirror surface. This is indicated in figg. 1-3.

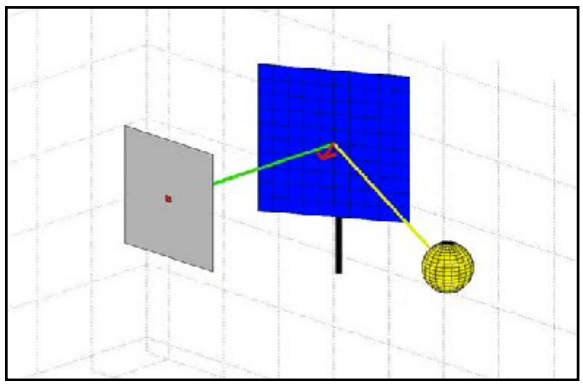


Fig.1. It is easy to keep sunlight reflected to a fixed receiver, if the mirror reflects the sun light in the plane which apparently follows the sun movement: the mirror, in fact, just needs to rotate about an axis perpendicular to the sun plane at a velocity, which is half of the sun's angular velocity (www.isomorph.it)

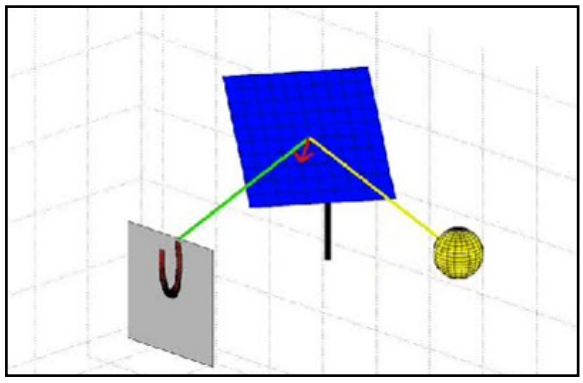


Fig.2. If instead the mirror reflects the sun rays out of the plane of the apparent sun movement, a simple rotation around the same axis is not sufficient anymore, in order to keep the sun rays concentrated on a fixed target

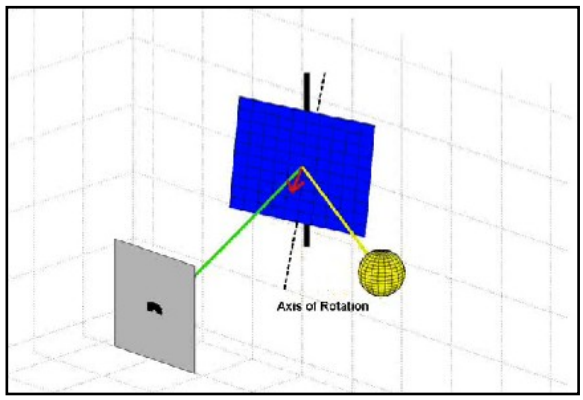


Fig.3. It is possible to place the axis of rotation in such a way, that the reflected sun rays remain close to a fixed target point during the day

In this way it becomes possible to keep all the different mirrors reflecting the sun light into one common receiver or "oven", which doesn't move with respect to the common frame.
For this reason the ensemble of mirrors can operate with only two motors: one motor can rotate the frame around the horizontal axis, the other motor rotates all of the mirrors around their axes in order to follow the path of the sun during the day.
In our experimental device the receiver consists of a heat exchanger with water: its dimensions are 70 cm x 80 cm for a surface of 0.56 m^2.
The heliostat mirror system is the most similar device to the "Linear Mirror": in that case, in fact, an ensemble of mirrors reflects light into a common receiver, but unlike the "Linear Mirror" system, each mirror has two motors of its own. So for instance a system with 100 mirrors must have 200 motors. Since the mirrors must reflect light at a high precision (much better than 1 degree), the motors must be "precision motors" and of course each of them needs also a corresponding monitor and a control system. In the "Linear Mirror" system, instead, the mirrors are connected between each other by means of simple levers and all of them are rotated during the day by only one motor.
The heat exchanger consists of an aluminium sheet with a pipe, which runs through it. The mechanism is similar to what is used in refrigerators. In our experiment the water circulates through the heat exchanger at a rate of at maximum 250 litres per hour. The heat exchanger used is made by the company CGA (Cividale-Italy).
The heat exchanger is isolated at its rear side, but not at its front side and it has no glass cover.
The power of the device is measured by a flow meter and two thermometers. The thermometers are mounted at the inlet and outlet tubes close to the boiler (300 litres).
The hydraulic circuit is very simple and doesn't automatically switch on or off, for which reason it has to be operated by hand.
The "Linear Mirror" is able to:

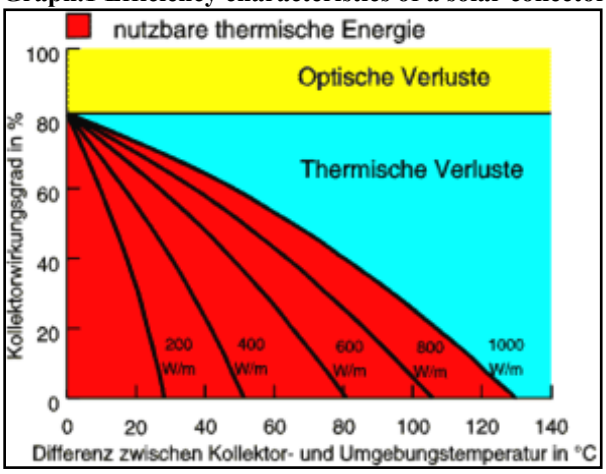
- produce electricity (with a steam turbine) like photovoltaic panels, but at a lower price;
- be combined with a photovoltaic panel which can be placed in the receiver (concentrating PV);
- provide process heat for producing bio-ethanol, designer fuels etc.;
- produce cool (with an absorption refrigerator);
- heat water like solar panels, but up to much higher temperatures and very much cheaper.

2.2 Solar systems: costs and results

To reach temperatures of around 100 °C or more, the use of "concentrating systems", like lenses or mirrors that can assemble the solar light on a receiver (the "oven") is to be preferred. Increasing the concentration of the light, the temperature will eventually get higher. The most common technologies are the parabolic mirror and the heliostat system and they are already found in commerce (for example the mirror "Sycon" of Systema spa, www.systema.it), but the prices are rather elevated,

typically very over 1.000 € for m^2 of reflecting surface. Those systems are often very complex, then the presence of experienced personnel would be required.
The traditional solar collectors are less expensive, but they effect a low concentration of the solar light or none at all. Their disadvantage, in fact, is that they don't reach elevated temperatures in winter.
The solar collectors that can reach more elevated temperatures are based on the technology "evacuated tube collectors", and they are able to reach temperatures around 60 °C in winter. The efficiency of the evacuated tube system under the external temperature, is shown in the graph.1 (http://www.solarserver.de/wissen/sonnenkollektoren.html). The y axis of the figure doesn't show the total efficiency, but only the efficiency to move the absorbed energy to the heat vector. To have the total efficiency of those systems it should be considered their way of construction, that causes a big loss of the solar radiation (ca. 40%), that is not picked up by the device (space not-covered among two pipes) (fig. 4). For that reason the total efficiency (energy produced from each m^2 of system) is about 40%, strongly dependence from the temperature.

Graph.1 Efficiency characteristics of a solar collector



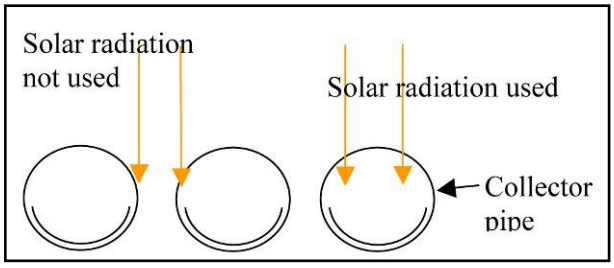


Fig.4. Loss of the solar radiation in a solar collector

In the summer the traditional collectors have, instead, the contrary problem: the systems cannot be stopped and if in the summer all the produced energy is not used, the plant starts to boil, the vapour in excess goes out through a safety valve, and consequently limestone is formed in the device.

2.2.1 Comparison between “Linear Mirror” and traditional systems

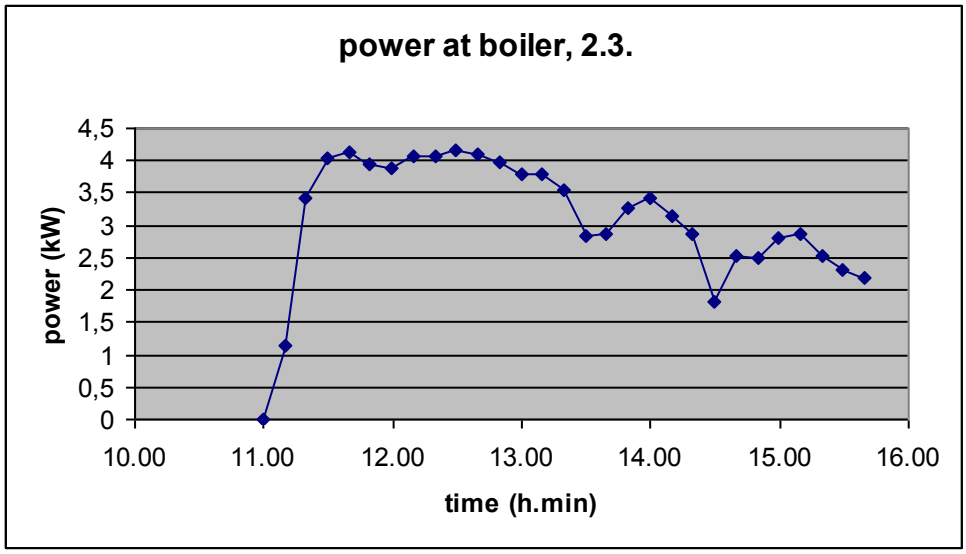
As said before the “Linear Mirror” system consists of a matrix of simple plain mirrors, which reflect the light on a common receiver. In the prototype, aluminium mirrors were used (equally cheap) which are light, easy to install and resistant to hail. In the device “Linear Mirror" shown in the fig. 5, there are 24 mirrors, which reflect the solar light on the receiver during the whole day. With 24 mirrors, it can easily reach a temperature of 100 ºC, for more elevated temperatures a greater number of mirrors can be chosen.
A traditional solar collector system, with the same power, should have a surface of around 15 m^2. A traditional collector and the receiver of the “Linear Mirror” system have around the same loss of energy for unity of surface, if heated to the same temperature (electromagnetic radiation and thermal conduction), but however the traditional system has a greater surface of a factor 15/0.56 = 27, for a loss of heat around 27 times greater.

Fig.5. The prototype of the “Linear Mirror”
The system consists of an array of plane mirrors, driven by only two motors

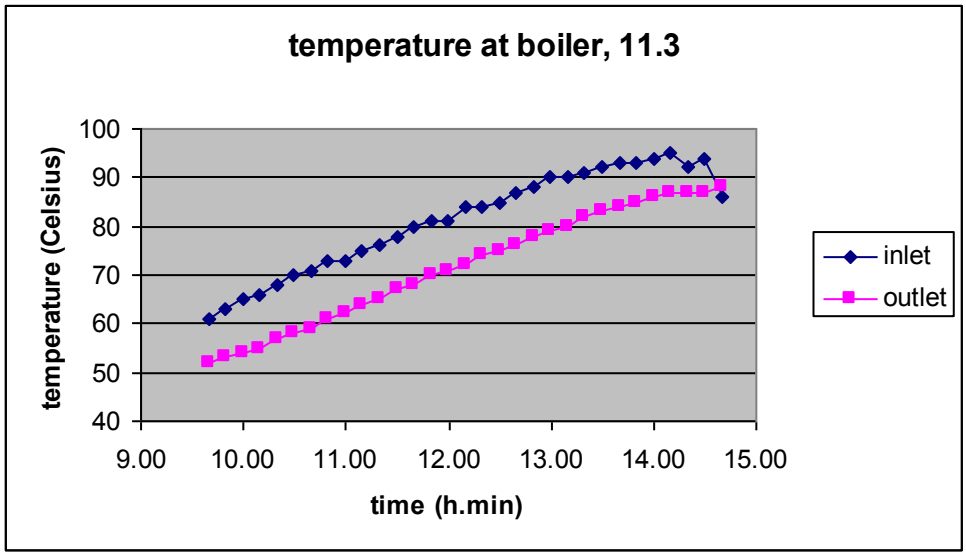
The power of the prototype of the “Linear Mirror” is 4 kW (see graph.2), and probably it could be still increased, improving the isolation. A comparison with the incidental radiation is still not done. Assuming for the spring time in Udine (Italy, at 46°3′48″N 13°14′8″E), a solar radiation of around 0.7 kW/m^2, it can reach an efficiency of 4 kW/(7.4 x 0.7kW) = 77%, that is around the double one of a traditional collector. In a first test the temperature of the water in the boiler reached

over 90 ºC (see graph.3), that was not overcome, considering that the expansion tank of the hydraulic circuit were not certified for temperatures over 100 ºC.

Graph.2 The power of the prototype of the "Linear Mirror"



Graph.3 The temperatures of the water in the boiler



In this moment (spring 2010) the "Linear Mirror" is sold to a price of 7.000 €, because the device is still assembled by hand and in few copies. 1 m^2 of surface costs in fact 909 € (7.000 € /7.7 =909 €). Obviously the price will fall down when an elevated number of "Linear Mirror" systems will be produced in an automated production.
Presently our device has dimensions of 4.5 m x 2.5 m, which are enough arbitrary: we could expect that a greater system will have a lower price for m^2.
Concerning the comparison between the "Linear Mirror" and the other solar systems,

in the internet we don't find specific information about the "performance" of the traditional systems, and we don't have the resources to perform the comparison by ourselves.
The prices of the traditional "evacuated tube collectors" are among 500 and 1.200 € /m^2. For this reason the traditional collectors are less expensive (20%) than a "Linear Mirror" system m^2 of surface, but on the other side, considering to work on high temperatures, our new device has around the double efficiency respect to the usual collectors: the final price for kW, in fact, results lower of around 35%.
Besides this advantage the "Linear Mirror" system can reach temperatures of 100 ºC and higher also in wintertime, and this would be difficult for traditional systems.
In the future the price of the "Linear Mirror" will probably be 200 €/m^2, but it won't happen in the next future (for lack of funds).
Example.
Data: 600 €/m^2 for a "Linear Mirror" system;
its life cycle can be of 15 years;
1500 hours of sun for year;
its middle power of 0.5 kW for m^2 of reflecting surface.
We can reach a price of 600 € / (15 x 750 kWh) = 5.3 cent/kWh. It's important underline that the "Linear Mirror" can have a very long middle life, surely much more than 15 years, because it doesn't contain component in strong movement.

2.2.2 A possible evolution: the "Linear Mirror" with a photovoltaic system

In the future a concentrating photovoltaic system could be introduced in the receiver of the "Linear Mirror" system. In such case, 10% of the solar energy will be turned into electric energy, the rest in heat. The select configuration depends on the temperatures to reach: the photovoltaic cells should remain under a temperature of 80 ºC. If we would like to heat the water from 20 ºC to 100 ºC, ¾ of the radiated surface of the "Linear Mirror" could be covered with the photovoltaic panel (it is heated up to 80 ºC) and in the remaining ¼ of the "oven", the water temperature can reach from 80 ºC to 100 ºC.
If in the future the subsidies for the photovoltaic energy will be reduced and then the traditional panels would get to be amortized anymore, the concentrating panels of the "Linear Mirror" system will always turn out to be economically interesting.

3. SOLAR MIRROR BETWEEN PAST AND FUTURE

3.1 Past: The "Linear Mirror", Archimedes and Alexandria

The "Linear Mirror" is an application of the physics of information: in order to create a cheap system of N mirrors, the decisive question always is, how many motors are necessary in order to move those N mirrors? A heliostat system uses 2N motors, but can it use less of them? It is important to underline that each of these N mirrors has to describe a complex function, following the sun, and this function is different for

each mirror. Therefore it seems, that it is not possible to operate a concentrating system with N mirrors with less then 2N motors.
Physics of information, instead, shows that in the physical world, all calculations can be traced back to linear functions, due to the final number of microstates in the Universe (Isomorph Letters (A) 1 Grassmann H., 2007).
Therefore, also the movement of each of the N mirrors can be expressed in terms of a linear function (for instance a regular clock) and, as a result, all mirrors can be driven by one common function.

In order to show this with an example, we can imagine the astronomical clocks, which were common in the Medieval Ages. These clocks showed the précised position not only of sun and moon, but also of all the known planets as a function of time. An astronomical clock, in principle, can be connected to a mirror which therefore follows the sun movement. This procedure can be done with each of the mirrors of a system of N mirrors, when all of N astronomical clocks are always driven by the same clock mechanism, hence all N mirrors, in principle, can be driven by one clock, representing a linear function, or one motor. For convenience, the actual "Linear Mirror" device uses instead two motors.
It is interesting to know that the device which showed, for the first time, the correct movement of the celestial bodies, was created by Archimedes – the *Antikythera* mechanism (Marchant J., 2008).
Archimedes, who had been working also at Alexandria, was in close contact to the local scientists like Kono, Dositheos and Eratosthenes. It seems, that the library of Alexandria contained also descriptions of this device, probably the only descriptions in existence: "..Pappus of Alexandria stated that Archimedes had written a new lost manuscript on the construction of these devices entitled "On Sphere-Making" - The surviving texts from the Library of Alexandria describe many of his creations, some even containing simple blueprints"
(see http://en.wikipedia.org/wiki/Antikythera_mechanism).
It means that at Alexandria Archimedes and his colleagues had already known about the physics of information for the particular case of the movement of the celestial bodies. Therefore they had the understanding, which is necessary for the construction of a "Linear Mirror".
We further note that Archimedes tried to defende Syracuse by means of a mirror system. That event is unfortunately very poorly described by Tsetses, but in his description the "ancient mirrors" have a lot of common points with the new "Linear Mirror" system.

Chiliades also wrote "Archimedes.. set similar mirrors with four edges, moved by links and by a form of hinge.." (Thomas I., 1941).
In the context of this paper it is surely not possible to conclude on this topic. Rather we want to bring these arguments to the attention of scholars who are more expert on this subject. From a more profound study, it may turn out that the "Linear Mirror" in the adobe village will bring back to Egypt an ancient (and at the same time most advanced) technology, a technology which had at least some of its roots in Alexandria, and which had been lost during Roman times.

3.2 Future: towards a new solar desert habitat

As already underlined (see chapt. 2) the basic idea of the team is twofold, creating some energetic self-sufficiency housing units and conserving the traditional earthen architecture of the rural villages.
As case study the research team proposes the Siwa Oasis urban fabric (29°11′N 25°33′E), investigated in the past during an architectural surveying mission. As an example of the expected results, three decayed portions of the vernacular settlement of Siwa Oasis has been analyzed in order to provide their reconversion into new energetic self-sufficiency housing units.

The peculiar building material of the Siwa Oasis vernacular architecture is the *karseef*, the salt and mud traditional block. The vernacular earthen architecture displays a compact urban fabric which consists of two or three floors high buildings facing the main street. From the street, the main door gives access to the back courtyard, a space for the family and social interaction. The conservation and rehabilitation of the earthen houses are based on the typological as well as technological integrity. For what concerns the energy production it's necessary to evaluate the appropriate courtyards, suitable for the power plant placement (figg. 6-7). These courtyard will be chosen after an evaluation of their exposure time to the solar radiation. Therefore particular attention should be paid to the correct positioning of the solar mirror unit in order to maximize the solar gathering (fig. 8). In the case of the Torar neighbourhood of Siwa Oasis, chosen as case study, the "Linear Mirror" should be positioned, also following the detailed study of the shadows and the solar course in this area. Moreover a direct interaction will be established between the living surface of the rehabilitated houses and the energy produced by the solar mirror units. In fact each "Linear Mirror" solar unit can furnish energy at least to three flats of 100 m^2 each.
That's why the pattern of foreseen reconversion of the decayed urban fabric, could be appropriate to the goals of the project.

The following practical examples show three different buildings situated in one of the neighbourhoods of the Siwa Oasis. In each of them the courtyard is used as suitable space to place the "Linear Mirror" solar unit.

The project aims to explain how could be appropriate the suggested integrated approach in order to provide a new energetic self-sufficiency housing based on a process of conservation of the exiting urban fabric as expression of the local architectural identity.

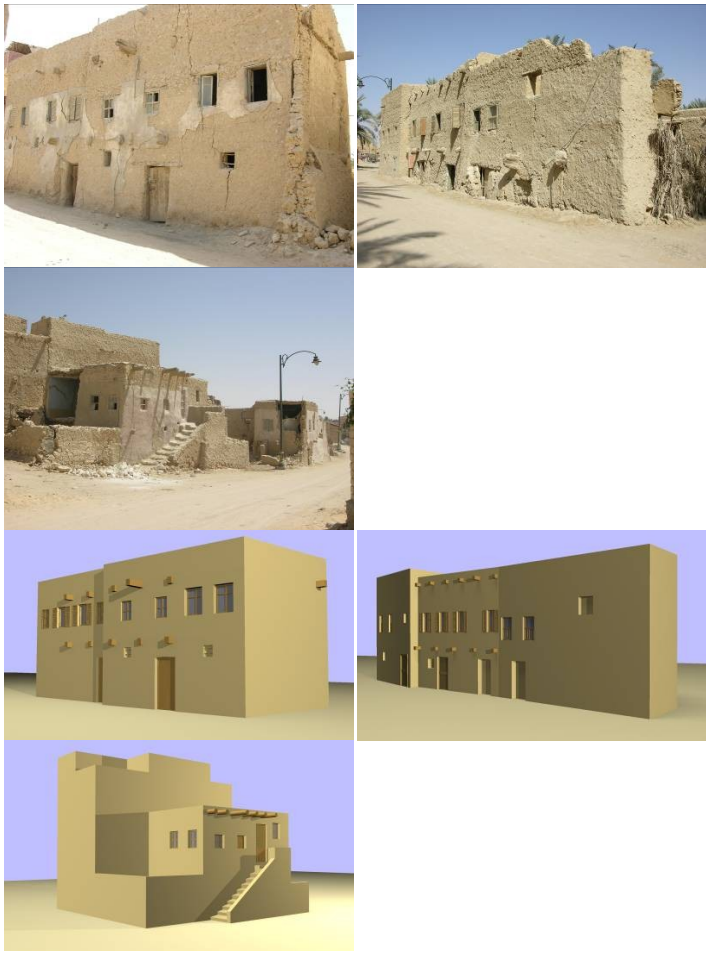


Fig.6. Three buildings involved in the process of rehabilitation and energy self-sufficiency

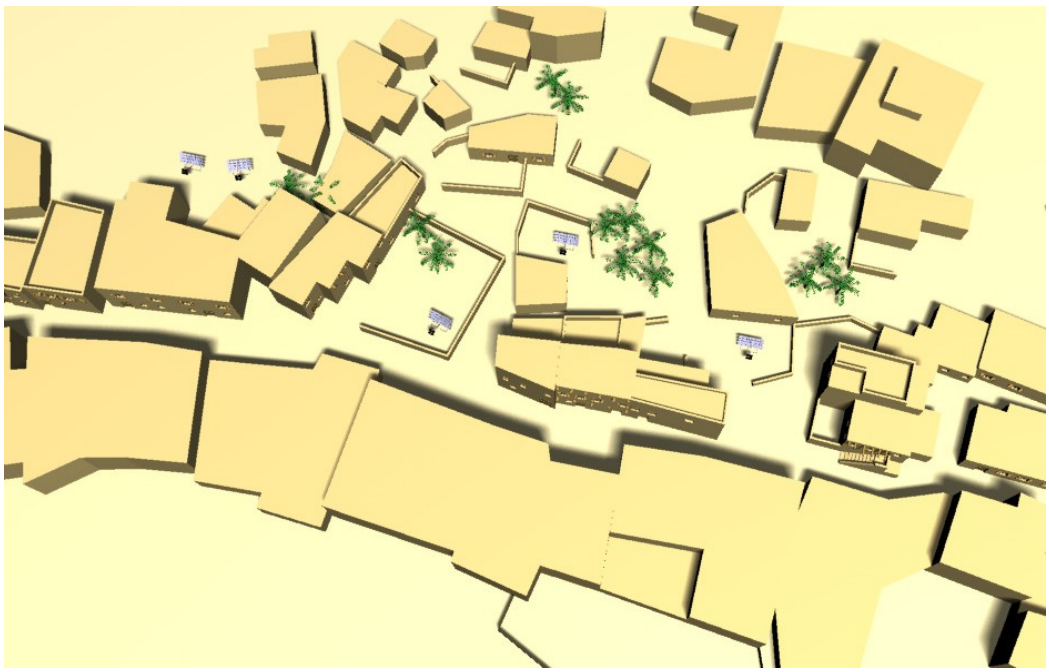


Fig.7. Evaluation of the appropriate courtyards, suitable for the power plant placement

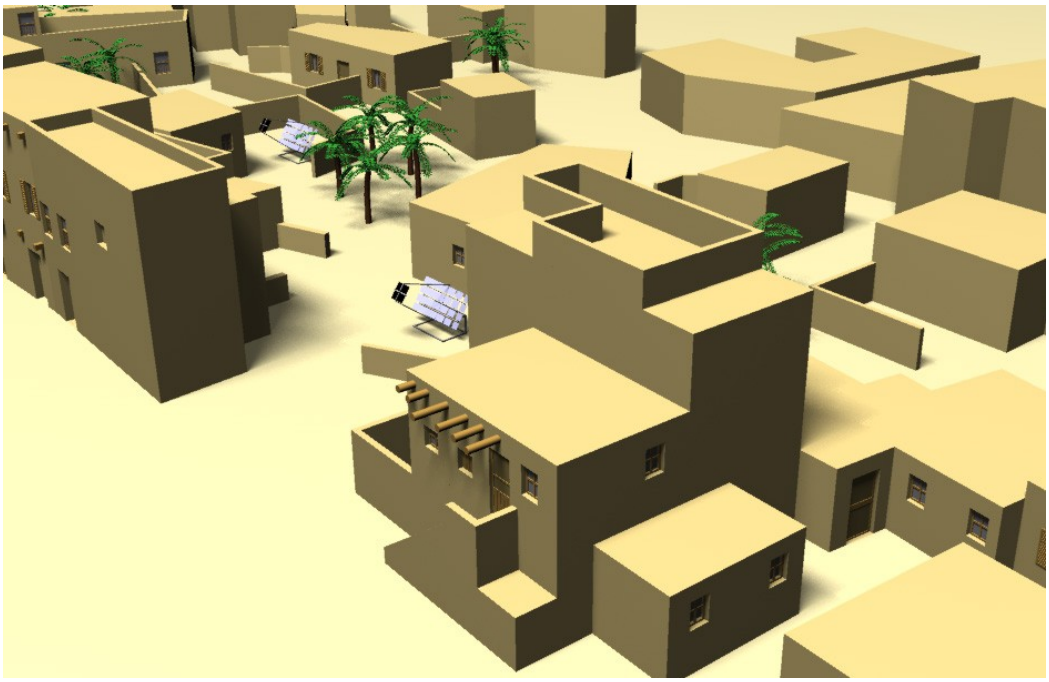


Fig.8. Positioning of the "Linear Mirror" unit systems in the courtyards

4. CONCLUSIONS: GENERAL FINDINGS AND EXPECTED OUTCOMES

The "Linear Mirror" prototype described is registered for patent and it is actually at the stage of pre-industrial production, which is foreseen for the end of 2010.
For what concerns the expected outcomes, being very cheap and very simple, the solar "Linear Mirror" power plant can be easily adopted to provide energetic self-sufficiency on the framework of rural villages rehabilitation for the construction of a sustainable environment.
The "Linear Mirror" is very flexible being that it can combine several functions all in one device:

- electricity production by means of steam turbines
- heating for oven to cook food where the wood is scarcely found;
- clean water production after sterilization on the high boiled temperatures;
- cooling and freezing for foods conservation.

In addiction to these described characteristics, the construction materials of the "Linear Mirror" power plant are easily available on site: the aluminium for the mirrors and the iron for their supporting structure. Moreover the "Linear Mirror" solar unit assemblage is very simple and improve the self-help local construction to reach a new level of sustainability in the desert villages.

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Synthesis Notes and Conclusions

In conclusion of the research presented in this thesis, considering the wide themes developed, we need to draft some synthesis notes, which can summarize the results of the work in an organic framework
These notes explain the main problematic key questions, which are analyzed in the thesis, considering a theoretical as well as technological point of view.

The knowledge, which concerns the safeguarding of the architectural heritage and its authenticity, starts to emerge prominently during the XIXth century.
For this reason, we present the main lines related to the restoration theme, reporting particularly the opinions of: Eugene Viollet-le-Duc with the "stylistic restoration", John Ruskin with the "romantic restoration", Luca Beltrami with the "historical restoration" and Camillo Boito with the "philological restoration".
The work focuses on the debate between Viollet-le-Duc and John Ruskin, underlining the two different opinions. The first one supports the reconstruction of the lost parts of the monuments, following the original style of the properties in order to lead them to their initial aspect. On the contrary Ruskin's thought sees in that approach, a serious risk, which can lead to create architectural falsifications. Camillo Boito seems to find an agreement between these two opposite opinions, promoting the preventive conservation of the monuments, instead of the complete restoration of them. During this debate, in 1931, the Athens Charter is born, followed by several others Restoration Charters. For example, the Venice Charter is drafted in 1964 and for the first time it mentions the term "authenticity" of the monuments. Thirty years later, the safeguarding of the authenticity will be the focal point of the debate, held during the Nara Conference.

The thesis investigates the term "restoration" and its evolution, which contribute to make clearer the concept of "conservation of the monuments" as well as the definition of "World Heritage".
Particular attention is given to the analysis of the Operational Guidelines of the World Heritage Centre of UNESCO, which provide a definition of cultural as well as natural heritage. In this context, deep consideration is set for the earthen heritage, considering cultural and mixed sites.
The central part of the thesis pictures the dynamic process, followed by the WH Centre, during the operational interventions, underling the procedures to be carried out in order to propose a site for the inscription on the World Heritage List.
For these reasons, the thesis investigates on the concept of "Outstanding Universal Value", which underlines the importance of a heritage at worldwide level. We understand how the OUV cannot be attributed to each and every monument, because it represents the main characteristic of the inscribed sites on the WHL. The work, therefore, analyzes the criteria, proposed by the 2011-OGs, adopted in order to establish if a site can be considered a "World Heritage". In order to deeply understand the meaning as well as the assignment of these criteria, discovering their varied aspects, we study three earthen sites: the Island of Mozambique, the city of Choga Zanbil and the Chan Chan archaeological zone.

This analysis on these three sites leads to understand that a monument, proposed for the inscription on the WHL, should demonstrate to have the OUV, meeting one or more criteria. Further the site should satisfy the tests of authenticity and integrity.

A main point of the thesis is the study of the satisfaction of the authenticity test, considering all the attributes, which should be safeguarded in a monument during the time

The thesis underlines as the attributes presented in 1977-OGs (design, materials, workmanship and setting) are considered to be limitative because they are too much related to the European conservation building technologies.
The Nara Conference on Authenticity provides a more dynamic version of the attributes, introducing new parameters like tradition, spirit and feeling etc., which represent the cultural diversity of the populations living in the sites. In 2005 the WH Centre-UNESCO inserts the new group of the attributes in its revised OGs: form and design, materials and substance, use and function, traditions, techniques and management systems, location and setting, language, and other forms of intangible heritage, spirit and feeling, other internal and external factors.

After considering some main aspects of the authenticity, the thesis focuses on the test of the integrity, which analyzes the attributes of a site, able to express the OUV, and considers their state of conservation.
The OGs requests also foresees that a proposed site for the WHL or already inscribed should be safeguarded and maintained during the time. The authenticity and the integrity should be guaranteed also in presence of risk factors. On the contrary a site can be delisted.
An example is the case of Dresden Elben Valley, delisted in 2009 because of the construction of a new bridge. The infrastructure modifies the original aspect of the valley, compromising the authenticity and the integrity and consequently the OUV is not safeguarded. For these reasons this site is no more considered as “World Heritage”.

In order to comprehend the risk factors, which affect the authenticity, this concept is discussed in relation with different cultures and particularly in the earthen sites, evaluating the satisfactory or not of the attributes.
The thesis underlines as the interpretation of the authenticity should always take into account the cultural diversity, belonging to the specified site. These multicultural aspects are the traditional construction as well as conservation technologies, which are often different to each other and for this reason make the monuments unique and meaningful. These techniques should be preserved because they represent a cultural identity, related to ideas, rituals, religious cults.
For what the authenticity in the earthen sites concerns, the thesis cites the case of the Djingerey-ber mosque, in Timbuktu, in Mali, where the local tradition proposes a particular interpretation of the concept of authenticity.
The earthen material is a living and changeable material in presence of dampness, wind etc.. The ritual conservation works of the mosque lead to changes in the final

aspect of the building and for this reason these practices are often judged as problematic elements, considering the safeguarding of the authenticity in the earthen sites.

The ritual works of the Djingerey-ber mosque, such as all those in raw earth, present in Mali, are known for cyclical maintenance activities, which alter considerably, time by time, the surface of the buildings, discovering new aspects, forms and colours, continuously modified.
This endless evolution of the façade of the buildings can lead to think that the authenticity of the original aspect of the monuments is not preserved.
On another side, instead, if we consider the authenticity of the form, referring it to the maintenance and the representation of all the modifications, carried out in the building during the years, the authenticity test fulfils its requirements.

For what the authenticity of the material concerns, the thesis focuses on the transformations of the existent earthen architecture, which is subjected to lots of alterations due to the inappropriate use of some materials like cement, considered to be more resistant against floods, landslide and earthquakes. For this reason, the authenticity of the material is deeply threatened during the conservation interventions. For example, we present some cases in which the inadequate implementations of "modern" materials are reported, describing the irreparable damages on the structure, as those caused by the spreading of a cement plaster on an earthen masonry.
An inappropriate implementation of materials, considered more durable, can be observed in Djenné, in Mali, where some buildings are covered by terracotta bricks. The fired brick is a material quite compatible with the raw earth, but the result is not satisfactory. Moreover this technique leads to a big alteration of the original aspect of the earthen buildings, compromising the authenticity of the form and aspect.

Related to the problems of the authenticity of the material, the thesis investigates the safeguarding of the traditional conservation technologies. The uncontrolled introduction of apparently new materials causes also the lose of the traditional know-how and the related building methods which should be preserved. They represent, in fact, the local building culture directly tided to the identity as well as the intangible heritage of the community. The intangible values can be considered as the spirit and the expression of the population, which follow rituals and traditions to be safeguarded.

Further the thesis focuses on the authenticity of use and function of the earthen buildings. We underline the increasing request of new living places, bigger and more healthy, which foresees the modification of internal distribution of the spaces, often carried out in an uncontrolled way. These interventions, in fact, are implemented without paying attention on the consequences in term of security, due to the dismantling of some masonries, which can be load-bearing walls.

For what concerns the authenticity attributes related to the location and the setting,

the context alterations are due, lots of times, to the construction of new infrastructures and hotels, often totally not in harmony with the existent buildings.

After analysing the concept of the authenticity in the earthen properties, the thesis investigates the OUV affecting factors which threat the sites inscribed on WHL and inserted in the World Heritage Earthen Architecture Programme Inventory.
The last part of the work focuses on the state of decay of earthen building inscribed or not present on the WHL, considering the appropriate conservation technologies for their preservation in the future.

In order to better choose a conservation treatment the thesis underlines the necessity to understand the pathologies, which affect the earthen structures. For this reason, we concentrate on the human activities (inadequate choice of the material, its inappropriate implementation and lack of maintenance of the buildings) and climatic events (heavy rains, floods, snow, intense cold, wind, etc.).
At this point the thesis presents a pathological framework of the earthen architecture. In particular we investigate the pathologies caused by dampness and structural defects.

After analysing these pathologies, the final part of the thesis focuses on the explanation, the comparison and the critical observations of some conservation treatments, carried out in the earthen architecture.
The conservation methodologies are discussed, taking into account the abroad mission on the field, hold by the PhD candidate, considering the intervention carried out with "traditional" materials like raw earth, wood and stone and others which use "modern" material like steel, cement, ethyl silicates etc.
The conservation treatments are evaluated, considering the differences between them and their efficacy. Moreover, considering the implementation of these conservation treatments as well as the obtained results, we provide some judgments on the respect of the authenticity of materials, forms, etc. We investigate several techniques, supporting the implementation of materials, which are considered more compatible with the raw earth.
The thesis underlines the conservation treatments, able to mix tradition and innovation. We propose some guidelines in order to maintain and consolidate each architectural element of a structure: the improvement of the ground load-bearing capacity and the foundations, interventions on vertical as well as horizontal elements, like floors and roofs.
We consider also some methodologies, able to increase the healthy conditions of the buildings, improving the living conditions of the populations.

The final part of the thesis presents the results of the conservation projects, carried out by the PhD candidate. From these case studies, she could take important teaches and evaluate the results of specified conservation methodologies which constituted fundamental reference points for the evolution of the thesis. For this reason the case studies are explained, reporting the scientific papers, presented during international conferences, which were focused on the conservation of the earthen architecture.

Note di Sintesi e Conclusioni

A conclusione dell'indagine trattata nella presente tesi e a fronte della vasta tematica affrontata, si sente la necessità di sviluppare alcune note di sintesi che riassumano in un quadro auspicabilmente organico i risultati del lavoro svolto.
In tali note si ritrovano i nodi problematici principali affrontati sia sul piano teorico che tecnologico.

La consapevolezza nei riguardi della salvaguardia del patrimonio architettonico e della sua autenticità comincia a delinearsi più marcatamente durante il XIX secolo.
A tal proposito si presentano i principali filoni nei quali si articola la problematica del restauro, riportando in particolare le teorizzazioni di: Eugene Viollet-le-Duc con il "restauro stilistico", John Ruskin con il "restauro romantico", Luca Beltrami con il "restauro storico" e infine Camillo Boito con il "restauro filologico".
In questa prospettiva, si indaga la contrapposizione tra Viollet-le-Duc e John Ruskin, sottolineando l'opzione del primo, favorevole alla costruzione delle parti mancanti dei monumenti seguendo lo stile originale, riportando l'edificio al suo aspetto originario. A tale opzione, come noto, si contrappone, la teoria ruskiniana che vede in tale approccio, il rischio di creare dei falsi architettonici. Il superamento di tali teorie, viene propugnato da Camillo Boito, nella ricerca di trovare un punto di accordo fra queste due opposte convinzioni, promuovendo la conservazione preventiva dei monumenti, evitando il restauro integrale dell'opera.
Nell'alveo di tale dibattito nasce nel 1931 la Carta di Atene, a cui fanno seguito, altre Carte del Restauro tra cui la Carta di Venezia del 1964, che definisce per la prima volta il termine "autenticità" dei monumenti. Un trentennio dopo, la salvaguardia dell'autenticità sarà al centro del dibattito della Conferenze di Nara.

La tesi si incentra poi sull'analisi del termine restauro e sulla sua evoluzione, fino alla esplicitazione del concetto di conservazione dei monumenti, che porta alla definizione di "Patrimonio Mondiale".
Una particolare attenzione è data all'indagine approfondita delle Operational Guidelines del Centro del Patrimonio Mondiale dell'UNESCO che forniscono una definizione di patrimonio culturale e naturale.
In questo quadro prospettico, enfasi viene data al patrimonio in terra cruda, per quanto attiene ai siti culturali o misti.
Il corpo centrale della tesi fotografa la dinamica processuale che presiede all'intervento operativo del Centro del Patrimonio Mondiale, sottolineando le procedure che portano all'iscrizione di un determinato sito nella Lista del Patrimonio Mondiale.
In tale prospettiva si approfondisce il concetto di "Oustanding Universal Value" (OUV), cioè il Valore Universale Eccezionale, che per il suo profondo significato, sancisce l'importanza di un patrimonio non solo a livello locale ma anche dal punto di vista "mondiale". Si sottolinea come l'OUV non può essere attribuito a ciascun monumento, ma caratterizza i siti iscritti nella Lista del Patrimonio Mondiale.
La tesi indaga pertanto i criteri proposti dalle OGs del 2011, adottati per stabilire se un patrimonio è "mondiale".

In relazione a tale percorso, si prendono in considerazione tre esempi di siti in terra per comprendere meglio il significato e l'attribuzione dei criteri, cogliendone i variegati aspetti. Per esemplificare la complessità dell'attribuzione dei criteri, la tesi, dunque, considera i siti dell'Isola del Mozambico, della città di Choga Zanbil e dell'area archeologica di Chan Chan.
Tale discussione sui tre siti porta alla comprensione che un monumento, per essere iscritto nella Lista del Patrimonio Mondiale, deve dunque essere ritenuto portatore di un OUV, rappresentando uno o più criteri. In seguito il sito dove soddisfare il test dell'autenticità e dell'integrità.

Il nodo del superamento del test dell'autenticità è un passaggio fondamentale della tesi che analizza gli attributi che i siti devono rispettare per essere iscritti nella Lista del Patrimonio Mondiale.

La tesi sottolinea in particolare gli attributi adottati nel 1977 dalle OGs, (forma e progetto, materiali, tecniche costruttive e contesto) che vengono considerati troppo legati ai metodi di conservazione e alle tecniche costruttive europee e per queste ragioni, limitativi per altre culture.
È la Conferenza di Nara sull'Autenticità, a fornire una visione più dinamica degli attributi, introducendo nuovi parametri, quali la tradizione, lo spirito, espressioni delle diversità culturali delle popolazioni presenti nei vari siti.
Tali modifiche vengono recepite, come noto, nel 2005, quando il Centro del Patrimonio Mondiale aggiorna la lista degli attributi, che diventa composta da: concezione e forma, materiali e sostanza, uso e funzione, tradizioni, tecniche e sistemi di gestione, ambiente e contesto, linguaggio e altre forme di patrimonio immateriale, spirito ed espressione, altri fattori interni ed esterni.

Il proseguo della tesi si focalizza sul test dell'integrità dei monumenti che analizza gli attributi in grado di esprimere l'OUV del sito e il loro stato di conservazione. Il test dell'integrità comporta dunque uno studio approfondito degli attributi del sito ed una valutazione delle loro possibili modifiche nel tempo dovute a fattori esterni.
Successivamente vengono indagate le procedure di controllo messe in campo dal Centro del Patrimonio Mondiale per monitorare la conservazione e la protezione dei siti. Dall'analisi delle OGs, si evince, infatti, che un sito proposto o già iscritto nella Lista del Patrimonio Mondiale, debba essere salvaguardato e mantenuto nel tempo. L'autenticità e l'integrità devono essere infatti garantite anche in presenza di fattori di rischio. In caso contrario, un sito può essere depennato dalla Lista.
Esempio eclatante di esclusione dalla Lista del Patrimonio Mondiale, è il caso di Dresda con la Valle dell'Elba, depennate nel 2009, a causa della costruzione di un nuovo ponte. L'infrastruttura modifica l'aspetto originario della valle, compromettendone l'autenticità e l'integrità e dunque l'OUV non è salvaguardata. Per queste ragioni questo sito non è più considerato Patrimonio dell'Umanità.

A questo punto la tesi, per meglio comprendere i fattori di rischio che minacciano l'autenticità dei monumenti, soprattutto in riferimento ai siti in terra, prende in considerazione, in prima istanza, l'autenticità in relazione alle diverse culture e

successivamente, la considera in rapporto al mancato o pieno soddisfacimento degli attributi.
In tale prospettiva, viene sottolineato come l'interpretazione dell'autenticità dovrebbe sempre tenere in considerazione la diversità culturale presente nel sito oggetto di analisi. Questa multiculturalità si rileva nelle tradizionali tecniche di costruzione e conservazione spesso diverse fra loro e che proprio per questa loro caratteristica, rendono i monumenti unici e ricchi di significato. Tali tecniche sono naturalmente connesse alle idee, ai rituali, ai culti religiosi e per questo vanno preservate, dal momento che sono l'espressione di un'identità culturale.
Nell'approfondimento sul rapporto tra autenticità e siti in terra, viene citato il caso della moschea di Djingerey-ber, a Timbuktu, in Mali, dove viene data, nella tradizione locale, una particolare versione dell'autenticità in relazione a questo edificio in terra cruda, monumento assai diverso da altri presenti nel mondo occidentale.
Il materiale terra, già di per sé è un materiale vivo e mutevole in presenza di umidità, vento ecc. I lavori rituali di manutenzione della moschea e la variabilità formale che tali attività inducono nell'equilibrio globale dell'edificio vengono assunti come elementi problematici e di discussione rispetto al tema dell'autenticità nel caso di edifici in terra cruda.
I lavori rituali nella moschea di Djingerey-ber come in tutte quelle in terra del Mali, oltre a costituire un'opera di manutenzione ciclica che altera sensibilmente di volta in volta la superficie dell'involucro dell'edificio stesso, mettono a nudo nuovi aspetti, forme e colori che si modificano continuamente.
Un tale quadro perennemente evolutivo, farebbe propendere per la mancanza di un'autenticità di forma, intesa come mantenimento dell'aspetto originario del monumento.
D'altro canto, invece, se si considera la salvaguardia dell'autenticità della forma intesa come mantenimento e rappresentazione di tutte le modifiche che l'edificio può aver subito negli anni, il test di autenticità può ritenersi superato.

Per quanto riguarda l'autenticità del materiale, l'indagine si è incentrata sulla trasformazione del costruito in terra esistente, che subisce in molti casi notevoli alterazioni dovute al crescente uso improprio dei materiali, quali il cemento, ritenuto più resistente a fenomeni come inondazioni, dilavamento e terremoti.
È evidente che un tale quadro minaccia profondamente l'autenticità del materiale terra durante gli interventi di conservazione.
Vengono segnalati a tale proposito esempi di utilizzo incongruo di materiali "moderni", descrivendo i danni irreparabili alla struttura che scaturiscono, ad esempio, dall'applicazione di un intonaco in cemento su una muratura in terra.
Un uso inappropriato di altri materiali, ritenuti più durevoli, è verificato nel caso di Djenné, in Mali, dove alcune case in terra sono ricoperte da mattoni in laterizio.
I risultati di tale operazione non sono stati soddisfacenti, nonostante il laterizio sia un materiale abbastanza compatibile con la terra cruda.
Il laterizio anche se è un materiale abbastanza compatibile con la terra cruda, i risultati non sono stati soddisfacenti.
Questa tecnica, inoltre, porta ad uno stravolgimento dell'aspetto originario delle

abitazioni, con un'alterazione dell'autenticità di forma e di aspetto.

È su questo caso che si innesta, nel prosieguo della tesi, un ragionamento sulla perdita dell'autenticità delle tecniche tradizionali.
L'introduzione incontrollata di apparentemente nuovi materiali è causa, infatti, anche della perdita dei metodi di costruzione e dei saperi tradizionali, che invece andrebbero preservati, perché rappresentanti di una cultura locale del costruire, direttamente legata all'identità della comunità e al suo patrimonio immateriale, cioè allo spirito e all'espressione di una popolazione, che segue rituali e tradizioni da salvaguardare.

Un altro passaggio importante sviluppato nella tesi, riguarda lo studio degli attributi dell'autenticità legati alla conservazione dell'uso e della funzione degli edifici in terra. Viene altresì sottolineato, nell'indagine svolta, come la richiesta continua di nuovi spazi abitativi, più ampi e salubri, preveda la modifica della distribuzione interna degli edifici, che spesso avviene in modo incontrollato, cioè senza riflessioni circa le conseguenze in termini di sicurezza, dell'abbattimento di alcune pareti e dello snaturamento dei caratteri distributivi di ciascuna abitazione.

Vengono poi indagati gli attributi legati all'ambiente e al contesto, in riferimento all'alterazione del quadro ambientale di riferimento, dovuta alla costruzione di nuove infrastrutture e di hotels, dalle architetture spesso totalmente decontestualizzate.

Una più approfondita focalizzazione caratterizza l'analisi del concetto di salvaguardia dell'autenticità nei siti in terra, con un'analisi dei fattori di rischio che concorrono a minacciare la salvaguardia dell'OUV, nei siti considerati Patrimonio Mondiale ed inseriti nell'inventario del World Heritage Earthen Architecture Programme.

Nell'ultima parte della ricerca l'analisi si focalizza sul degrado degli edifici in terra iscritti o non presenti nella Lista del Patrimonio Mondiale e sulle tecniche appropriate per la loro conservazione nel tempo.
A tal proposito, la ricerca approfondisce alcuni tra i fattori che minacciano l'architettura in terra sia per quanto attiene le attività umane (inadeguata scelta del materiale, sua inappropriata applicazione e scarsa manutenzione degli edifici), che per quanto attiene agli eventi climatici (la pioggia torrenziali, le alluvioni, la neve, il gelo, il vento, ecc.).

Un ulteriore passaggio nodale presentato dalla tesi, riguarda la costruzione di un quadro patologico di riferimento per quanto riguarda le architetture in terra, con particolare indagine riguardo all'ambito delle patologie causate dall'umidità e da alcuni difetti strutturali.

La parte finale della tesi s'incentra, sull'esposizione, sulla comparazione e sulla critica di alcuni trattamenti conservativi delle strutture in terra.
Le metodologie di intervento esposte vengono discusse anche sulla base di

esperienze maturate sul campo dalla dottoranda, considerando quelle fondate sull'impiego di materiali "tradizionali" come terra, legno e pietra e materiali "moderni" come ad esempio acciaio, cemento, etil silicati, etc..
Di tali interventi sono valutate le differenze e l'efficacia, e vengono forniti anche giudizi riguardanti il rispetto dell'autenticità dei materiali, della forma, ecc., in base al loro metodo di impiego e ai risultati ottenuti.
In tale ampio spettro tematico vengono indagate tecniche molto varie, favorendo l'utilizzo di materiali compatibili con la terra cruda.
Una particolare sottolineatura riguarda le tecniche di intervento in grado di fondere tradizione ed innovazione. Vengono anche proposte alcune linee guida per la conservazione ed il consolidamento di elementi architettonici costituenti la struttura di un edificio: dal miglioramento della resistenza del terreno su cui poggia la struttura, alle fondazioni, dagli elementi verticali a quelli orizzontali, come solai e coperture.
Inoltre vengono considerati anche interventi in grado di migliorare, dal punto di vista della salubrità, le condizioni di vita di molte popolazioni.

La parte finale della tesi presenta i risultati dei progetti di conservazione nei quali la dottoranda è stata coinvolta a vari livelli. Da tali esperienze essa ha potuto trarre importanti insegnamenti, arrivando a valutare i risultati di determinate metodologie di intervento che hanno costituito un importante riferimento per l'evoluzione stessa della tesi.
In tal senso i casi di studio vengono presentati impiegando le sintesi scientifiche operate in occasione di convegni internazionali sul tema proposto dalla tesi.

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Abbreviations

ABs	Advisory Bodies
COM	World Heritage Committee
OGs	Operational Guidelines
ICCROM	International Centre for the Study of the Preservation and Restoration of Cultural Property

ICOMOS	International Council on Monuments and Sites
IUCN	International Union for the Conservation of Nature
OUV	Outstanding Universal Value
SOUV	Statement of Outstanding Universal Value
SOC	State of Conservation
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WH Centre	World Heritage Centre
WH Committee	World Heritage Committee
WH Convention	World Heritage Convention
WHEAP	World Heritage Earthen Architecture Programme
WHL	World Heritage List
WHLD	World Heritage List in Danger

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Appendix

Appendix 1: The Definitions of Conservation, Maintenance, Preservation, Restoration, Reconstruction, Provided by the Burra Charter (1981)

The Burra Charter, The Australian ICOMOS Charter for the Conservation of Places of Cultural Significance Changes to the World Heritage Cultural Criteria develops some principles of the Venice Charter, providing some interesting definitions.

"1.4. **Conservation** means all the processes of looking after a *place* so as to retain its *cultural significance*.

1.5**. Maintenance** means the continuous protective care of the *fabric* and setting of a *place*, and is to be distinguished from repair.
Repair involves restoration or reconstruction.

1.6. **Preservation** means maintaining the *fabric* of a *place* in its existing state and retarding deterioration.

1.7. **Restoration** means returning the existing *fabric* of a *place* to a known earlier state by removing accretions or by reassembling existing components without the introduction of new material.

1.8. **Reconstruction** means returning a *place* to a known earlier state and is distinguished from *restoration* by the introduction of new material into the *fabric*.

(…)

Article 14. Conservation processes
Conservation may, according to circumstance, include the processes of: retention or reintroduction of a *use*; retention of *associations* and *meanings*; *maintenance*, *preservation*, *restoration*, *reconstruction*, *adaptation* and *interpretation*; and will commonly include a combination of more than one of these.

(…)

Article 16. Maintenance
Maintenance is fundamental to conservation and should be undertaken where *fabric* is of *cultural significance* and its maintenance is necessary to retain that *cultural significance*.

Article 17. Preservation
Preservation is appropriate where the existing *fabric* or its condition constitutes evidence of *cultural significance*, or where insufficient evidence is available to allow

other *conservation* processes to be carried out.

Article 18. Restoration and reconstruction
Restoration and *reconstruction* should reveal culturally significant aspects of the *place*.

Article 19. Restoration
Restoration is appropriate only if there is sufficient evidence of an earlier state of the *fabric*.

Article 20. Reconstruction
20.1. *Reconstruction* is appropriate only where a *place* is incomplete through damage or alteration, and only where there is sufficient evidence to reproduce an earlier state of the *fabric*. In rare cases, reconstruction may also be appropriate as part of a use or practice that retains the *cultural significance* of the place.

20.2. *Reconstruction* should be identifiable on close inspection or through additional *interpretation*".

Appendix 2: Changes to the World Heritage Cultural Criteria (Criteria (i)-(vi)) in Different Versions of the Operational Guidelines

ICOMOS – ICCROM – IUCN – UNESCO WHC

	OG 1977	OG 1980	OG 1983	OG 1984
Crit (i)	Represent a unique artistic or aesthetic achievement, a masterpiece of human creative genius	Represent a unique artistic or aesthetic achievement, a masterpiece of human creative genius	Represent a unique artistic achievement, a masterpiece of human creative genius	Represent a unique artistic achievement, a masterpiece of human creative genius
Crit (ii)	Have exerted considerable influence, over a span of time or within a cultural area of the world, on subsequent developments in architecture, monumental sculpture, garden and landscape design, related arts, or human settlements	Have exerted great influence, over a span of time or within a cultural area of the world, on developments in architecture, monumental arts, or town planning and landscaping	Have exerted great influence, over a span of time or within a cultural area of the world, on developments in architecture, monumental arts, or town planning and landscaping	Have exerted great influence, over a span of time or within a cultural area of the world, on developments in architecture, monumental arts, or town planning and landscaping
Crit (iii)	Be unique, extremely rare, or of great antiquity	Bear a unique or at least exceptional testimony to a civilization which has disappeared	Bear a unique or at least exceptional testimony to a civilization which has disappeared	Bear a unique or at least exceptional testimony to a civilization which has disappeared
Crit (iv)	Be among the most characteristic examples of a type of structure, the type representing an important cultural, social, artistic, scientific, technological or industrial development	Be an outstanding example of a type of structure which illustrates a significant stage in history	Be an outstanding example of a type of building or architectural ensemble which illustrates a significant stage in history	Be an outstanding example of a type of building or architectural ensemble which illustrates a significant stage in history
Crit (v)	Be a characteristic example of a significant, traditional style of architecture, method of construction, or human settlement, that is fragile by nature or has become vulnerable under the impact of irreversible socio-cultural or economic change	Be an outstanding example of a traditional human settlement which is representative of a culture and which has become vulnerable under the impact of irreversible change	Be an outstanding example of a traditional human settlement which is representative of a culture and which has become vulnerable under the impact of irreversible change	Be an outstanding example of a traditional human settlement which is representative of a culture and which has become vulnerable under the impact of irreversible change
Crit (vi)	Be most importantly associated with ideas or beliefs, with events or with persons, of outstanding historical	Be directly or tangibly associated with events or with ideas or beliefs of outstanding universal significance	Be directly or tangibly associated with events or with ideas or beliefs of outstanding universal significance	Be directly or tangibly associated with events or with ideas or beliefs of outstanding universal significance

	importance or significance	(the Committee considered that this criterion should justify inclusion in the List only in exceptional circumstances or in conjunction with other criteria)	(the Committee considered that this criterion should justify inclusion in the List only in exceptional circumstances or in conjunction with other criteria)	(the Committee considered that this criterion should justify inclusion in the List only in exceptional circumstances or in conjunction with other criteria)

	OG 1988	**OG 1992**	**OG 1994**	**OG 1996**
Crit (i)	Represent a unique artistic achievement, a masterpiece of human creative genius	Represent a unique artistic achievement, a masterpiece of human creative genius	Represent a unique artistic achievement, a masterpiece of human creative genius	Represent a masterpiece of human creative genius
Crit (ii)	Have exerted great influence, over a span of time or within a cultural area of the world, on developments in architecture, monumental arts, or town planning and landscaping	Have exerted great influence, over a span of time or within a cultural area of the world, on developments in architecture, monumental arts, or town planning and landscaping	Have exerted great influence, over a span of time or within a cultural area of the world, on developments in architecture, monumental arts, or town planning and landscape design	Exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town planning or landscape design
Crit (iii)	Bear a unique or at least exceptional testimony to a civilization which has disappeared	Bear a unique or at least exceptional testimony to a civilization which has disappeared	Bear a unique or at least exceptional testimony to a civilization or cultural tradition which has disappeared	Bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared
Crit (iv)	Be an outstanding example of a type of building or architectural ensemble which illustrates a significant stage in history	Be an outstanding example of a type of building or architectural ensemble which illustrates a significant stage in history	Be an outstanding example of a type of building or architectural ensemble or landscape which illustrates (a) significant stage(s) in human history	Be an outstanding example of a type of building or architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history
Crit (v)	Be an outstanding example of a traditional human settlement which is representative of a culture and which has become vulnerable under the impact of irreversible change	Be an outstanding example of a traditional human settlement which is representative of a culture and which has become vulnerable under the impact of irreversible change	Be an outstanding example of a traditional human settlement or land-use which is representative of a culture (or cultures), especially when it has become vulnerable under the impact of irreversible change	Be an outstanding example of a traditional human settlement or land-use which is representative of a culture (or cultures), especially when it has become vulnerable under the impact of irreversible change
Crit (vi)	Be directly or tangibly associated with events or with ideas or beliefs of outstanding universal significance (the Committee	Be directly or tangibly associated with events or with ideas or beliefs of outstanding universal significance (the Committee	Be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of	Be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of

	considered that this criterion should justify inclusion in the List only in exceptional circumstances or in conjunction with other criteria)	considered that this criterion should justify inclusion in the List only in exceptional circumstances or in conjunction with other criteria)	outstanding universal significance (the Committee considered that this criterion should justify inclusion in the List only in exceptional circumstances or in conjunction with other criteria)	outstanding universal significance (the Committee considered that this criterion should justify inclusion in the List only in exceptional circumstances or in conjunction with other criteria cultural or natural)

	OG 1997/1999	**OG 2005**	**2008**	**2011**
Crit (i)	Represent a masterpiece of human creative genius	Represent a masterpiece of human creative genius	Represent a masterpiece of human creative genius	Represent a masterpiece of human creative genius
Crit (ii)	Exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town planning or landscape design	Exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town planning or landscape design	Exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design	Exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design
Crit (iii)	Bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared	Bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared	Bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared	Bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared
Crit (iv)	Be an outstanding example of a type of building or architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history	Be an outstanding example of a type of building or architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history	Be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history	Be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history
Crit (v)	Be an outstanding example of a traditional human settlement or land-use which is representative of a culture (or cultures), especially when it has become vulnerable under the impact of irreversible change	Be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change	Be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change	Be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change
Crit	Be directly or tangibly associated with events	Be directly or tangibly associated with events	Be directly or tangibly associated with events	Be directly or tangibly associated with events

(vi)	or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance (the Committee considered that this criterion should justify inclusion in the List only in exceptional circumstances and in conjunction with other criteria cultural or natural)	or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance (The Committee considers that this criterion should preferably be used in conjunction with other criteria)	or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance (The Committee considers that this criterion should preferably be used in conjunction with other criteria)	or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance. (The Committee considers that this criterion should preferably be used in conjunction with other criteria)

Appendix 3: Evaluations of the Saloum Delta (Senegal)

The ICOMOS Evaluation

ICOMOS

2011

Evaluations of Nominations of Cultural and Mixed Properties to the World Heritage List

ICOMOS Report for the World Heritage Committee, 35th ordinary session
UNESCO, June 2011

WHC-11/35.COM/INF.8B1

United Nations Educational, Scientific and Cultural Organization

World Heritage Convention

III Mixed properties

A Africa

New Nominations

Saloum Delta (Senegal) No 1359

Official name as proposed by the State Party
Saloum Delta

Location
Thiès and Fatick regions
Foundiougne, Fatick and Mbour departments
Senegal

Brief description
The Saloum Delta is testimony to original human occupation within a vast wet and brackish region. Its development was based on shellfish gathering and fishing, within a natural environment of extensive biological diversity comprising mangroves, water courses, sand banks and mudflats. The shell mounds built up through the ages by human activity form man-made promontories and islets. The presence of tumuli on some of the shell mounds is testimony to the ancient and permanent nature of this human culture in symbiosis with a specific natural environment.

Category of property
In terms of categories of cultural property set out in Article I of the 1972 World Heritage Convention, the nominated property is a *site*.

In terms of the *Operational Guidelines for the Implementation of the World Heritage Convention* (January 2008), paragraph 47, it is also a *cultural landscape*.

[Note: The property is nominated as a mixed cultural and natural site. IUCN will assess the natural significances, while ICOMOS assesses the cultural significances.]

1 Basic data

Included in the Tentative List
18 November 2005

International Assistance from the World Heritage Fund for preparing the Nomination
None

Date received by the World Heritage Centre
22 January 2010

Background
This is a new nomination.

Consultations
ICOMOS consulted the International Scientific Committee on Cultural Landscapes, as well as several independent experts.

Literature consulted (selection)

Agbogba, C., et al., *La mangrove à usages multiples de l'estuaire du Saloum (Sénégal)*, Dakar, EPEEC-MAB, 1985.

Baltzer, F., Diop, E. S., and Barusseau, J. P., « L'estuaire et la mangrove du Sine-Saloum », *Rapport sur les Sciences de la Mer*, n° 32, Paris, UNESCO, 1985.

Descamps, C., *Le Sénégal de l'âge de la Pierre à l'âge des Métaux*, Paris, AUDECAM, 1976.

Thilmans, G., « Sauvegarde de certains amas coquilliers du Saloum », *Saint-Louis - Lille - Liège*, 3, 1997, p. 22-29.

Technical Evaluation Mission
A joint ICOMOS/IUCN technical evaluation mission visited the property from 29 September to 6 October 2010.

Additional information requested and received from the State Party
ICOMOS requested additional information from the State Party on 23 September 2010 and 14 December 2010 concerning:

- The historical and/or contemporary reuses of the shell mounds, and the application of measures to prevent their exploitation;
- The inventory and the archaeological studies concerning the tumulus mounds;
- The presence of any material vestiges of fishing activity;
- The regional comparative analysis, especially West African tumuli;
- The property's integrity and authenticity in relation to current human activities;
- The management of relations between natural heritage and cultural heritage at a local level;
- The shell mounds' listing as Historical Monuments;
- The situation of private property or property returned to the inhabitants within the property;
- The respective boundaries of the National Park, Biosphere Park, Marine Area and Palmarin Reserve in relation to the boundaries of the property and its buffer zone;
- The responsibilities and official implementation of the new Management Plan;
- The possibility of extending the buffer zone north of the Saloum River.

The State Party's responses, received on 16 November 2010 and 28 February 2011, are taken into account in this evaluation.

Date of ICOMOS approval of this report
10 March 2011

2 The property

Description

At its greatest, the surface area of the Saloum Delta region is close to 5,000 km^2, of which the actual delta represents approximately half. The property comprises the western, southern and central parts of the delta, the most humid and most typical, with a surface area of approximately 800 km^2; it also includes the coastal marine area from the mouth of the Saloum River in the northwest, to the Gambian border in the south.

The property is structured by three main river arms: the Saloum itself in the north (110 km), the Diombos in the centre (30 km) and the Bandiala in the south (18 km). Together with a great many *bolons* or brackish channels, they form a dense network encompassing over 200 main islands and islets. The property is defined by three main ecosystems: the mangrove forest, which is the most extensive, the Atlantic marine environment in the west and southwest, and a dry forest in the southeast. Along with these dominant environments, the property includes floodable sandbanks, mudflats and several sandy cultivatable expanses. The original ground is always at a very low altitude, a few metres at most. These are, especially as regards the mangroves, very rich ecosystems able to provide food for human consumption.

The delta's ecosystems have supplied vital resources for human communities for over 2,000 years, mainly from fishing and shellfish gathering. In addition to these resources, wood is collected from the mangrove forest and forest, along with some crop growing, domestic stock-breeding and beekeeping. The close and fragile link between humans and the mangrove forest resulted in expertise and social behaviour respectful of the environment at a very early stage. The wealth of plant life yields fruit, bark and medicinal roots. The buffer zone, drier and slightly higher, is more suitable for agricultural use.

Shellfish were particularly sought after by the local population, notably cockles and mangrove oysters, for food and preparation methods which enabledtheir storage and transport. As a result, numerous shell mounds have been created: 218 have been observed within the property; they are grouped in 96 identified and mapped mound sites (Thilmans inventory, 1997). They form man-made islets in a lake environment, physical supports for human settlements and for animals and plants. The largest and most representative have names. The mounds sometimes have imposing dimensions; the largest are up to 400-500 m at their greatest length (Dioron Boumak) and even 800 m (Ndiamon-Badat); they are a few metres high and even up to 8 to 12 m for the most imposing. Trees, especially baobabs, indicate the presence of shell mounds and they are clearly identifiable on satellite images. They form a relic archaeological landscape characteristic of the Saloum Delta.

The shell mounds are above all present in the more maritime section of the Saloum islands and in all the Betenti islands, in the south of the property. Their distribution may initially appear random, but they are generally grouped into clearly identified local sub-assemblies: three main sub-assemblies for the Saloum islands and six for the Betenti islands. These sub-assemblies have up to fifteen mounds, sometimes relatively close to each other. The largest mounds, around twenty, are more than 100 metres long; the average sized mounds are between 50 and 100 metres; and the smallest are under 50 metres.

Of these shell mounds, 28 have funerary sites in the form of tumuli (Thilmans inventory 1997), of which over 900 have been identified to date. They are shell cairns containing the remains of one or many individuals. The number of tumuli on any given mound is generally in the tens; sometimes there are less (2 or 3 tumuli). The number exceeds one hundred on the three main mounds: Dioron-Boumak (125), Ndiamon-Badat (149), and Tioupane near Falia (222). The mounds with a great many tumuli have a characteristic undulating profile and they are home to specific vegetation, notably large baobabs, that aids their identification.

In some cases, for an important individual, a funerary structure using a baobab circle forms a sanctuary (tomb of the *griot* Wolof Bak Kawl on Dioron Boumak). The frequent geographic proximity of mounds with tumuli follows fairly precise topographic rules indicating the presence of a funerary area to the inhabitants. Rites and/or bans were associated with these necropolises and funerary areas; occasionally, they are still practised by the local population.

Archaeological excavations of the tumulus mounds have revealed notable artefacts in the form of often remarkable pottery, and funerary objects. These are important for a better understanding of the cultures associated with the various periods of the delta's occupation. These archaeological artefacts are mainly conserved in scientific institutions and museums in Dakar.

The following 17 tumulus mounds sites can be considered the most important and the most representative in terms of the number of tumuli, their individual quality, or their symbolic meaning still present today:

1 Tioupane-Boumak and Tioupane-Boundaw, 222 tumuli
2 Ndafafe, 20 tumuli
3 Ndiamon-Badat, 149 tumuli
4 Site 35, near Dionewar, 11 tumuli
5 Fandanga, 17 tumuli
6 Ndiouta-Boumak, 26 tumuli
7 Sandale, 17 tumuli
8 Mbar-Fagnick, 4 tumuli
9 Site 9, on the Bakhalou bolon, 6 tumuli
10 Site 14, on the right bank of the Diombos, 77 tumuli
11 Dioron-Boumak, 125 tumuli
12 Dioron-Boundaw, 12 tumuli
13 Site 45, right bank of the Bandiala, 14 tumuli
14 Site 90, Bossinka north bolon, 63 tumuli

15 Bandiokouta, 30 tumuli
16 Site 67, Oudierin bolon, 72 tumuli
17 Site 46, left bank of the Bandiala, 33 tumuli

Like mollusc gathering, the aim of fishing is to feed the local population and, after preparation, to provide an export commodity to the region's towns and villages. Fishing has not left any notable material vestiges.

History and development
Human exploitation of shellfish in brackish or freshwater wet zones dates back to prehistoric times. From as early as the early Palaeolithic, archaeological traces of these customs have been found in the Mediterranean, on the Libyan coast, and on the coast of South Africa; a little later in Europe in Jutland, Scandinavia, and Brittany; in Asia in Japan, etc.

In northwest Africa, the exploitation of marine molluscs combined with fishing can be seen during the Neolithic, along the coast of Western Sahara and Mauritania. The oldest sites date back to 4000-4700 BC; they are more numerous between 4000 and 2000 BC. Shellfish gathering areas, cockles in particular, are then found further south between 2000 and 600 BC, notably in the mouth of the Senegal River. They reached the Saloum Delta and Casamance River a little later, benefiting from vast expanses of brackish water and considerable biodiversity associated with the mangroves. A culture of shellfish exploitation combined with fishing spread here permanently.

In the Saloum Delta, carbon 14 dating of the shell mounds dates the oldest at up to 400 BC. The creation of the mounds is the result of deliberate action by the population so as not to block the delta's channels and to create promontories in floodable land. They are man-made structural points within the delta's shifting territory.

The creation of tumuli on certain large shell mounds occurred later. It started in the 8th century AD and developed through to the 16th century. Various populations occupied the islands in the Saloum Delta one after another: Fulani, Tukulor and Serer in particular. The latter arrived in the 11th century from modern northern Senegal fleeing the Almoravid conquest. They erected large tumuli and they are still the dominant ethnic group in Saloum. In the 12th and 13th centuries, the islands were occupied by the Guelowars, who unified the local population under their leadership.

Population movements undoubtedly regularly affected the delta's history, an area attractive for its shellfish and fish resources. These migrations are in particular reflected in the linguistic practices in certain villages and by their oral traditions concerning their origins.

Large-scale shellfish gathering and the resultant creation of shell mounds continued in a regular and intense manner for around 2,000 years, until around 1600 AD. Combined with fishing, it forms a stable and sustainable development model. Less intensive exploitation of the natural resources has continued to the present day where it still provides an appreciable source of additional resources. The material testimony of this delta culture principally resides in the shell mounds and their landscapes, in the tumuli and their funerary uses, and in the study of pottery and its regional dissemination. In addition to the population movements having affected the delta, these aspects confirm the development of a sustainable human culture, with stable and appropriately managed resources, in a specific physical and biological environment, for more than 2,000 years through to the present day.

In the Saloum Delta, the intensive exploitation of shellfish and fishing satisfies local needs as well as providing long-standing and long distance economic trade. The preparation of the shellfish and fish is an elaborate process resulting in a long-lasting dried or smoked product. Specific local pottery called Dioron-Boumak-ware was long used for storage, archaeological finds provide important information about the dissemination of Saloum products. This preservation process enabled long-distance trade between the Saloum Delta islands and the neighbouring coastal communities, as well as those in the hinterland. The dried or smoked molluscs and fish must have been traded for iron, copper and cereals.

As early as the 15th century, the Saloum shell mounds were mentioned by the first Portuguese explorers, such as Dinis Diaz. In the early 16th century, Valentim Fernandes described in his *Description of the African West Coast,* how the molluscs were processed by the inhabitants and sold commercially in locally made earthenware pots. The formation of centralised hegemonic kingdoms from the 13th to the14th centuries, then the colonial maritime pressure from the 16th century onwards, disrupted the traditional lifestyles and trade between peoples. This would explain the decline in shellfish gathering and fishing, gradually leading the delta people back towards self-sufficiency and poorer living conditions. In the 18th century, the colonial audits refer to a Saloum king heavily involved in the slave trade and profiting from Franco-British rivalry.

The end of the 19th and the 20th centuries were marked by the regional need for building materials for construction and public works (lime kilns, aggregate for concrete, fill, etc.). In a certain number of cases, the shell mounds became quarries exploited using canoes. Certain mounds have disappeared (Baboura); at least twenty have been intensively exploited. These practices have decreased considerably since the introduction of conservation measures for natural spaces in the 1970s and 1980s; they are now banned, but illegal extraction seems still to take place. Today, the shells from shellfish gathering contribute relatively little to the mounds, being used directly for construction; the finest examples are of greater value and are used to decorate facades or gardens.

The shell mounds were long considered natural accumulations. It was only in the 1930s that their man-made origin was fully proven, and their funerary role

brought to light. The first archaeological excavations in the Saloum Delta were carried out in Dioron-Boundaw and Dioron-Boumak in 1939. Stratigraphic cross-sections revealed their structure and shell composition, making it possible to deduce the rate of formation and periods of accumulation, and to help understand how the shellfish were exploited. The mounds have since been the subject of several major study campaigns, notably at the beginning of the 1950s and in 1971-1973. The research programmes were started up again in the 2000s.

The material and landscape testimonies are complemented by anthropological testimonies that support the traditional legends and descriptions by travellers, such as those by Valentim Fernandes.

Shellfish gathering and processing for trade is today performed by women, while the men devote their time to fishing, without it being possible to know when this division of labour occurred. The shellfish are gathered in the mudflats and edges of the mangroves during the dry season, from December to June. The techniques used are derived directly from traditional practices (wooden dugout canoes, plant fibre baskets, knives, etc.). Gathering is performed rationally, the objective being to sustainably conserve the natural resource. The molluscs are boiled, the flesh extracted from the shell, then dried or smoked. Cockles and mangrove oysters are highly prized foods in West Africa, and their regional sale provides the population with an appreciable income. These activities provide a considerable counterweight to the rural exodus. The farming and collection of shellfish also contributes to mangrove conservation. The development of fishing techniques are still based on traditional methods and transport is also environmentally-friendly (bicycles today).

The current population is concentrated around six medium-sized towns (Niodior, Dionewar, Bassoul, Djirnda, Palmarin and Betenti) and a fishing centre (Missira). Nonetheless, the development of human settlements has been limited by the scarcity of fresh water resources and the low proportion of farmland in the delta; these activities are largely found in the buffer zone.

3 Outstanding Universal Value, integrity and authenticity

Comparative analysis

The State Party first proposes a comparison of shell mounds, a phenomenon that is well-known to archaeologists, the testimonies of which are found in numerous regions around the world. In various phases of the Palaeolithic and then the Neolithic, numerous cultures used salt or freshwater marine molluscs as a food source. Intensive exploitation systems appeared in the Mesolithic, for example in Scandinavia and Japan, that produced significant shell mounds.

In the northwest African context, the Saloum Delta is part of a general history of shellfish exploitation dating back to the Neolithic, often combined with fishing (see History). The oldest mounds are found north of Saloum, on the West Saharan Atlantic coast and in Mauritania. These are mounds of a relatively different structure, in the form of long ribbons, sometimes one kilometre or more; but they are not very thick, just a few tens of centimetres in general, one metre at the most. Slightly later mounds, on the old mouth of the Senegal River, reveal an intermediate structure: they are considerably larger and they can be as much as between one and two metres thick. They are, however, smaller in size than the Saloum mounds and they are fossilized in nature. Of easy access and close to Saint-Louis, they were quarried for fill and lime kilns. They are poorly preserved and no longer form a coherent, clearly identifiable ensemble.

South of Saloum, on the banks of the Gambia River estuary, shell mounds are also found, but their structure is different: composed mainly of oyster shell, they are smaller; they have also been extensively mined for lime kilns. Other West African sites are also mentioned: Bijagós Islands in Guinea Bissau and the Niger Delta in Nigeria.

In Brazil, numerous shell mounds (or *sambaquis*), almost one thousand, are spread along the coast in estuaries. However, they are fossil sites and the largest, while similar in form to the Saloum shell mounds, are nonetheless smaller. Large shell mounds also existed in North America, in Florida and California, but they were dismantled in the 19th and 20th centuries, to make way for building land and used as fill for urban development and road networks. Those that still remain in Japan (Tokyo Bay) are in an urban or peri-urban area where they are integrated into public squares. Most of these sites have completely lost their mangrove forests.

While shell mounds are common-place, the presence of organised tumuli on them is far rarer. The mounds close to Gambia have so far not revealed any sepulchres, although this does remain a possibility. Tumuli in shell mounds have been identified in California and Japan, but they have either disappeared or are now outside their cultural context.

The additional documentation provided by the State Party (November 2010) details the importance of the protohistoric phenomenon of tumuli, called *Mbanar* in West Africa. They are found relatively frequently in the Megalithic zones in the centre and northwest of Senegal; several thousand have been identified and many are found inside the Megalithic Stone Circles of Senegambia (2006, criteria (i) and (iii)). These practices continued throughout historic periods and the Serer people built tumuli until recent times. The general type of protohistoric tumulus is a funerary chamber dug in the earth and covered with a conical roof, which is then buried beneath an earthen mound. Artefacts and sacrificial objects are often found along with the remains of the deceased.

The shell mound tumuli are part of this West African cultural tradition, notably with respect to similar funerary

artefacts testifying to significant contact between the delta and the mainland, even up to considerable distances.

In this relatively general context of the regional funerary practice of tumuli, the shell mound tumuli differ in terms of their presence up until relatively recent historical periods, the originality of the materials and higher position linked to the topography of these man-made topographic spaces. The result is a funerary protocol specific to the Saloum Delta, where inhumations were concentrated in precise and delimited spaces. They accumulated over long periods of time, whereas the mainland inhumations in a given place are simultaneous and without any subsequent funerary re-use. The Saloum tumuli shell mounds, at least the largest of them, are concentrations of a small number of tombs and fulfil the role of necropoli and permanent sacred spaces. Their construction typology is, moreover, different to those in Senegambia.

ICOMOS considers that the arguments in the comparative analysis for the property have been approached appropriately and notably strengthened by the additional documentation (November 2010) and concludes that there are no properties of similar values already inscribed on the List. The shell mounds of the Saloum Delta are among the largest and most representative of human cultures which have practiced a sustainable lifestyle of shellfish gathering in a wet brackish zone. This exploitation of the natural environment, combined with fishing, is still practised using traditional methods. The historic and ethnological meanings of the property are also illustrated and made tangible by the many funerary tumuli on certain shell mounds. Acting as necropolises and sacred spaces, they are testimony to unique funerary practices in the region. Their undulating forms and specific vegetation form a remarkable cultural landscape.

ICOMOS considers that the comparative analysis justifies consideration of this property for the World Heritage List.

Justification of Outstanding Universal Value

The nominated property is considered by the State Party to be of Outstanding Universal Value as a cultural property for the following reasons:

- The shell mounds of the Saloum Delta are testimony to food-gathering practices as much for local food supply as for trade. They date back almost 3,000 years.
- Over the centuries, the shell mounds have led to the creation of numerous man-made islets contributing to the stabilisation of the delta's channels and its territory. The largest mounds have considerable dimensions.
- The use of certain mounds as funerary sites with numerous tumuli provides precious information about the lifestyle of coastal peoples and its consistency throughout time. These are sacred spaces with exceptional characteristics.
- The funerary artefacts are testimony to extensive contact between the delta people and coastal and hinterland societies.
- These various cultural practices are still in use and they have moulded a typical and unique landscape in the delta which is testimony to a sustainable balance between humans and nature.
- It is a rich and varied ecosystem preserved by the limited and careful use by man (see natural property).

ICOMOS considers that this justification is adequate. The Saloum Delta landscapes are testimony to an original traditional human settlement in a vast wet tropical zone with brackish water. A civilisation based notably on shellfish gathering and fishing has been able to develop sustainably. These landscapes of the delta are characterised by numerous shell mounds of man-made origin, at times imposing, which provide structure to and organise the delta's space. They are the fixed points in the landscape, in symbiosis with a complex and diverse natural environment. Some mounds are funerary sites with tumuli which, in the light of archaeological studies of regional pottery, have provided a better understanding of the traditional societies of the West African coast and their contacts. It is a living tradition that dates from protohistoric times, but it is fragile from both the socio-economic and environmental aspects.

Integrity and authenticity

Integrity

The State Party considers that the nominated property has been maintained at a high level of integrity as a result of the following points:

- The state of conservation of the natural environment and its biodiversity is remarkable. It has been maintained to the present day in symbiosis with the development of a stable human culture.
- The traditional exploitation practices of the fishery and mollusc resources have generated careful and sustainable relations between humans and their natural environment. They are still used today.
- The very many shell mounds as well as the archaeological and ethnographic studies testify to this traditional lifestyle.
- The many shell mounds are well preserved within the property, the central part of which is formed by the delta's ocean-facing side. They have suffered greater alteration closer to the mainland, in the buffer zone and in the internal part of the delta.
- The meeting between traditional life styles and the already ancient policy of preserving the natural environment guarantees this integrity.

ICOMOS considers that the conditions of cultural integrity of the Saloum Delta are in theory adequate, but the integrity is fragile. The shell mounds and cultural landscapes and the biodiversity of the natural environment may be under threat from poorly controlled socio-

economic behaviour. While a large number of shell mounds and tumulus mounds appear to be intact, or only slightly affected by human mining, others have disappeared or been damaged in the contemporary era (see History). Monitoring and better knowledge of the conditions of integrity of the entire property must be reinforced for the shell mounds.

Authenticity

The State Party presents an authenticity analysis along with the integrity analysis, supplemented by the documentation supplied in November 2010. The arguments in favour of a high degree of authenticity are therefore very similar: the state of conservation of the natural environment in symbiosis with man, the constancy of the utilisation of the natural resources, traditional lifestyles, especially mollusc gathering, and the good preservation of the shell mounds and tumuli on the ocean-facing islands. Moreover, there is no doubt as to the authenticity of the shell mounds.

ICOMOS first of all considers that the conditions of authenticity apply to the characteristic shell mound landscapes. It is expressed by the perception of them as an ensemble within the natural environment, by the character of their typical plant cover (presence of baobabs, plant density, etc.) and by the characteristic morphology of the tumulus mounds.

Secondly, this is a living property given the continuity of use through the on-going traditional harvesting of shellfish by the women of the community, by the respect for gathering zones and the right periods to harvest them, in order to ensure sustainable breeding, and finally by the traditional methods used for their preservation. The elements of modernisation concern aspects of protection and health, such as the use of gloves, rubber boots, plastic buckets and shears. This analysis of the anthropological authenticity of food practices also covers fishing and the production of dugout canoes. More noticeable elements of modernisation have, however, occurred in this area: use of motors (roughly for 50% of the dugouts), nets made of plastic fibre, etc.

In conclusion, ICOMOS considers that the conditions of authenticity of the mounds, tumulus mounds and their landscapes are generally adequate. They are augmented by an anthropological authenticity of the shellfish gathering and, to a lesser extent, fishing practices.

ICOMOS considers that the conditions of integrity and authenticity have been met.

Criteria under which inscription is proposed
The property is nominated on the basis of cultural criteria (iii), (iv) and (v) (and natural criteria (vii) and (x)).

Criterion (iii): bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared;

This criterion is justified by the State Party on the grounds that the Saloum Delta has important shell mounds that testify to a subsistence and trading economy dating back almost 3,000 years. While this lifestyle based on shellfish gathering and fishing is widespread in many regions of the world, from prehistoric times in some instances, the Saloum shell mounds are remarkable in terms of their great number, dimensions, state of preservation and persistence of this lifestyle up to the present day. The testimony is unique as a result of the presence of mounds containing a great many still-intact tumuli. They are exceptional in terms of the construction of shell tumuli, the accumulation of burials over time, the lasting role as necropolises and funerary areas, and by their characteristic landscapes.

ICOMOS considers that in terms of the important shell mounds, associated landscapes and the presence of a rare and well preserved ensemble of funerary tumulus mounds, the Saloum Delta provides an exceptional testimony of a coastal lifestyle, in a subtropical Sahelian environment with brackish water rich in shellfish and fish. Such a civilisation dates back more than 2,000 years and has continuously developed through to today, notably in its relationship with the resources of the natural environment. The traditional techniques for the preservation of the molluscs and fish have enabled self-sufficiency and regional trade. This is a living civilisation to which numerous anthropological elements bear witness.

ICOMOS considers that this criterion has been justified.

Criterion (iv): be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history;

This criterion is justified by the State Party on the grounds that the Saloum shell mounds, in particular those with tumuli, present an exceptional and authentic cultural landscape. The property overall forms an almost perfect example of a sustainable human settlement in a mangrove environment from the protohistoric era through to the present day. The islands and islets, with their dense plant cover, form a complete and extremely rich, physical and biological system in which the action of humans and nature harmoniously complement each other.

ICOMOS considers that the ensemble of the shell mounds, built up over a 2,000-year cultural process, has formed a physical structure of stable islets and reclaimed land within the Saloum Delta. This has resulted in stabilised land and brackish water channels favourable to the development of the natural mangrove environment and the permanency of its biodiversity in harmony with its human exploitation. These are exceptional evolving cultural landscapes that illustrate a long period of the history of human settlements along the coast of West Africa.

ICOMOS considers that this criterion has been justified.

Criterion (v): be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change;

This criterion is justified by the State Party on the grounds that the shell mounds and the tumulus mounds are testimony to an interaction between humans and their environment over a very long period. In this way, humans have modelled their environment and modified its landscapes. The shell islets and their abundant vegetation dominate the lagoon and naturally floodable lands. Some mounds have acted as necropolises with funerary tumuli with multiple sepulchres, their undulating forms associated with large baobabs are testimony to the apogee of the populations who erected them. While this culture may have disappeared in terms of its funerary and symbolic expressions, the exemplary nature of a virtuous exploitation of the delta's resources remains.

ICOMOS considers that the property constitutes an eminent example of traditional human settlement in a river delta. It represents a lifestyle based on shellfish gathering and fishing within the context of a rational interaction with the natural environment of mangroves, mudflats, brackish water channels and floodable land. It is a fragile balance that is in particular threatened by the aggressive practices of the modern and contemporary world. It is a perfect example of sustainable development in a natural environment of great biodiversity, itself also under threat.

ICOMOS considers that this criterion has been justified.

ICOMOS considers that the nominated property meets criteria (iii), (iv) and (v) and conditions of authenticity and integrity and that Outstanding Universal Value has been demonstrated.

Description of the attributes

- The many shell mounds in the Saloum Delta are well preserved and they sometimes have imposing dimensions. They form an exceptional ensemble testifying to very ancient cultural practices widely spread across the globe.
- Over the centuries, the shell mounds have formed numerous man-made islets helping to stabilise the delta's land and channels.
- With their characteristic vegetation, the shell mounds form a typical cultural landscape within the delta's natural environment of mangroves, brackish water channels and sandy soil.
- The use of certain mounds as funerary sites comprising numerous tumuli is a remarkable testimony to past lifestyles of the coastal peoples of West Africa.
- The mounds and their landscapes are testimony to a human culture fully and sustainably adapted to a rich but fragile natural environment. This refers to shellfish-gathering, fishing and the preservation of molluscs and fish. These practices dating back to the protohistoric era are still alive.
- It is a rich and varied ecosystem preserved thanks to the limited and considered impact of human action on the natural environment.

4 Factors affecting the property

Development pressures

The most direct threat on the property's cultural integrity is the use of the shell mounds as quarries for construction and public works. These uses were considerable at the end of the 19th century through to recent times, notably in that part of the delta closest to the mainland. The State Party has announced that these practices are declining as a result of the application of regulations banning such practices.

Pressure is also being exerted by the development of farming land which is tending to encroach on the integrity of the mangroves and the forest.

Pressure from urban growth would seem to be moderate; it is limited to the existing agglomerations and villages whereas the delta is for the most part not suitable for permanent settlement.

The growing pressure from fishing is affecting the delta's fishery resources and, as a result, threatens the social stability of the community of fishermen who account for approximately 50% of the population.

Tourism pressures

The growth of tourism is leading to construction and the phenomenon of buildings being decorated with shells. This is contributing to the potential extraction of material from the shell mounds.

Ecotourism is leading to the creation of camps in the coastal regions, which could have an impact on the landscape and the environment.

Environmental pressures

There is the threat of the pollution of the entire ecosystem, which is all the more sensitive given that it is a fragile environment, as a result of, on the one hand, waste coming from the sea, sometimes from far away, which washes up on the coast and, on the other hand, poorly managed urban and village waste which directly affects the delta water, and sometimes the landscape. The result is a deterioration of the environment near the villages, with resultant health consequences for the population.

A certain number of mounds are eroded by the coastal currents and storm water. This could eventually cause

difficulties for the conservation of some of the property's shell mounds.

ICOMOS considers that the management of waste and wastewater must be rapidly improved to limit polluting the environment and to protect the health of the inhabitants and their traditional lifestyles.

Natural disasters

Tropical storms and exceptional rainfall compound the phenomena of the erosion of the banks, especially the banks of the shell mounds.

Impact of climate change

The general trend towards rising sea-water levels increases the risk of the physical deterioration of the shell mounds. Ultimately, certain reclaimed land may be permanently inundated. Also, the lower rainfall in recent years has changed the freshwater inflow resulting in increased salinity in the '*bolons*', which may alter the balance of the natural environment and the shellfish and fish resources.

ICOMOS considers that the most direct threats to the cultural property are the natural erosion of some of the shell mounds, illegal mining of the shell mounds and pressure from the growth of villages and tourism. Poorly controlled management of waste and wastewater is a threat for the inhabitants and their traditional lifestyles, as well as for the cultural landscapes.

5 Protection, conservation and management

Boundaries of the nominated property and buffer zone

The surface area of the nominated property is 145,811 hectares. It has a population of 55,000 (2009 projection), mainly in the rural towns of Bassoul, Dionewar, Djirnda, Keur and Toubacouta.

The buffer zone has a surface area of 78 842 hectares. It has a population of 81,000 (2009 projection). Also, the part of the delta north of the Saloum River's main channel has very similar characteristics to those of the proposed buffer and is very close to the actual property.

ICOMOS raised the issue with the State Party of an eventual extension of the buffer zone north of the property. In its February 2011 reply, the State Party indicated that such an extension would be of little use as it would have no direct influence on the property or its value; it would also be complex to implement and would contribute to dissipating its already very extensive protection efforts. Furthermore, the most vulnerable coastal area of the zone north of the Saloum River is already protected by the Community Reserve of Palmarin.

ICOMOS considers that the boundaries of the nominated property and of its buffer zone are adequate.

Ownership

The bulk of the property belongs to the National Estate, owned by the State, notably the areas forming the park and listed forest. The aquatic marine and river sections belong to the State Marine Estate. Law 64/46 of 17 June 1964 of the National Estate defines the land use and establishes the property rights given to private owners. All the vacant land or land not registered with the National Registry of Mortgages is owned by the National Estate. The State can transfer it to third parties for its development under national or regional development plans and programmes. Law 96/07 of 22 March 1996 transfers property responsibilities to the regions and municipalities.

ICOMOS requested from the State Party clarification concerning private ownership and property returned to individuals or private legal entities within the property. In its February 2011 reply, the State Party indicated that under the Protection Law of 25 January 1971, no listed cultural property can be ceded by the State to individuals.

Protection

The various geographic and ecological parts of the property are protected by four entities with national, international or local status, which overlap geographically and complement each other:

- Saloum Delta National Park (March 1976) covers a surface area of 76,000 hectares;
- A Biosphere Reserve has been recognised by UNESCO (February 1981); in particular, it is tasked with assessing the human impact on the natural environment;
- Marine Protected Area of Bamboung (1984);
- Community Reserve of Palmarin (2001).

These regional entities contribute to the conservation of the overall property, notably its natural and landscape components. The State Party also indicates its support for various international agreements on the protection of nature and the protection of cultural properties; it is working on their implementation.

Following the request by ICOMOS, the State Party has provided an adequate map detailing the geographic boundaries of the National Park, the Biosphere Reserve, the Marine Area and the Community Reserve of Palmarin. The map makes it clear that the entire property and its buffer zone are located within the Biosphere Reserve and that the latter's boundaries correspond to the boundaries of the buffer zone.

Legal protection

In addition to the aforementioned more general statutes concerning the property's regional protection, the shell mounds should be protected by being listed as *historic monuments* under Law No 71-12 of January 1971, but

without specific stipulation. This Law also protects the archaeological tumulus sites and sets out the conditions for excavation and research.

The 28 tumuli mounds and their inventory are also taken into account in the specific Decree No 08836 of 12 November 2007.

Following the request made by ICOMOS, the State Party provided confirmation in its February 2011 reply that all the shell mounds are included in the National Heritage List in accordance with the Law of January 1971.

Traditional protection

Bans and rites still associated with certain funerary areas contribute to protecting the tumulus mounds.

Through their traditional lifestyle, the local population is involved in the protection and conservation of the delta's topographical structures and the natural habitat.

The local communities and village associations are active partners in the property's protection and conservation. Numerous local agreements govern their operation and their relations with the entities in charge of the property's protection and management.

Effectiveness of protection measures

ICOMOS considers that an obvious effort to protect the property exists, notably through the various regional structures and the heavy involvement of the local communities in the various programmes for the rational use of the natural resources and protection of the biodiversity as a guarantee of sustainable development.

The National Park's responsibility for protection and conservation is reflected at the ground level by permanent monitoring stations and the presence of park guards and eco-guards from the villages.

In its February 2011 reply to the request by ICOMOS, the State Party confirmed that the mining of all the shell mounds in the property and its buffer zone is prohibited under the Law of January 1971 concerning Listed National Monuments. The National Park eco-guards are responsible for monitoring and enforcing this measure. Nonetheless, ICOMOS considers that the same land protection regime must be ensured for those areas of the property located outside the National Park and which form the bulk of the property's land components with the majority of the shell mounds.

ICOMOS considers that the protective measures are adequate. Nonetheless, ICOMOS recommends that the same land protection regime be ensured for all the property's shell mounds, both within and outside the National Park.

Conservation

Inventories, recording, research

The property has been the subject of many research studies and scientific inventories, both cultural and natural. The results are published as scientific reports and articles.

For the cultural aspect, the inventory of the shell mounds was first published in 1982 by the National Parks of Senegal. It was updated by the scientific publication of G. Thilmans (1997). It was further augmented with photographic documentation carried out in 2007-2008.

The documents and archives are held in Dakar by the National Parks Department and the Cultural Heritage Department.

The archaeological artefacts (pottery, ornaments, iron weapons, etc.) are mainly conserved in the collections of the Fundamental Institute of Black Africa, of the University of Cheikh Anta Diop (IFAN-Ch. A. Diop) in Dakar, and secondarily in various museums in Senegal (Gorée and Saint-Louis).

Present state of conservation

More protected from the pressures of modern urban development than most other similar sites, the Saloum Delta region has been relatively well preserved. Closely associated with the property's conditions of integrity and authenticity, the state of conservation concerns the shell mounds, the tumulus mounds and the associated characteristic landscapes. It is considered fairly good but fragile. It is threatened by the natural and man-made deterioration of the shell mounds, by a potential deterioration in the natural environment and by pollution from human sources. More broadly, a reasonable balance between the human activities and natural resources guarantees the property's sustainable conservation.

Active Conservation measures

The conservation of the shell mounds, tumulus mounds and landscapes is assured by the organisation of their monitoring by guards and the application of regulatory measures protecting them from human exploitation. More broadly, the conservation measures for the cultural heritage are developed as part of the management of the natural heritage and sustainable development programmes designed to conserve the economic and social value of the fishing and shellfish gathering practices. In the future, the cultural dimension must be given greater priority as regards the property's management, notably through the preparation of the Management Plan (2010-2014). The latter must enable a stricter application of the protection regulations for the shell mounds. It makes provision for the presence on the property's site of personnel specialising in cultural heritage, which has not been the case up until now.

ICOMOS considers it is essential to significantly strengthen the practical measures for the protection and conservation of the property's cultural values. In the first instance, this refers to the use of eco-guards for the entire property, not just that part incorporated in the National Park, and improved training; and, more widely, to have onsite a sufficient number of staff trained in the protection and conservation of the property's cultural values.

Maintenance

There is no specific maintenance policy for the property given its mixed and open-air nature. Further, in the villages, the property's maintenance and the quality of its landscapes come back to the issue of waste and wastewater.

ICOMOS considers that a policy of "best practices" could be promoted in inhabited and tourism areas as part of a general framework of improved management of household waste and wastewater within the property.

Effectiveness of conservation measures

ICOMOS considers that the conservation measures for the material cultural heritage have until a very recent period been handled in an ancillary manner compared with the conservation measures for the natural environment. Following the recognition of the property's outstanding universal value, they must become a priority in the Management Plan and they require the presence of a sufficient number of competent staff. Furthermore, sustainable economic development programmes respectful of traditional fishing and shellfish gathering values are very important measures for the conservation of a living heritage.

ICOMOS considers that there is a risk of erosion of certain shell mounds by sea and river currents, and that it is necessary to consider conservation measures.

ICOMOS considers there is a conservation dynamic for the cultural heritage linked to the conservation of the natural environments and the sustainable development programmes. This must, however, be confirmed and detailed, and a sufficient number of competent staff provided. Conservation measures for the shell mounds threatened by erosion need to be considered.

Management

Management structures and processes,
including traditional management processes

Given the extent of the delta and the diversity of the aspects of its management, the multiple stakeholders operate, insofar as their relevant sector of expertise is concerned, through various programmes or development plans and within the framework of the regional organisations in place (park, reserves and villages). The following are the groups of stakeholders:

- Several ministries (Environment, Fishing, Tourism and Culture) are represented by six ministerial departments, three of which are exclusively part of the Ministry of the Environment (Water and Forests, National Parks and the Environment);
- The university and various national research institutions are involved in the property's scientific management;
- Regional and municipal bodies and community associations are involved in the property's management.
- Various organisations and international agencies, including the United Nations (*Millennium Development Goal Fund*), non-governmental organisations (NGOs) or specialist foundations are also involved in specific programmes.

The main regional stakeholder in the property's management is the Saloum Delta National Park, which reports to the National Parks Department (DPN) of the Ministry of the Environment. It works in a coordinated manner with the rural communities, which are administrative entities, and village associations, through programmes and specific actions, such as the organisation of eco-guards or the management of the Marine Protected Area of Bamboung and the Community Reserve of Palmarin. The Park is responsible for a certain number of conservation or development programmes in association with other institutional partners (Department of the Environment, districts and sub-prefecture, the National Programme for the Management of Marine and Coastal Resources (*GIRMAC*)), national scientific institutions (Society for the Protection of the Environment and Fauna, Dakar Oceanium, etc.), international institutions (UNDP, UNESCO regional office, etc.), and NGOs concerned with environmental protection (IUCN, Waame) and sustainable development (USAID).

The Cultural Heritage Department has for the moment limited itself to providing a remote advisory role for the Park and assistance with the training of personnel. The Fundamental Institute of Black Africa, University of Cheikh Anta Diop (IFAN-Ch. A. Diop), Dakar, coordinates archaeological issues in the delta.

In its February 2011 reply to the request by ICOMOS for clarification regarding the structure of the property's management, the State Party indicated that it is currently the Property's Steering Committee, assisted by the United Nations' *MDG-Fund* Technical Committee, that fulfils this role. The property's future Permanent Management Committee will be established as part of the current (2011) establishment of the Community House in Toubacouta.

Soukouta Community Radio plays an important role in providing information and raising awareness among the local population.

Policy framework: management plans and arrangements, including visitor management and presentation

The property Management Plan has been drawn up for 2010 to 2014. It covers the various actions and programmes in progress, while displaying a forward-looking approach to seeking new goals.

The main plans and programmes in progress are:

- The integrated regional development plan, which includes five rural community development plans;
- The participative development and management project for the Protected Marine Area of Bamboung (Oceanium);
- The Wula Nafaa project for the considered exploitation of natural resources (USAID);
- Tourism development projects: circuits, eco-guard and guide training, Bamboung eco-tourism camp, etc.;
- The Toubakouta cultural interpretation centre project;
- The various natural environment conservation programmes.

For the near future, the Management Plan defines the general objectives for the conservation of the cultural heritage and sustainable development. This refers, in particular, to the "Culture and Development" project (*MDG Fund*) aimed at integrating the current actions and providing them with new perspectives on a larger scale than the nominated property. The Management Plan also aims to strengthen the legal protection and improve the property's overall management. The inhabitants' living conditions are the subject of a programme aimed at developing local production and appreciation of the natural and cultural heritage.

The new Management Plan includes a tourism development programme. Tour circuits have been identified and information boards are starting to be erected. For the moment, visits are mainly accompanied by private guides. The plan comprises sections concerning: circuits and information panels, promotion of the property, a village interpretation centre project, campaigns targeting the inhabitants to raise their awareness of the property's cultural and natural values, production of educational and communication material, provision of accommodation, etc. The interpretation centre will exhibit examples of the archaeological artefacts selected from IFAN's collections.

The actions set out in the Management Plan are the result of the application of a SWOT analysis. They form a coordinated ensemble with an application schedule. Their implementation is guaranteed by the United Nations' *MDG-Fund* budget for 2009 to 2011, and its probable extension within the Management Plan (2010-2014).

ICOMOS considers that the proposed Management Plan adequately defines the general objectives and that it aims to harmonise actions between multiple stakeholders. The local actions must strengthen protection of the mounds and raise awareness among the inhabitants of their cultural value; they must also strengthen good practice in terms of waste and wastewater treatment. Tourism development programmes, notably facilities and accommodation, must pay particular attention to landscape conservation. More broadly, ICOMOS recommends extreme vigilance in the effective application of the Management Plan and clear coordination between the various bodies responsible for the natural and cultural heritage, up until now little or not at all involved in the field. Additionally, the official promulgation of the Management Plan must be confirmed and the financial resources for its application consolidated.

In its February 2011 reply to ICOMOS, the State Party indicated that a ministerial decree that will bring the Management Plan into effect is under examination and that the Management Committee will be established by a decree at the regional level.

Risk preparedness

There is no specific section dealing with risk preparedness, given that risks are closely associated with the property's preservation and conservation, from both the natural and cultural angles.

Involvement of the local communities

This is at the heart of the management process, through the rural communities and actions coordinated with the National Park and eco-guards, sustainable development programmes, etc.

Resources, including staffing levels, expertise and training

The National Park benefits from permanent presence in the field of surveillance and supervisory personnel belonging to the National Parks Department (DPN); a total of 15 in the central control station and 6 monitoring stations.

The eco-guards are volunteers from the villages; there are currently about 40. In addition to their park surveillance tasks, supporting the DNP guards, their role is scientific (animal counts, observation missions), educational (local population awareness, guidance) and economical (participation in development programmes). The eco-guards are given cultural heritage training by the Heritage Department; their headquarters are in Missira.

The Natural Reserve of Bambourg has 16 volunteer eco-guards.

In addition to the eco-guards, personnel need to be recruited as part of the creation of the Toubakouta Interpretation Village, especially for surveillance and promotion of the cultural heritage.

Up until now, the property's management has relied on a variety of sources of public and private, local and

international finance. Funds are generally tied to specific programmes, which sometimes complicates coordination. The contribution in the coming years from the "Culture and Development" project with funding of 6.5 million US dollars (United Nations *MDG Fund*), should provide greater stability, scale and synergy for the programmes.

Effectiveness of current management

ICOMOS considers that the current management is effective and adequately coordinated by the National Park, even if there are a large number of varied programmes and stakeholders. The ensemble forms a satisfactory management system for the property, with the main stakeholders and managers clearly identified, notably in the case of the National Park and rural communities. Nonetheless, the multiplicity of programmes and stakeholders tends to make some situations somewhat confused. Certain dynamics, such as the active protection of the cultural assets, are very recent and need to be confirmed. Furthermore, the official promulgation of the Management Plan and appointment of the people in charge of its application must be confirmed.

ICOMOS considers that the management system for the property is adequate; it is, however, necessary to confirm the official promulgation of the Management Plan, ensure its financial consolidation, appoint the people in charge and ensure its correct implementation. Particular attention needs to be paid to the complete integration of the protection and conservation of the property's cultural components into the National Park management.

6 Monitoring

Indicators have been established for monitoring the conservation of the natural environment, biodiversity and shell mounds. For the latter, the aim is to monitor the number of mounds still intact, the degree of degradation of the others, the number of mounds illegally exploited and regular checks to identify the presence of illicit excavations. Monitoring is coordinated by the Cultural Heritage Department of the Ministry of Culture (Dakar). There is a standard document for the individual monitoring of mounds.

Further to the request by ICOMOS regarding the possibility for improved monitoring of the landscapes, notably by photographic means, the State Party recalls the existence of a standard monitoring file for cultural properties and the possibility for more detailed monitoring of certain notable landscapes. The territory is moreover too vast to consider a systematic photographic approach.

ICOMOS considers that the elements allowing for the individual monitoring of the mounds exists, but that frequency and the responsibility for their implementation need to be specified. The monitoring needs to be extended to include the most significant cultural landscapes, for example by publishing an annual monitoring report on the property's state of conservation.

7 Conclusions

ICOMOS recognises the Outstanding Universal Value of the cultural dimension of the mixed property Saloum Delta, Senegal, as a particularly representative and well preserved testimony of coastal civilisations that exploited fishery resources and gathered shellfish.

Recommendations with respect to inscription
ICOMOS recommends that the Saloum Delta, Senegal, be inscribed as a cultural landscape on the World Heritage List on the basis of ***cultural criteria (iii), (iv) and (v)***.

Recommended Statement of Outstanding Universal Value

Brief synthesis

The region of the Saloum Delta is a remarkable testimony to the synergy between a natural environment with extensive biodiversity and a style of human development that is still present albeit fragile. Sustainable shellfish gathering and fishing practices in brackish water, and the processing of the harvest for its preservation and export was developed here. The shell mounds and the tumulus mounds form specific and exceptional cultural landscapes.

The numerous shell mounds in the Saloum Delta are generally well preserved and they sometimes have imposing dimensions. They are direct testimony of sustainable and very ancient socio-economic practices. Over the centuries, they have led to the formation of numerous man-made islets contributing to the stabilisation of the delta's land and channels. With their characteristic vegetation within the delta's natural environment, the shell mounds form typical cultural landscapes. Some mounds include tumuli; they form, with their baobab vegetation and their undulating forms, funerary sites with specific landscape features.

Criterion (iii): With its numerous shell mounds, associated landscapes and the presence of a rare and well-preserved ensemble of funerary tumulus mounds, the Saloum Delta provides exceptional testimony to a coastal lifestyle, in a Sahelian subtropical environment, with brackish water rich in shellfish and fish.

Criterion (iv): All the shell mounds built up over a 2,000 year-long cultural process have formed a physical structure of stable islets and reclaimed land within the Saloum Delta. The resultant cultural landscapes are exceptional and illustrate a long period of the history of human settlement along the West African coast.

Criterion (v): The Saloum Delta is an eminent example of traditional human settlement. It represents a lifestyle and sustainable development based on the gathering of shellfish and fishing, in a considered interaction with a natural environment of extensive but fragile biodiversity.

Integrity

The conditions of cultural integrity of the Saloum Delta are in theory very adequate, even if some shell mounds have been damaged, but the integrity remains fragile. The shell mounds and the cultural landscapes and the biodiversity of the natural environment may be threatened by poorly controlled socio-economic behaviour.

Authenticity

The conditions of authenticity of the mounds, tumulus mounds and their landscapes are generally adequate. They are complemented by the anthropological authenticity of the shellfish gathering practices and to a lesser degree of the fishing practices.

Management and protection requirements

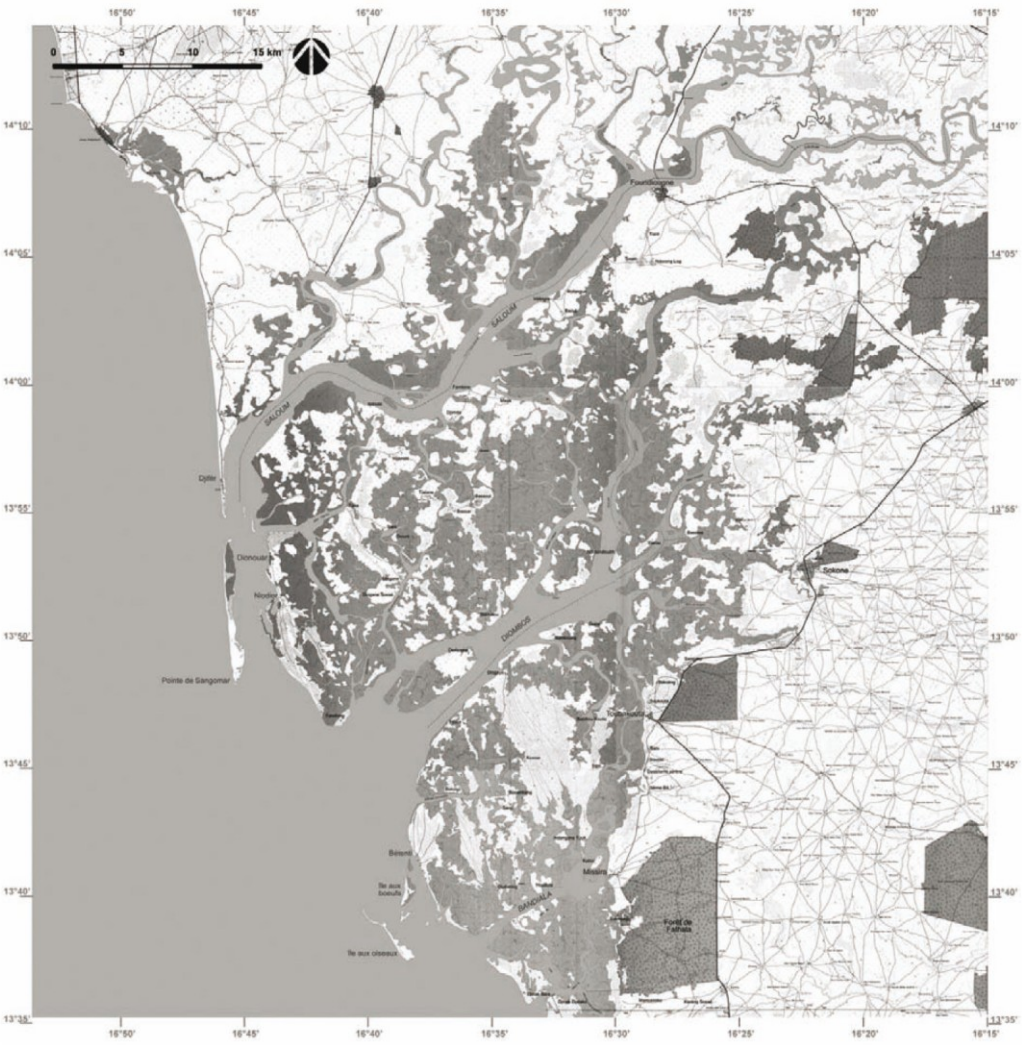
The protection of the shell mounds and the tumuli mounds is ensured by adequate regulatory measures. However, the active protection of the cultural sites in the field is recent and must be extended to the property as a whole, and not just concern the National Park. Additionally, the general policy for the property's conservation is closely tied to the conservation of the natural environment and the sustainable development programmes for the delta as a whole.

The property's management relies on numerous individuals in the field. Together they form an adequate management system for the property, with the key stakeholders and those in charge clearly identified, notably the National Park, the rural communities and the United Nations *MDG-Fund*. However, this management system is evolving and the multiplicity of programmes and stakeholders tends to make some situations somewhat confused. The overall management committee still has to be set up (2011), its resources confirmed, and the homogeneous handling of management and conservation for the entire property needs to be improved.

ICOMOS recommends that the State Party give consideration to the following:

- Prioritise attention on the simultaneous protection and conservation of the property's cultural elements and associated natural elements within the context of the Management Plan and economic and social development programmes. Ensure this joint protection-conservation is of the same level across the entire property, especially by means of eco-guards throughout the whole property;
- Confirm the official promulgation of the Management Plan (2010-2014) and the establishment of the Management Committee tasked with its implementation and coordination; stipulate the Management Committee's human and material resources as well as its ties with, on the one hand, the Community House in Toubacouta and, on the other hand, the Saloum Delta National Park;
- Consider specific conservation measures for the shell mounds threatened by erosion and/or by currents;
- Improve waste and wastewater management in order to limit pollution of the environment and to protect the inhabitants' health and traditional lifestyle, and those cultural landscapes near inhabited areas;
- Pay particular attention to the landscape management aspects of tourism development;
- Pay particular attention to the complete integration of the protection-conservation of the property's cultural elements in the property's management and development programmes;
- Specify the frequency of, and the responsibility for, the implementation of monitoring. It should be extended with respect to the most significant cultural landscapes. The publication of an annual report on the state of the property's cultural and landscape conservation is also desirable.

ICOMOS also recommends that the State Party compile a report on the implementation of its protection and management system for the property, for examination by the 36th session of the World Heritage Committee in 2012.



Plan showing the boundaries of the nominated property

Aerial view of mangrove forests

Undulating surface created by tumuli erected at the summit of the Tioupane-Boumak mounds

Dioron Boumak mound

Oyster culture on wooden stakes

The IUCN Evaluation

WHC-11/35.COM/INF.8B2

IUCN

IUCN Evaluations of Nominations of Natural and Mixed Properties to the World Heritage List

IUCN Report for the World Heritage Committee, 35th Session, Paris, France, June 2011

United Nations Educational, Scientific and Cultural Organization

World Heritage Convention

IUCN World Heritage Evaluations 2011

B. MIXED PROPERTIES

B1. NEW NOMINATIONS OF MIXED PROPERTIES

AFRICA

SALOUM DELTA

SENEGAL

WORLD HERITAGE NOMINATION – IUCN TECHNICAL EVALUATION

SALOUM DELTA (SENEGAL) – ID No. 1359

IUCN RECOMMENDATION TO 35th SESSION: Not to inscribe the property under natural criteria

Key paragraphs of Operational Guidelines:
77 Property does not meet natural criteria.
78 Property does not meet conditions of integrity or protection and management requirements.

1. DOCUMENTATION

a) Date nomination received by IUCN: 15 March 2010.

b) Additional information officially requested from and provided by the State Party: No supplementary information was requested.

c) Additional literature consulted: wide consultation of literature including: BirdLife International (2009). **Important Bird Area factsheet: Delta du Saloum**, Senegal; BirdLife International (2010) **Important Bird Areas factsheet: Arquipélago dos Bijagós**. Dia, I.M.M. (2003). Elaboration et mise en oeuvre d'un plan de gestion intégrée - **La Réserve de biosphère du delta du Saloum, Sénégal.** UICN, Gland, Suisse et Cambridge, Royaume-Uni. xiv + 130 pp. Diouck, D. (1999). **Adaptations aux modifications du milieu des Colobes bais (Colobus badius temminckii) de la forêt de Fathala, parc national du Delta du Saloum, Sénégal.** PhD Thesis. Dakar : UCAD. 165 pp. Dodman, Tim, Ndiaye Mame Dagou Diop & Sarr Khady (eds.). (2008). **Conservation Strategy for the West African Manatee.** UNEP, Nairobi, Kenya and Wetlands International Africa, Dakar, Senegal. Dupuy, A.R. (1986). **The Status of Marine Turtles in Senegal**. Marine Turtle Newsletter 39:4-7. FAO (2007). **The World's Mangroves 1985-2000.** FAO Forestry Paper 153. Rome, Italy.; IUCN (1992). Protected Areas of the World: **a Review of National Systems. Volume 3: Afrotropical**. Compiled by WCMC. IUCN, Gland, Switzerland and Cambridge, UK. xii + 360 pp. Keijl G.O., Brenninkmeijer, A., Schepers, F.J., Stienen, E.W.M., Veen, J. and Ndiaye A. (2001). **Breeding gulls and terns in Senegal in 1998, and proposal for new population estimates of gulls and terns in north-west Africa**. Atlantic Seabirds 3(2): 59-74. LPO Mission rapaces. (2009). **Compte-rendu du comptage de rapaces insectivores (Faucon crécerellette et Elanion naucler) fréquentant le dortoir de l'île de Kousmar (Kaolack / Sénégal) le 21 janvier 2009**. LPO, 4p. Mullié, W.C. (2009). Birds, locusts and grasshoppers. In: Zwarts, L., Bijlsma, R.G., van der Kamp, J., Wymenga, E. (eds.) **Living on the edge. Wetlands and birds in a changing Sahel**. KNNV Publishing, Zeist. pp. 202 -223. Oates, J.F., Struhsaker, T., McGraw, S., Galat-Luong, A., Galat, G. and Ting, T. (2008). **Procolobus badius**. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3; Powell, J. and Kouadio, A. 2008. **Trichechus senegalensis**. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4; Sadio, S. **Pédogenèse et potentialités forestières des sols sulfatés acides salés des tannes du Sine-Saloum.** ORSTOM, Paris, 1991, 269 pp. UNDP (2007). Project Title: **Integrated Ecosystem Management in Four Representative Landscapes of Senegal, Tranche 2**. Project submitted to the GEF by UNDP. 51 pp.

d) Consultations: two external reviewers consulted. The mission also met and travelled with representatives of the national cultural and natural heritage administrations, national office of UNESCO, and the President and Vice-President of the Rural Council for the area. The mission met with the Director of Cabinet, Ministry of Culture, the Adjoint Director of the Park Service, and the Sous-Préfet for Toubakouta Ibou Ndiaye. Consultations with Ecoguards and other park staff, inhabitants of the village inside the park, a selection of local artists and politicians, the Director of the Forest of Fathala and the President of the Bamboung marine protected area were also undertaken.

e) Field visit: Dr Wendy Strahm, September – October 2010 (joint mission with ICOMOS).

f) Date of IUCN approval of this report: 29 April 2011.

2. SUMMARY OF NATURAL VALUES

The nominated property named the Delta du Saloum (DDS) (Saloum Delta in English) is located c.150 km south of Dakar, some 50 km southwest of Kaolack, and 20 km from Banjul in the Gambia. The nominated property lies within the wider area of the delta, which also extends across the border into the Gambia, formed by a number of rivers including the Saloum, Sine, Bandiala and Diombos. The delta covers an estimated 500,000 ha, which includes some 60-80,000 ha of mangroves. The nomination put forward is for a mixed property and the IUCN evaluation below considers the natural values of the area, whilst the evaluation of cultural values will be carried out by ICOMOS.

The whole area of the delta of the Saloum includes some 200 islets separated by narrow channels of mostly saline to somewhat brackish water, and is protected in part by some sandy spits and islets on the seaward side which are very important for breeding and migratory waterfowl and marine species. Rising from 0-5 m above sea level (apart from the "artificial" islands which have been created by shell middens created over two thousand years which may reach 10 m in height), the delta includes important wetland habitats including mangrove swamps, coastal marine, and an adjoining area of dry woodland.

There is a complex and confusing pattern of designation of protected areas within the area: 180,000 ha of the delta was designated as a Biosphere Reserve in 1980, including the smaller 76,000 ha Saloum Delta National Park (SDNP), 73,000 ha of which has also been designated as a Ramsar site. SDNP contains 61,000 ha of marine habitat, 7,000 ha of mangroves and saltwater vegetation, and 8,000 ha of dry savanna and forest. Crossing the national border to the south, the delta is contiguous with the 4,940 ha Niumi National Park in the Gambia.

The nominated property, DDS, includes 145,811 ha which includes the SDNP in its entirety as well as a community-managed marine protected area (Bamboung) and a number of other mangrove islands falling under different management regimes. Thus DDS includes a much larger area of mangrove islets than does that of the National Park, mainly because it is these islets which include shell middens of cultural importance. The mangroves in the nominated zone are largely intact, whilst mangroves further north and east of the property have been killed by increased soil salinity. A "buffer zone" of 78,842 ha includes, in addition to villages and cultivated lands, the "community nature reserve" of Missira.

A high number of waders and seabirds, many occurring in large congregations, are found in the DDS which is an Important Bird Area defined by BirdLife International. The sandy islands, particularly "Île aux Oiseaux", host important breeding populations of African Royal Terns, Caspian Terns, Slender-billed Gulls and Grey-headed Gulls. Of greatest interest is the African Royal Tern, of which Île aux Oiseaux has the largest Royal Tern breeding colony in the world. Although the nomination cites the Royal Tern as threatened, it has been listed by IUCN as Least Concern. Recorded bird numbers of 66,784 individuals on Île aux Oiseaux during the breeding season (May 2009) and 120,000 wintering waterfowl comprising 95 species (1998) are provided in the nomination. Thus this island as well as the sandbars and mudflat habitat in the DDS provides an important spectacle of large numbers of birds during the breeding season as well as during the northern winter as the site lies along the East Atlantic Flyway. Other notable bird species occurring in the DDS include Lesser and Greater Flamingo, Great White and Pink-backed Pelicans, Sacred Ibis, Western Reef-egret, Goliath and Black Herons, African Fish Eagle and Osprey (none listed as threatened by IUCN).

The nomination lists the presence of West African Manatee (Vulnerable) as an important attribute, although in Senegal, the Manatee is close to extinction, noting that in most areas of the country it has not been seen for many years. Although there have been some reported sightings in the delta of the Sine Saloum River near Kaolack, the species is considered to be severely depleted and threatened and given the saline water in the DDS, it is unlikely to be a very important element inside the nominated site. The Atlantic Hump-backed Dolphin (Vulnerable) is cited as present in the DDS, with 100 animals out of an estimated population size of several thousand stretching from the coasts of southern Morocco to Angola. Marsh Mongoose and Nile Monitor Lizard are also noted in the property but are not globally threatened.

Thirty-six species of large and medium sized terrestrial mammals, are noted in the dry forest area of the DDS. Almost all of these species have a fairly widespread distribution and while are perhaps threatened in Senegal and therefore of national importance, are not threatened at a global level (e.g. Sitatunga and African Clawless Otter). The most interesting species is the Endangered Red Colobus, a monkey of which a subspecies (*Procolobus badius temminckii*) occurs in the DDS where it is at the north-western limit of its range (Senegal, Gambia, Guinea-Bissau and north-west Guinea). This species seems to be declining throughout most of its range, and although the subspecies *temminckii* occurs in a number of protected areas (e.g. Abuko NP and River Gambia NP in the Gambia, Niokolo-Koba NP in Senegal; and Cufada NP in Guinea-Bissau), the absence of large and well-managed protected areas means that the status of this subspecies is likely to continue to decline. It is estimated that there are probably fewer than 400-500 individuals of *P. b. temminckii* surviving in Saloum Delta NP, and probably fewer than 100 in the isolated Niokolo-Koba and north-west Guinea population. Therefore despite its relatively small remnant of dry forest, the DDS may have the potential to contribute to the conservation of this species, provided integrity issues (below) in this forest are resolved.

Six species of marine turtles have been listed as using the DDS including five species that the nomination cites as "frequent". Four species have been recorded as nesting in the DDS: the Vulnerable Olive Ridley, Endangered Green and Loggerhead, and Critically Endangered Leatherback. Two other Critically Endangered turtles (Hawksbill and Kemp's Ridley) have also been recorded. It appears that while some turtles (mainly Green) still nest on Île aux Oiseaux and Sangomar, nesting records are rare in Senegal with a decline noted from a minimum of 200 nestings observed on the coast in the 1950's, to about 20 observed in 1985. Therefore DDS is not an important breeding site for any of these species, but the area has the potential to be

much more important for turtle conservation once the threats can be solved.

Within the estuary component of the property 114 species of fish belonging to 42 families have been identified, including one species of carp (*Lisa bandialensis*) which is considered to be endemic to the DDS and is decreasing because they are highly sought after by Senegalese consumers. The site is an important fish nursery as well as provides habitat for numerous crustaceans and molluscs of which several (shrimps, oysters, and various other shells) are very important locally. There is also high diversity in the marine ecosystem, including cartilaginous fish (80 species in 30 families) and bony fish (470 species in 110 families). A number of these species are over-exploited and given the comparatively small marine area in the nomination compared to the area where these species range, the contribution of the property for marine fish as well as marine mammals and invertebrates is limited.

The dry forests of the DDS are said to contain about 20% of the flora of Senegal making the area of national importance. Baobabs growing on the shell middens, while scenic, are not natural as they require lime-rich substrates so only grow on the artificial islands; indeed they serve as an indicator to identify where the shell middens occur.

Mangroves in Senegal (as throughout West Africa) are under severe pressure. Since 1980 Senegal has lost approximately a third of its area under mangroves, and the largest area remaining in Senegal is in the Delta du Saloum providing a largely intact and very important habitat.

3. COMPARISONS WITH OTHER AREAS

The property is nominated under natural criteria (vii) and (x), in addition to cultural criteria. In relation to its representation of superlative phenomena, the principal points of comparison are also relevant to the application of the biodiversity criteria and are discussed below, consider notably that there are larger, more natural and more diverse areas within the region (notably the Banc d'Arguin in Mauritania and the Bijagos in Guinea-Bissau). From the point of view of aesthetic values, the property is certainly attractive, but does not present distinct values in this regard that would set it apart from other areas of mangroves of marine conservation areas both in the sub-region and elsewhere in the world. IUCN considers the property is clearly of great national significance for Senegal for both natural beauty (the mangrove, tropical sandy island and marine habitats) and natural phenomena (including its highly important seabird nesting colony along the West African coast). However at a global level these habitats and phenomena are found in a range of places and at a larger scale.

In relation to biodiversity values, the nomination recognises that mangrove forests (here composed of four species) are common throughout the world and that there are many other mangrove forests much larger than that found in the DDS. The nomination focuses on the juxtaposition of the natural values of the site with the cultural values, which are mainly the man-made shell middens that occur in the site, and which are in effect protected from erosion by the mangroves as a key value. Whilst this may be the case, IUCN considers that this issue is an important aspect of integrity regarding the cultural attributes of the property, but would not be a basis for the application of natural criteria.

Regarding species conservation, no comparative analysis is made with the relatively small dry forest portion of this nomination. This area could, with more effective management become the most important area for the conservation of the Red Colobus, although the same could be said for larger areas where this species occurs. Although a number of threatened marine species occur within the reserve, the marine component is small and there are either other or larger areas which play a more significant role in their conservation. The site is important for the Atlantic Hump-backed Dolphin, but probably not the most important site for this species.

The most significant basis for international conservation value of DDS appears to relate to its bird population. IUCN regards the Delta of Saloum as the third most important site for *waterfowl* in West Africa after the Banc d'Arguin in Mauritania and Djoudj in Senegal, whilst BirdLife cites the Bijagos Archipelago of Guinea-Bissau as the second most important site for *migratory waders* after the Banc d'Arguin. When the Banc d'Arguin was evaluated, IUCN noted that it was by far the most important area for *migratory birds* in the region with only the Bijagos Archipelago in Guinea-Bissau coming close. The other World Heritage wetland site found in the same biogeographic province is the Djoudj National Park where riverine flats also support significant Palaearctic migrants, mostly waterfowl. It is, however, much smaller and does not have a marine aspect.

The nomination notes that there are many close similarities between the DDS and the Bijagos, noting that the Bijagos covers a much larger area. The Bijagos, in addition to being important for migrating waterfowl, also have a number of nesting species including ibis and a heronry. On the basis of breeding species (see Table 1), the DDS is significant, in particular for gulls and terns. These are mainly on the 200 ha Île aux Oiseaux, and this tern and gull colony is very spectacular. However, there exist spectacular tern and gull colonies in other parts of the world, but with different species. Therefore in comparing areas within the same biome, the breeding bird colonies in the DDS surpass those of the Banc d'Arguin and the Bijagos, but are not globally exceptional.

All of the water birds listed above are classified by IUCN as "Least Concern" species, although there is one species that nests in very large but few colonies, and that is the African Royal Tern (a subspecies that is

restricted to the West African coast, with another subspecies occurring in the Americas). African Royal Terns only breed in Senegal, Mauritania, Gambia and Guinea Bissau, and Île aux Oiseaux in the DDS has the largest Royal Tern breeding colony in the world. However, it has been noted that breeding colonies of Royal Terns can shift between breeding sites, resulting in seemingly large fluctuations at any site. While 40,000 pairs were observed in 1999 on Île aux Oiseaux, "only" 21,000 pairs were counted in 1998 (Keijl *et al.*, 2001), and the nomination cites a figure of 19,588 individuals counted in May 2009. This may indicate a decline since the BirdLife data is some ten years old. In summary, whilst the nominated property is certainly of international interest, the values of the property appear to be at a lower level than those of both the Banc d'Arguin and Bijagos in the region, thus the case for the application of criteria x is weakened.

Table 1. Breeding pairs of IBA species (BirdLife, 2010)

Species	Season	Banc d'Arguin	DDS	Bijagos	Djoudj
Greater Flamingo	resident	12,940	-	-	-
Eurasian Spoonbill	resident	1,610	-	-	-
Western Reef-egret	resident	745	1,750	870	-
Great White Pelican	breeding	3,080	-	-	8,500
Great Cormorant	breeding	4,260	-	-	-
Grey-headed Gull	breeding	-	4,600	800	-
Slender-billed Gull	breeding	1,610	3,350	170	-
Gull-billed Tern	breeding	1,180	309	-	-
Caspian Tern	breeding	2,575	8,610	1330	-
Royal Tern	breeding	5,630	40,000	7,600	-
Common Tern	breeding	40	80	-	-
African Sacred Ibis	breeding	-	-	742	-
African Spoonbill	breeding	-	-	1,000	-
Black-crowned Night-heron	breeding	-	-	168	1,000
Squacco Heron	breeding	-	-	318	-
Great Egret	breeding	-	-	925	807
Little Egret	breeding	-	-	553	-
TOTAL		33,670	58,699	14,476	10,307

4. INTEGRITY, PROTECTION AND MANAGEMENT

4.1. Protection

The legal protection (apart from the portion of the DDS inscribed as National Park) of the proposed site is unclear. The nomination notes the land nominated as core is mostly State-owned, but does not explain what land is under private ownership. Given that a number of small villages and one small hotel lie within the proposed core area, the situation pertaining to any private land inside the proposed property requires clarification. The nomination also notes that the State may "transmit the utilisation and rational enhancement of [State] land in conformity with development plans and programmes to third parties", and the law 96-07 of 22 March 1996 allows the region, commune and rural community to define and organise the use of this land, in liaison with the State (i.e. the National Park Service and the Forest Department). Thus the extent of actual protection provided is not clear and whilst World Heritage site status could provide a basis to strengthen and clarify the legislative protection, it could also lead to increased visitation and resultant impacts on the area.

IUCN considers the protection status of the nominated property does not meet the requirements set out in the Operational Guidelines.

4.2 Boundaries

The boundaries of this property include three ecosystems: mangrove, dryland forest and marine. Included in the nomination is the entire National Park as well as additional mangrove habitat. The fact that there exists a Biosphere Reserve, a National Park, and a Ramsar Site, as well as the present nomination, within the Delta of Saloum makes understanding what is happening very difficult. There are some discrepancies noted during the evaluation, for instance DDS is cited as totalling 224,653 ha, but the Biosphere Reserve is said to cover 180,000 ha and appears on maps to be larger than the nominated area. Likewise why the DSNP is said to cover 76,000 ha and the Ramsar Site 73,000 ha (but they are supposed to have the same boundaries) also requires clarification.

The nomination includes a 3 km wide buffer zone on the seaward side, and a somewhat unclear buffer zone to the west (which, in addition to villages and cultivated areas, is supposed to include the community managed reserve of Missira). The present marine buffer zone is too narrow to be effective, but it was explained that this was due to management reasons as the National Parks could not police a larger zone, and thus included the same buffer zone as that included in the Biosphere Reserve. There is no buffer zone to the edge of the Forest of Fathala, where one would appear needed, due to the proximity to the Gambian border to the south and villages (and a hunting zone) to the west.

Apart from the issue of the Forest of Fathala, the boundaries for the nomination seem reasonable, especially as they include a good amount of mangrove and marine habitat. It is not certain that all of the area where the Red Colobus occurs is included in the nomination. Thus whilst the actual area of the nominated property needs to be checked, and investigation as to whether all the important areas of

forest for the Red Colobus are included would be useful, the boundaries appear to meet minimum requirements.

IUCN considers that the boundaries of the nominated property meet the requirements set out in the Operational Guidelines.

4.3 Management

Although the nomination submitted a management plan for the property, much of this is a reproduction of the nomination and it is not apparent that there is an overall management system for the property in place. However there seem to be a number of different management and development plans for the Delta, and the challenge will be to see how to combine all of these into a coherent system for the management of a WH property. In supplementary information provided to ICOMOS, the State Party notes that next steps to improve the management of the site will be to create a management committee and to identify a manager.

The nomination stresses the importance of local conventions, noting that traditional practices have had a great importance in the conservation of the site and that these would continue. However it also recognised that there have been declines in biodiversity and projects are in place, such as the community marine protected area at Bamboung, to reverse this trend. The mission noted a range of types of use going on inside the proposed core of the property (tourism, gathering of grasses and other plant products, bee-keeping, shell collection, fishing, some livestock-rearing, agriculture, possibly some hunting). The extent to which these uses are being addressed by the management system, and the levels of use that would or not be considered sustainable are also not clear.

There is a structure in place for managing the National Park, and the Forest Department manages "Classified Forests" (Forêts classées). However the mechanisms for managing State land that has no protection status is unclear. There appears to be good progress in the development of an ecoguard/ecoguide programme and the work with the community managed marine protected area. There are a number of different initiatives with NGO's (including IUCN) to better manage the area and also a number of examples of projects that have clearly been unsustainable.

A special note needs to be made about the management of the Forest of Fathala. This 11,800 ha area has been included inside the National Park and therefore the DDS. The management of a third of the forest (4,000 ha) has been given to a Dakar-based NGO (SPEFS, the "Société pour la Protection de l'Environnement et de la Faune du Sénégal"), which has fenced 2,000 ha with electrified fencing. There appears to be significant conflict between this reserve and the surrounding local people, including poaching of wildlife.

The nomination lists a total of 15 people spread over 7 bases. In addition to the staff of the Forest of Fathala, there are also 38 ecoguards listed who work mostly on a voluntary basis at the community level. Still, there are not sufficient resources to manage a protected area of this size. Annual bird censuses are undertaken although seem to be less than before when there was more intense Belgian interest in counting the birds. Otherwise the monitoring of the property at the present time appears to be very limited.

IUCN considers the management of the nominated property does not meet the requirements set out in the Operational Guidelines.

4.4 Threats

Wildlife management
In addition to trying to conserve the native fauna of the area, an attempt has been made to re-introduce elements of the fauna that have become extinct, in many cases a long time ago, such as the Western Giant Eland, Buffalo and Roan Antelope. However other species, such as two White Rhino, four Giraffe (a different subspecies of Giraffe as the original West African one is extinct), and a herd of Cape Zebra (that never existed in Senegal), all coming from South Africa, have been introduced to the reserve. Most of these experiments seem to be failing however. For example the evaluation mission was informed that 3 of the 4 Giraffe had being poached. While it is laudable to try to "recreate" biodiversity that once occurred, the unscientific manner in which animals are being introduced to a National Park is clearly not appropriate.

Population growth and unsustainable use
The nomination says that the DDS has integrity given the good state of conservation of the property and the traditional practices of sustainable use (for shell collection and fishing), although also notes that there has been unsustainable use which is being resolved by the creation of a marine reserve and new techniques for oyster farming that reduce impacts. Whilst many parts of the area including the mangroves surrounding the islands are for the most part intact, the property is not pristine and impacts from the resident population include agriculture, fire, fuel wood collection, pollution, and possible collection of bird and turtle eggs. It is not clear as to how many people actually live inside the proposed core area, but the nomination says that some 55,000 people are living mostly at the edge of the property, and another 81,000 people reside in the buffer zone (and population growth is at 2.5%). The nomination notes pressure from increasing rice cultivation and illegal firewood collection as well as bush fire, which was also evident during the evaluation mission.

Tourism
Tourism is still very basic in the delta but developing, which seems to be one of the main motivations for inscribing this area as World Heritage. The neighbouring towns of Missira, Toubakouta and Foundiougne all have

plans for tourism development. The mission noted interest in sports fishing, and some local people receive income from stuffing or making models of the tourist's "big catch". The mission heard reports that few proceeds from the larger hotels in the region go to the local community. Unmanaged tourism in the area could pose a very real threat to the natural values of the site, especially to Île aux Oiseaux which still receives a relatively low number of tourists and is said to be strictly managed by the National Park, but increased visitor demand will create management issues. In this context the preparedness of the management of the property to consider possible increases does not yet seem to be in place.

Soil salinisation and erosion
In 1991, it was estimated that soil salinisation affected 90,000 ha in the Saloum estuarine domain. While rainfall seems to be increasing today, with global change it is impossible to predict what will happen in the future. Low rainfall means that the whole of the area could be threatened by increases in salinity which would destroy the remaining mangroves. Similarly in 1994 the "Point of Sangomar" was breached and this sandy spit turned island is progressively moving southward, removing the previous protection of the mangroves from wave erosion.

Pollution
The Delta du Saloum is not far from Banjul, capital of the Gambia, and there seems to be a direct flow of water to the delta which brings lots of plastic debris that ends up on the mudflats and forms garlands of plastic on the mangroves. Other pollution comes from Kaolack. The mission noted community clean up efforts and that measures are being taken to tackle both solid waste and sewage, but fixed plans are not yet made.

The State Party is clearly aware of the challenges to this property and is doing much to address them through the creation and better management of reserve areas, as well as wider planning efforts. Nevertheless there are a range of significant sources of concern, including from the potential impacts of World Heritage status in relation to tourism pressures, and there remain underlying issues regarding the adequacy of legislation, staffing and resources to resolve before a viable management system could be established. Whilst World Heritage status might arguably have a catalytic role, and this appears to be a basis for UNESCO local support for the initiative, it also has the potential to bring additional pressures ahead of adequate management capacity being established. Conversely the existing recognition by UNESCO of the area as a biosphere reserve, as well as its existing recognition as a Ramsar site provide alternative and existing sources of leverage for conservation and sustainable development efforts, more clearly relevant to the property at the present time.

IUCN considers the nominated property does not meet the conditions of integrity as outlined in the Operational Guidelines.

5. ADDITIONAL COMMENTS

One area within the delta but which is not located within the nomination that could possibly increase the OUV of the site is "Île de Kousmar", which houses possibly the largest bird of prey roost ever discovered. This massive winter roost contains approximately 45,000 insectivorous raptors, including over 28,600 Lesser Kestrels and 16,000 African Swallow-tailed Kites. The roost is thought to host more than half of the combined known breeding Lesser Kestrel (Vulnerable) populations of western Europe and northern Africa. This species has declined rapidly in western Europe since 1950 and significant conservation efforts have been devoted to the Lesser Kestrel in its European breeding range, but the discovery of this 'super-roost' in 2007 highlights the importance of protecting wintering sites as well. In the winter it must be an extraordinary spectacle to observe this density of raptors in one place. Whilst it would be challenging to associate this area, remote from the nominated property, to a revised nomination, it should be noted and protected as a highly noteworthy and important area within Senegal.

6. APPLICATION OF CRITERIA

The Delta du Saloum has been nominated under natural criteria (vii) and (x), as well as under cultural criteria which will be evaluated separately by ICOMOS.

Criterion (vii): Superlative natural phenomena or natural beauty and aesthetic importance
This property is of great national significance for Senegal for both natural beauty (the mangrove, tropical sandy island and marine habitats) and natural phenomena (the most important seabird nesting colony along the West African coast). However at a global level these habitats and phenomena (although not with the same species) exist elsewhere and at a larger scale.

IUCN considers that the nominated property does not meet this criterion.

Criterion (x): Biodiversity and threatened species
The property is of international significance as an important seabird nesting colony, including one quarter of the entire breeding population of African Royal Terns. It is however the third most important wintering site for Palaearctic migratory waders, after the Banc d'Arguin in Mauritania and the Bijagos Archipelago in Guinea-Bissau. It is differentiated from these two sites by its combination of sandy islands and mangroves. Whilst the property provides habitat for a number of threatened species, including six species of marine turtles and the Atlantic Hump-backed Dolphin, its contribution to overall conservation of these species within their ranges is limited due to its small marine area and impacts of human use. The dryland forest provides one of the last habitats for the Endangered Red Colobus, along with a number of reserves in the region. The levels of integrity and protection and management of the property are not

sufficient to provide protection for these values at the present time.

IUCN considers that the nominated property does not meet this criterion.

7. RECOMMENDATIONS

IUCN recommends that the World Heritage Committee adopt the following draft decision:

The World Heritage Committee,

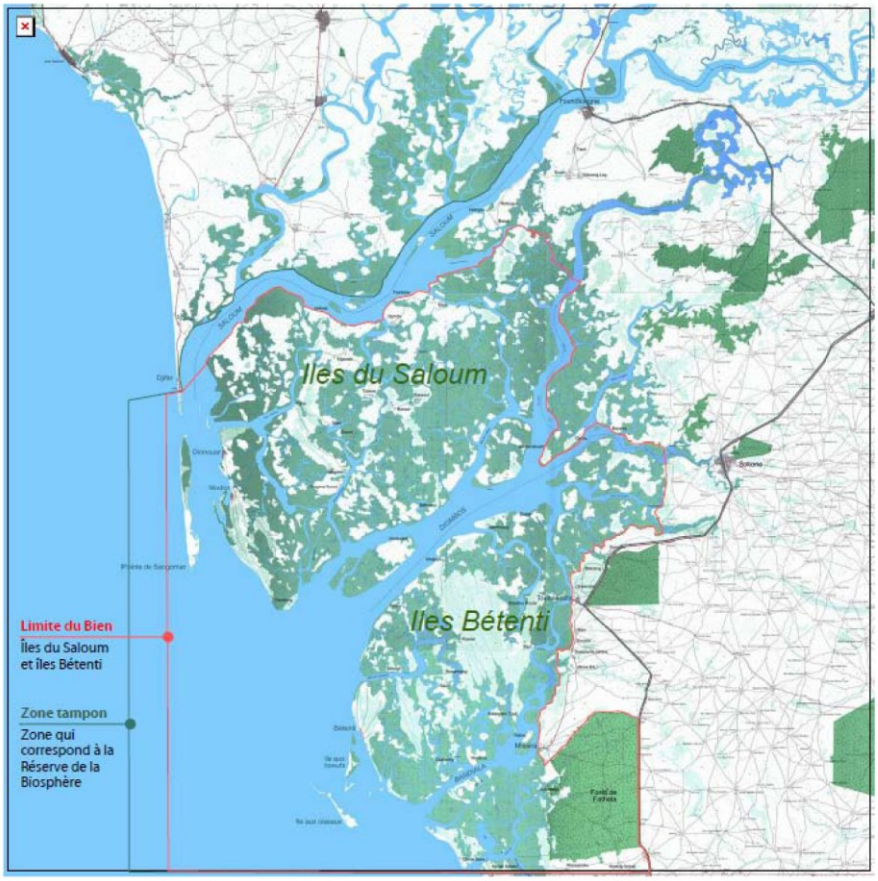
1. Having examined Documents WHC-10/35.COM/8B and WHC-10/35.COM/INF.8B2;

2. Decides not to inscribe the **Saloum Delta (Senegal)** on the World Heritage List under natural criteria (vii) and (x);

3. Recommends the State Party to seek assistance via the UNESCO Man and Biosphere Programme and also of the Ramsar Convention, in order to ensure the international recognition of the Saloum Delta as both a Biosphere Reserve and as a Ramsar Site contributes to the effective conservation of the site, and also assists the development of well-planned and equitable approaches to sustainable development within the property and the surrounding area, including via sustainable tourism;

4. Further recommends the State Party to clarify and strengthen the legal protection of the property, and to increase the available human and financial resources to ensure the protection and conservation of the site, including the protection, and restoration where appropriate, of the important natural values within the area, including the high quality mangrove habitat, dry forest areas capable of supporting conservation of the Red Colobus, the important bird and turtle conservation area of the *Île aux Oiseaux*, and to also put in place an effective protection and management regime to secure the conservation of the nearby Île de Kousmar.

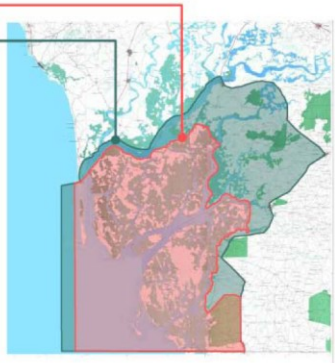
Map 1: Nominated property and buffer zones



Surface du bien proposé ..... 145 811 Ha

Surface de la zone tampon ..... 78 842 Ha

Total ..... 224 653 Ha



The Committee Final Decision

United Nations
Educational, Scientific and
Cultural Organization

Organisation
des Nations Unies
pour l'éducation,
la science et la culture

World Heritage **35 COM**

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UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION

CONVENTION CONCERNING THE PROTECTION OF THE WORLD CULTURAL AND NATURAL HERITAGE

World Heritage Committee

Thirty-fifth session
Paris, UNESCO Headquarters
19-29 June 2011

DECISIONS ADOPTED BY THE WORLD HERITAGE COMMITTEE AT ITS 35th SESSION (UNESCO, 2011)

a) The establishment of the Integrated Management System for the trilateral property that ensures the protection of the functional linkages between the component parts,

b) The establishment of cooperative and transnational research and monitoring plans in order to monitor and report on the transnational serial property as a whole,

c) Set up cooperative international programmes of capacity building to share best practices from countries included in the series, and other countries with significant primeval and ancient beech forests;

5. Commends the States Parties of Ukraine, Slovakia and Germany for their on-going commitment to ensure a comprehensive approach to conserving the primeval and ancient beech forests of Europe and for their exploration of the potential for the *World Heritage Convention* to further these efforts by cooperating with the support of IUCN and the World Heritage Centre, with other interested States Parties towards a finite serial transnational nomination in order to assure the protection of this unique forest ecosystem.

MIXED PROPERTIES

Decision: 35 COM 8B.14

The World Heritage Committee,

1. Having examined Documents WHC-11/35.COM/8B, WHC-11/35.COM/INF.8B1 and WHC-11/35.COM/INF.8B2,

2. Refers the nomination of the **Saloum Delta, Senegal,** back to theState Party under criterion (x) to allow the State Party to further develop studies on endangered species and biological diversity within the property;

3. Inscribes the **Saloum Delta, Senegal**, as a cultural landscape on the World Heritage List on the basis of **criteria (iii), (iv)** and **(v)**;

4. Adopts the following Statement of Outstanding Universal Value:

Brief synthesis

The region of the Saloum Delta is a remarkable testimony to the synergy between a natural environment with extensive biodiversity and a style of human development that is still present albeit fragile. Sustainable shellfish gathering and fishing practices in brackish water, and the processing of the harvest for its preservation and export was developed here. The shell mounds and the tumulus mounds form specific and exceptional cultural landscapes.

The numerous shell mounds in the Saloum Delta are generally well-preserved and they sometimes have imposing dimensions. They are direct testimony of sustainable and very ancient socio-economic practices. Over the centuries, they have led to the formation of numerous man-made islets contributing to the stabilisation of the delta's land and channels. With their characteristic vegetation within the delta's natural environment, the shell mounds form typical cultural landscapes. Some mounds include tumuli; they form, with their baobab vegetation and their undulating forms, funerary sites with specific landscape features.

Criterion (iii): With its numerous shell mounds, associated landscapes and the presence of a rare and well-preserved ensemble of funerary tumulus mounds, the Saloum Delta provides exceptional testimony to a coastal lifestyle, in a Sahelian subtropical environment, with brackish water rich in shellfish and fish.

Criterion (iv): All the shell mounds built up over a 2,000 year-long cultural process have formed a physical structure of stable islets and reclaimed land within the Saloum Delta. The resultant cultural landscapes are exceptional and illustrate a long period of the history of human settlement along the West African coast.

Criterion (v): The Saloum Delta is an eminent example of traditional human settlement. It represents a lifestyle and sustainable development based on the gathering of shellfish and fishing, in a considered interaction with a natural environment of extensive but fragile biodiversity.

Integrity

The conditions of cultural integrity of the Saloum Delta are in theory very adequate, even if some shell mounds have been damaged, but the integrity remains fragile. The shell mounds and the cultural landscapes and the biodiversity of the natural environment may be threatened by poorly controlled socio-economic behaviour.

Authenticity

The conditions of authenticity of the mounds, tumulus mounds and their landscapes are generally adequate. They are complemented by the anthropological authenticity of the shellfish gathering practices and to a lesser degree of the fishing practices.

Protection and Management requirements

The protection of the shell mounds and the tumuli mounds is ensured by adequate regulatory measures. However, the active protection of the cultural sites in the field is recent and must be extended to the property as a whole, and not just concern the National Park. Additionally, the general policy for the property's conservation is closely tied to the conservation of the natural environment and the sustainable development programmes for the delta as a whole.

The property's management relies on numerous individuals in the field. Together they form an adequate management system for the property, with the key stakeholders and those in charge clearly identified, notably the National Park, the rural communities and the United Nations MDG-Fund. However, this management system is evolving and the multiplicity of programmes and stakeholders tends to make some situations somewhat confused. The overall management committee still has to be set up (2011), its resources confirmed, and the homogeneous handling of management and conservation for the entire property needs to be improved.

5. Recommends that the State Party give consideration to the following:

   a) Prioritise attention on the simultaneous protection and conservation of the property's cultural elements and associated natural elements within the context of the Management Plan and economic and social development programmes. Ensure this joint protection-conservation is of the same level across the entire property, especially by means of eco-guards throughout the whole property,

   b) Confirm the official promulgation of the Management Plan (2010-2014) and the establishment of the Management Committee tasked with its implementation and coordination; stipulate the Management Committee's human and material resources as well as its ties with, on the one hand, the Community House in Toubacouta and, on the other hand, the Saloum Delta National Park,

   c) Consider specific conservation measures for the shell mounds threatened by erosion and/or by currents,

   d) Improve waste and wastewater management in order to limit pollution of the environment and to protect the inhabitants' health and traditional lifestyle, and those cultural landscapes near inhabited áreas,

   e) Pay particular attention to the landscape management aspects of tourism development,

   f) Pay particular attention to the complete integration of the protection-conservation of the property's cultural elements in the property's management and development programmes,

   g) Specify the frequency of, and the responsibility for, the implementation of monitoring. It should be extended with respect to the most significant cultural landscapes. The publication of an annual report on the state of the property's cultural and landscape conservation is also desirable;

6. Also recommends the State Party, in relation to the associated natural values of the property, to seek assistance via the UNESCO Man and Biosphere Programme and the Ramsar Convention, in order to ensure that the international recognition of the Saloum Delta as both a Biosphere Reserve and as a Ramsar Site contributes to the effective conservation of the site, and also assists the development of well-planned and equitable approaches to sustainable development within the property and the surrounding area, including via sustainable tourism;

7. Further recommends the State Party to clarify and strengthen the legal protection of the property, and to increase the available human and financial resources to ensure the protection and conservation of the site, including the protection, and restoration where appropriate, of the important natural values within the area, including the high quality mangrove habitat, dry forest areas capable of supporting conservation of the Red Colobus, the important bird and turtle conservation area of the Île aux Oiseaux, and to also put in place an effective protection and management regime to secure the conservation of the nearby Île de Kousmar.;

8. Requests the State Party to submit a report by **1 February 2012** on the implementation of its protection and management system for the property, for examination by the World Heritage Committee at its 36th session in 2012.

Decision: 35 COM 8B.15

The World Heritage Committee,

1. Having examined Documents WHC-11/35.COM/8B, WHC-11/35.COM/INF.8B1 and WHC-11/35.COM/ INF.8B2,

2. Inscribes the **Wadi Rum Protected Area, Jordan**, on the World Heritage List on the basis of **criteria (iii)**, **(v)** and **(vii)**;

3. Takes note of the following provisional Statement of Outstanding Universal Value:

Brief synthesis

Wadi Rum Protected Area (WRPA) is located in the southern part of Jordan close to the border with Saudi Arabia, around 290 km south of Amman and 60 km northeast of the coastal city of Aqaba. The total area of WRPA is 74,200 ha. The property extends approximately 42 km from north to south and approximately 33 km from east to west. A buffer zone of c.5 km in width, with some excepted areas, surrounds the area and is stated as having a total area of 60,000 ha.

Wadi Rum is a major feature within the Hisma desert lying to the east of the Jordan Rift Valley and south of the steep escarpment of the central Jordanian plateau. Its natural values include desert landforms developed within continental sandstones. These landforms have been developed under the influence of a combination of various controlling factors such as lithology, tectonic activities (including rapid uplift, numerous faults and joints) and surface processes (including various types of weathering and erosion associated with desert climate as well as humid climates in the past), representing million years of ongoing landscape evolution.

Widespread petroglyphs, inscriptions and archaeological remains testify to 12,000 years of human occupation and interaction with the natural environment, illustrating the evolution of pastoral, agricultural and urban human activity in the Arabian Peninsula and the environmental history of the region.

Criterion (iii): The Wadi Rum Protected Area bears a unique testimony to the practice of rock art and inscriptions that has been on-going for millennia. The combination of 25,000 petroglyphs with 20,000 inscriptions and their continuity over a period of at least 12,000 years sets Wadi Rum apart from other rock art and/or inscription sites. The petroglyphs, representing humans and animals, are engraved on boulders, stones, and cliff faces. They trace the evolution of human thought, the long term patterns of pastoral, agricultural and urban human activity in the Arabian Peninsula, and the environmental

Appendix 4: The Nara Document on Authenticity

Preamble

1. We, the experts assembled in Nara (Japan), wish to acknowledge the generous spirit and intellectual courage of the Japanese authorities in providing a timely forum in which we could challenge conventional thinking in the conservation field, and debate ways and means of broadening our horizons to bring greater respect for cultural and heritage diversity to conservation practice.

2. We also wish to acknowledge the value of the framework for discussion provided by the World Heritage Committee's desire to apply the test of authenticity in ways which accord full respect to the social and cultural values of all societies, in examining the outstanding universal value of cultural properties proposed for the World Heritage List.

3. The Nara Document on Authenticity is conceived in the spirit of the Charter of Venice, 1963, and builds on it and extends it in response to the expanding scope of cultural heritage concerns and interests in our contemporary world.

4. In a world that is increasingly subject to the forces of globalization and homogenization, and in a world in which the search for cultural identity is sometimes pursued through aggressive nationalism and the suppression of the cultures of minorities, the essential contribution made by the consideration of authenticity in conservation practice is to clarify and illuminate the collective memory of humanity.

Cultural Diversity and Heritage Diversity

5. The diversity of cultures and heritage in our world is an irreplaceable source of spiritual and intellectual richness for all humankind. The protection and enhancement of cultural and heritage diversity in our world should be actively promoted as an essential aspect of human development.

6. Cultural heritage diversity exists in time and space, and demands respect for other cultures and all aspects of their belief systems. In cases where cultural values appear to be in conflict, respect for cultural diversity demands acknowledgment of the legitimacy of the cultural values of all parties.

7. All cultures and societies are rooted in the particular forms and means of tangible and intangible expression which constitute their heritage, and these should be respected.

8. It is important to underline a fundamental principle of UNESCO, to the effect that the cultural heritage of each is the cultural heritage of all. Responsibility for cultural heritage and the management of it belongs, in the first place, to the cultural community that has generated it, and subsequently to that which cares for it. However, in addition to these responsibilities, adherence to the international charters and conventions developed for conservation of cultural heritage also obliges

consideration of the principles and responsibilities flowing from them. Balancing their own requirements with those of other cultural communities is, for each community, highly desirable, provided achieving this balance does not undermine their fundamental cultural values.

Values and authenticity

9. Conservation of cultural heritage in all its forms and historical periods is rooted in the values attributed to the heritage. Our ability to understand these values depends, in part, on the degree to which information sources about these values may be understood as credible or truthful.
Knowledge and understanding of these sources of information, in relation to original and subsequent characteristics of the cultural heritage, and their meaning, is a requisite basis for assessing all aspects of authenticity.

10. Authenticity, considered in this way and affirmed in the Charter of Venice, appears as the essential qualifying factor concerning values. The understanding of authenticity plays a fundamental role in all scientific studies of the cultural heritage, in conservation and restoration planning, as well as within the inscription procedures used for the World Heritage Convention and other cultural heritage inventories.

11. All judgements about values attributed to cultural properties as well as the credibility of related information sources may differ from culture to culture, and even within the same culture.
It is thus not possible to base judgements of values and authenticity within fixed criteria. On the contrary, the respect due to all cultures requires that heritage properties must considered and judged within the cultural contexts to which they belong.

12. Therefore, it is of the highest importance and urgency that, within each culture, recognition be accorded to the specific nature of its heritage values and the credibility and truthfulness of related information sources.

13. Depending on the nature of the cultural heritage, its cultural context, and its evolution through time, authenticity judgements may be linked to the worth of a great variety of sources of information. Aspects of the sources may include form and design, materials and substance, use and function, traditions and techniques, location and setting, and spirit and feeling, and other internal and external factors. The use of these sources permits elaboration of the specific artistic, historic, social, and scientific dimensions of the cultural heritage being examined.

Definitions

CONSERVATION: all operations designed to understand a property,know its history and meaning, ensure its material safeguard, and, if required, its restoration and enhancement.

INFORMATION SOURCES: all physical, written, oral, and figurative sources

which make it possible to know the nature, specificities, meaning, and history of the cultural heritage..

The Nara Document on Authenticity was drafted by the 35 participants at the Nara Conference on Authenticity in Relation to the World Heritage Convention, held at Nara, Japan, from 1-6 November 1993, at the invitation of the Agency for Cultural Affairs (Government of Japan) and the Nara Prefecture. The Agency organized the Nara Conference in cooperation with UNESCO, ICCROM and ICOMOS.
This final version of the Nara Document has been edited by the general rapporteurs of the Nara Conference, Mr. Raymond Lemaire and Mr. Herb Stovel.

Appendix 5: The WHEAP Leaflet

2007/2017
EARTHEN ARCHITECTURE
WORLD HERITAGE PROGRAMME

BACKGROUND

Since ancient times, people all over the world have used earth as their main building material. Earthen architecture has in a way become a symbolic expression of the human capacity to build, and to make the best use of the resources available in the nearby environment. Earthen architectural heritage includes a great diversity, ranging from archaeological sites to living monuments and from groups of buildings to historic towns and cultural landscapes. Today, about one third of the world population lives in houses made totally or partially with earth.

In 2007, 106 out of the 660 cultural properties inscribed on the World Heritage List incorporated earthen structures. However, some of these sites are threatened both by natural disasters and by changes to the environment (e.g. degradation of the environment, inappropriate use of modern technology, disappearance of traditional conservation practices). Furthermore, about a quarter of the cultural properties inscribed on the List of World Heritage in Danger are earthen architectural sites.

Considering that earth will probably remain in the coming years the most important resource available to build quality houses, it becomes urgent for the international community to focus on the safeguarding of the most outstanding earthen heritage around the world and to inform on its significant role for social improvement as well as its great potential for contributing to poverty alleviation.

This is to be achieved through development and dissemination of best practices of both conservation methods and techniques and technical adaptations using new available means, and through capacity building at State Party level. Implementation of these activities should be supported by agencies specialised on earthen architecture and involve research projects, pilot activities in the field, publications on the results, awareness raising and promotional activities.

Since its approval by the World Heritage Committee in 2001, the earthen architecture conservation Programme has carried out a range of projects including preparation of the conservation plans for Timbuktu and the Cliff of Bandiagara in Mali, the safeguarding of the Royal Palaces of Abomey (Benin), conservation activities at the archaeological site of Chan Chan, and training and restoration projects in Central Asia.

The proposed 2007-2017 programme whose structure is inspired by the successful AFRICA 2009 programme model is an integrated approach in all regions of the world for the formulation of appropriate conservation methods, techniques and policies for the sustainable conservation of earthen architectural heritage protected under the World Heritage Convention, and for a comprehensive collection and evaluation of the results and knowledge obtained.

PROGRAMME OBJECTIVES

- To develop appropriate methods and techniques for improving the sustainability of the conservation and the management of the different types of earthen architectural heritage inscribed on the World Heritage List and/or included in States Parties' Tentative Lists;
- To ensure that best practices are broadly disseminated for practical application at properties protected under the World Heritage Convention, with also possible broader application at the community level for the upgrading of the living conditions, as a contribution to poverty alleviation.

PROGRAMME ORIENTATIONS

- Development of in-depth pilot projects at selected World Heritage and Tentative List sites, including long term follow-up and evaluation in all regions of the world;
- Development of cooperation agreements with States Parties to develop conservation and research activities in the field of earthen architectural preservation;
- Development of series of activities to address specific thematic issues or Typologies;
- Contribution to sustainable development (social, economic, cultural) and poverty alleviation;
- Involvement of local communities and women in particular in programme activities;
- Reinforcement of the capacities of regional institutions around the world to address the conservation problems facing earthen architecture heritage;
- Progressive transfer of the programme management responsibility at the regional level;
- Consideration of the fundamental role of scientific research and of the capacity of the UNESCO Chair.

PROGRAMME MANAGEMENT

The programme will be managed by a steering committee composed of representatives of the main programme technical and financial partners.
UNESCO World Heritage Centre which will ensure the overall coordination of the Programme as well as its adherence to the strategic vision. It will regularly report to the World Heritage Committee on progress. CRATerre-ENSAG will obtain a primary advisory and coordinating role in the implementation of in situ and research projects activities, and it will report back to the steering committee. ICCROM will advise on training activities and will develop training materials in collaboration with CRATerre-ENSAG. ICOMOS will coordinate all necessary studies on the World Heritage List and the tentative lists. For Africa and the Arab states, EPA in Benin, CHDA in Kenya and CERKAS in Morocco are identified as potential regional secretariats. Institutions in the other regions will be identified during the first phase of the programme.
A scientific counsellor with expertise in the field of earthen architecture conservation, recruited by the World Heritage Centre, will assure daily coordination of the work between the World Heritage Centre, Programme partners, World Heritage site managers and representatives of States Parties to the Convention.

TECHNICAL PARTNERS INVOLVED IN THE ACTIVITIES

The programme involves the main international and regional institutions with the professional competency to contribute to the Programme's implementation:
CRATerre-ENSAG as the focal point of the UNESCO Chair of "Earthen Architecture, Building Cultures and Sustainable Development;
ICCROM as the priority partner of the World Heritage Committee for training (Global Training Strategy) and in the development and implementation of the Global Strategy for a representative, balanced and credible World Heritage List;
ICOMOS, as the priority partner of the World Heritage Committee in the evaluation of properties nominated for inscription on the World Heritage List, and monitoring the state of conservation of World Heritage cultural properties, through its International Scientific Committee for earthen Architecture; and
EPA in Benin, **CHDA** in Kenya, and **CERKAS** in Morocco, as regional institutions.

In addition to the technical partners of the Programme, several other institutions will collaborate during specific activities. National institutions in charge of Cultural Heritage and local Government authorities will also be involved wherever possible.

FINANCIAL SUPPORT

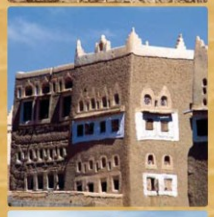
In addition to seed money provided by the World Heritage Committee, international donors and sponsors will be called to help ensuring that proper funding for the programme is secured. Of course, national heritage institutions as well as local authorities and stakeholders are to contribute to the provision of the means necessary to implement activities at the local level. Links with other programmes will also be studied (Africa 2009 and its possible follow-up programme, ATHAR, World Heritage risk preparedness and climate change programmes).

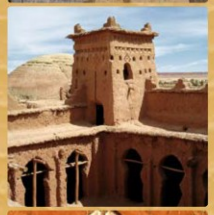
EARTHEN ARCHITECTURE

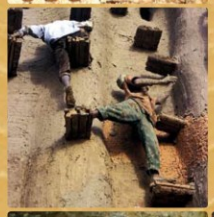
WORLD HERITAGE PROGRAMME 2007/2017

United Nations Educational, Scientific and Cultural Organization

World Heritage Convention







PROGRAMME ACTIVITIES

IN SITU PILOT PROJECTS

Towards developing "best practices" examples:

- Elaboration of conservation and management plans;
- Conservation projects for monuments, historic towns and archaeological sites;
- Conservation projects for sustainable tourism development;
- On-site training for site managers, technicians, artisans, tourist guides;
- Elaboration of technical guide lines for restoration and rehabilitation;
- In-situ experiments and other research activities;
- Close follow-up of implementation with regular technical inputs.

RESEARCH

Scientific research and applied research at site level will comprise:

- Laboratory research on raw materials, stabilization, damp migration;
- Applied research and documentation;
- Experimentation using prototype samples and other methods;
- Thematic seminars with site managers and earthen architecture specialists;

TRAINING

Increase opportunities for specialized training:

- Organization of thematic courses;
- Assistance to Regional institutions in developing training on earthen architecture at different levels (vocational, basic, university, Post graduate);
- Preparation of teaching material for dispatch to and use by the UNESCO earthen architecture Chair network.

PROMOTION / ADVOCACY

Ensure better recognition at international and national levels through:

- Publication of a series of technical books on earthen architecture in general and on World Heritage earthen architecture in particular (management plans, preventive conservation, etc.);
- Organization of exhibitions and participation in festivals;
- Organization of regional workshops on conservation of earthen architecture;
- Organization of international conferences on earthen architecture and partnership for Terra conferences organized by the Getty Conservation Institute.

PROGRAMME STRUCTURE AND SPECIFIC ACTIVITIES

The Programme will last 10 years and will be structured in 4 phases:

PHASE 1 (2007-2008)

PREPARATION

- A partners consultation meeting for the determination of the Programme strategy for each region;
- Analysis of the World Heritage List: inventory of properties with earthen materials assets, identification of typologies, state of conservation and threats, indicators for measuring speed of decay;
- Support for the participation to the Terra Conference (organized by Getty Conservation institute) to promote the earthen architecture conservation.
- Preparation of a costed multi-year programme document with a realistic work plan aiming at prioritizing the various components of the Earthen architecture programme;
- Preparation of a fundraising and marketing document on the Programme;

PHASE 2 (2009-2010)

PILOT PHASE

- 2 regional meetings and 2 training workshops for site managers and decision-makers from Africa and Arab States on earthen architecture preservation;
- In situ projects in Africa and Arab States addressing specific typologies and focusing on rehabilitation and management;
- Preparation of nomination dossiers for inscription on the World Heritage List;
- Laboratory research for restoration techniques;
- Development of a strategy to ensure an effective transfer of the Programme management to Regional training Institutions;
- Promotion and advocacy (books and technical guides).

PHASE 3 (2011-2014)

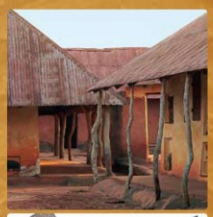
CONSOLIDATION PHASE

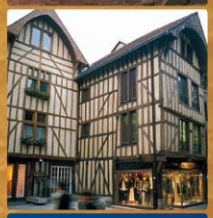
- 2 regional meetings and 2 training workshops for site managers and decision-makers on earthen architecture preservation (Latin America, Central Asia);
- In situ projects addressing a specific typology and focusing on applied research and experimentation on restoration;
- Studies for setting-up of monitoring mechanisms;
- Preparation of curricula for training and educational activities in earthen architecture;
- Elaboration of best practices guides for earthen architecture conservation and sustainable management;
- Publications of series of technical books;
- Launching of progressive decentralization of the management, transfer of training and in-situ Project activities to regional training institutions.

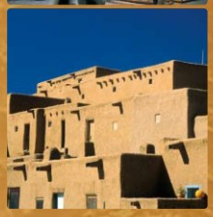
PHASE 4 (2015-2017)

FINAL PHASE

- 2 regional meetings and 2 training workshops for site managers and decision-makers on earthen architecture preservation (Europe, Asia);
- Regional meetings for site managers and decision-makers on the results achieved;
- In situ projects addressing a specific typology and focusing on applied research and experimentation on restoration;
- Transfer of earthen architecture conservation curricula to Universities and Regional training institutions;
- Synthesis of the results achieved, evaluation, conclusions, recommendations;
- Finalization of the publications.







EXPECTED OUTPUTS

By its conclusion in 2017, the Programme will have achieved the following ten outputs:

- Identification and understanding of problems earthen architecture heritage is exposed to, in the larger context of sustainable development;
- Development of policies for conservation, use or revitalization and valorization of earthen architecture heritage protected under the Convention;
- Definition of appropriate methods and techniques of interventions concerning earthen architecture;
- Organization of training and awareness activities by regional training institutions;
- Elaboration or updating of management and conservation plans for at least 25 World Heritage properties;
- Preparation of technical specifications for the restoration of historic towns as well as for the inclusion of modern infrastructures;
- Efficient protection and enhancement of at least 15 earthen architecture sites protected under the Convention;
- Organization of at least 4 capacity building activities in earthen architecture conservation and management with regional training institutions;
- Involvement of trained national professionals and other skilled persons in all countries with earthen architecture sites;
- Setting-up of an active global network for exchange of information and experience.

Appendix 6: The WHEAP Inventory Sites

AFRICA
Bénin
Palais Royaux d'Abomey
Burkina Faso
Les ruines de Loropeni
Ethiopie
Lalibela
Harar Jugol, the fortification historic town
Gabon
Ecosystème et paysage culturel relique de Lopé-Okanda
Ghana
Bâtiments traditionnels Ashanti
Madagascar
Colline Royale d'Ambohimanga
Mali
Vieilles villes de Djenné
Tombouctou
Falaises de Bandiagara
Tombeau des Askias, Gao
Mozambique
Island of Mozambique
Nigéria
Forêt sacrée d'Osun-Oshogbo
Sukur Cultural landscape
Ouganda
Tombes de rois Buganda à Kasubi
Togo
Koutammakou

ARAB STATES
Algérie
Vallée du M'Zab
Casbah d'Alger
Bahrain
Qal'at al-Bahrain
Egypte
Ancient Thebes and its Necropolis
Maroc
Medina de Fès
Medina de Marrakech
Ksar de Ait Ben Haddou
Cité de Meknes
Site archéologique de Volubilis
Mauritanie
Anciens Ksours de Ouadane, Chinguetti, Tichitt et Oualata
Iraq
Hatra
Assour (Qal'at Cherqat)
Ville archéologique de Samarra
Oman
Fort et oasis de Bahla
République Lybienne
Vieille cité de Ghadamès
Saudi Arabia
Al-Hijr archaeological site (Madan Sâlih)
République arabe syrienne
Ancienne cité de Damas
Ancienn cité d'Alep
Tunisie
Cité de Carthage,
Medina de Tunis
Ville Punique de Kerkouane et sa necropolis
Medina de Sousse
Yémen
Vieille cité de Shibam et ses murs
Vieille cité se Sana'a
Ville historique de Zabid

ASIA PACIFIC REGION
Afghanistan
Paysage culturel et vestiges archéologiques de la vallée de Bamiyan
Minaret and archaeological remains of Jam
Chine
La Grande Muraille

Caves de Mogao
Mausolée du premier Empereur Qin
Historic Centre of Macao
Ensemble historique du Palais du Potala, Lhassa
Yin Xu
Tulou de Fujian

Corée du Sud

Ensemble du palais de Changdeokgung
Royal tombs of Joseon Dynasty

Corée du Nord

Complex of Koguryo tombs

India

Churches and convents of Goa

Iran (République islamique d')

Meidan Emam, Ispahan
Site de Tchogha Zanbil
Persépolis
Takht-e Sulaiman
Bam et son paysage culturel
Soltaniyeh
Behistun
Shustar, Historical Hydraulic System

Japon

Monuments Bouddhistes de l'aire de Horyn-ji
Himeji-jo
Monuments historiques de l'ancienne Kyoto
Villages historiques de Shirakawa-go et Gokayama
Autel Shinto d'Itsukushima
Monuments historiques de l'ancienne Narra
Autels et Temples de Nikko

Népal

Vallée de kathmandou

Pakistan

Ruines archéologiques de Moenjodaro

Ouzbékistan

Site d'Itchan Kala
Centre historique de Boukhara
Centre historique de Shakhrisyabz
Samarkand, crossroad of cultures

Sri Lanka

Old Town of Galle and its fortification

Turkménistan

Parc culturel et historique d'état de l'ancienne Merv
Kunye Urgentch
Forteresses Parthes de Nisa

EUROPE AND NORTH AMERICA

Espagne

Centre historique de Cordoba
Alhambra, Generalife et Albayzin, Grenade
Parc Güell, Palais Güell, et Casa Mila à Barcelone
Old Town of Caceres
Cathédrale, Alcazar et Archivo de Indias à Séville

Etats-Unis d'Amérique

Site de Mesa Verde
Site historique d'état des Cahokia Mounds
Parc historique national de la Culture Chaco
Pueblo de Taos

France

Canal du Midi
Ville historique de Lyon
Ville médiévale de Provins
Fortification of Vauban

Israel

Biblical Tels

Portugal

Centre historique d'Evora
Centre historique de Porto
Centre historique de Guimaraes

Royaume-Uni de Grande Bretagne et d'Irlande du Nord

Mur d'Hadrien

Azerbaidjan

Les Murs de la ville de Bakou avec le Palais Shirvanshah et la Tour Maiden Tower

LATIN AMERICA AND THE CARIBBEAN

Bolivie

Ville de Potosí

Ville historique de Sucre

Brésil

Ville historique d'Ouro Preto

Centre historique de la ville d'Olinda

Centre historique de Salvador de Bahia

Centre historique de São Luís

Centre historique de la ville de Diamantina

Centre historique de la ville de Goias

Colombie

Port, fortresses and group of monuments, Cartagena

Historic centre of Santa Cruz de Mompox

National archaeological park of Tieradentro (dugouts tombs)

Chile

Historic quarter of the seaport city of Valparaiso

Sewell mining town

Cuba

Vinales valley

Le Vieux Havane et ses fortifications

Ville de Trinidad et Vallée de Los Ingenios

Urban historic center of Cienfuegos

Historic centre of Camagüey

Équateur

Ville de Quito

Centre historique de Santa Ana de los Rios de Cuenca

El Salvador

Site archéologique de Joya de Ceren

Guatemala

Antigua Guatemala

Mexique

Historic Monuments Zone of Querétaro

Cité préhispanique de Teotihuacan

Centre historique de Oaxaca et site archéologique de Monte Alban

Centre historique de Puebla

Ville historique de Guanajuato et ses mines d'argent

Centre historique de Morelia

Centre historique de Zacatecas

Zone archéologique de Paquimé, Casas Grandes

Protective town of San Miguel & the sanctuary of Jesus Nazareno

Pérou

Ville de Cuzco

Zone archéologique de Chan Chan

Centre historique de Lima

The sacred city of Caral-Supe

Uruguay

Quartier historique de la ville de Colonia de Sacramento

Venezuela (République bolivarienne du)

Ville de Coro et son port de La Vela