

CENSUS OF ABANDONED BUILT HERITAGE ASSETS: THE IMPORTANCE OF DEFINING SHARED METHODOLOGIES AND ONTOLOGIES

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ABSTRACT:

The paper shows the studies carried out within the framework of two research agreements for the census of abandoned enlisted assets owned by public bodies in the Provinces of Piacenza, Parma and Reggio Emilia, stipulated with the respective Heritage Departments. The purpose of this research is to increase the cognitive framework of cultural assets in a state of abandonment, and then to transfer the results to the dedicated WebGIS platform, with the aim of identifying the ones which are most in need of a conservation and reuse intervention, in order to return them back to their community. Afterwards, as a result of the cataloguing carried out, it was possible to make some critical considerations and statistical reworkings of the collected data. The data analysis, performed through the design of a GIS database, finds out a higher frequency of abandonment for some specific building types and with recurring locations. The research also highlights, once again, the importance of defining common ontologies, which are essential for statistical data processing and interoperability between different existing databases.

1. INTRODUCTION

1.1 Conservation Policies: the importance of the program phase

The restoration project can be considered as the final result of a broader and more complex process that begins with the recognition of what is a Cultural Heritage asset - tangible and/or intangible - that carries a value to be preserved. Considering the heterogeneity of the Cultural Heritage(CH), the specialized skills required for multi-level activities related to the built heritage conservation and the spread of sustainable orientations, it seems of primary necessity to identify new models to promote the transition to more effective forms of intervention and management of the historic built environment (Della Torre and Oteri, 2020).

In this perspective, specific attention is paid not only to the social and sustainable role of conservation, but also to the importance of the preliminary census and planning phase, able to identify priorities and long terms strategies of interventions, with the related economic and territorial issues. These activities can be considered the basis for an effective management of conservative policies, aiming at the optimization of and financing strategies.

Such aspects, already discussed in the 1990s (Benhamou 1996; Lai, 1998; Pickard 2009), have recently returned in the core of the restoration debate because of the restriction of resources for heritage conservation (Bagwell, Corrie, Rotheroe 2015). In this context, the need for the integration of multiple objectives arises (Van Balen, Vandesande 2016) and the importance of the evaluation of benefits of greater social relevance with a view to territorial capitalization and the experimentation of new tools emerges (Boniotti, Della Torre 2016).

Several research projects, e.g. the European project CHANGES (Della Torre, 2020) have analyzed the funding policies adopted so far in order to identify the most effective ways to ensure the quality of the projects, the competence of the people involved and the centrality of the object to be restored.

These studies highlight that the program phase, which is preliminary to planning, assumes a key role since, during this phase long-term strategies can be introduced, alliances can be formed, quality levels can be defined, the use of technologies can be mandated, and expertise can be targeted to be recovered (Della Torre 2015). Moreover, the cited research proved that innovative tools make preservation strategies more feasible, while also enabling cost reductions: for example, digitization and interoperability can reduce the costs of information management, sometimes prohibitive.

Therefore, considering that the design and regulation of financing strategies and common conservative policies deeply influence the operational conditions of restoration, it is important to adopt an effective approach to management of planning phase, also with the support of innovative tools such as information systems, which make it possible to analyze large quantities of georeferenced data, manage the exchange of information and direct conservation methods towards effective strategies.

1.2 GIS database and the importance of shared ontologies for architectural heritage

To preserve built heritage assets, it is essential to establish common methodologies for its knowledge and management, as declared in (UNISDR, 2017). Among the available tools, Geographic information systems (GIS) are one of most in use for the large-scale management of Cultural Heritage. However, the proliferation of different databases, especially in the field of CH, designed with specific purposes and therefore with specialized lexicons, has resulted in an overabundance of data, heterogeneous and with ambiguous meanings (Acierno, Fiorani, 2019). This fact can lead to the misinterpretation of information as well as to the loss of data (Cerutti, Noardo, Spanò, 2015). In order to avoid this risk, different international CH institutions developed standard and shared ontologies and vocabularies for different fields of Cultural Heritage. The International Council of Mounments (ICOM) developed the "CIDOC conceptual

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reference model" (CIDOC-CRM), which represents a standard core ontology for sharing information between museums, archives and libraries (Cerutti, 2015). Moreover, among the projects aimed at identifying shared ontologies, "Europeana" (<https://www.europeana.eu/it>) is also included to improve the interoperability among European CH. On this basis, other ontologies, more specific to the field of architecture, have been developed. For example, among the various vocabularies offered by the Getty Institute, The Art and Architecture Thesaurus (AAT) collects terms for categorizing works of art and architecture (Colucci, 2018). While the System for Monument Damage Description (MONDIS) represents a first attempt to synthesize the analysis of decay and damage mechanisms of historic buildings, though with a predominantly mechanical approach and operative purpose (Fiorani, 2017). Moreover, the field of Historical Architectural Heritage currently presents some difficulties, especially related to the need for continuously updating of the data about the use, the maintenance and restoration.

On the basis of these international databases, in the Italian context different national databases have been designed. The SIGECWeb, General Catalog Information System (ICCD, 2023), is the informative tool, developed by the ICCD (Central Institute for Catalogue and Documentation), through which the Ministry of Culture manages the cataloging of listed assets, movable and immovable (Fiorino, Loddo, 2015). While the Risk Map (MiC, 2023) is the first ontology specifically focused on the architectural conservation process (Acierno, Fiorani, 2019;). In detail, this database evaluates the risks (natural and anthropogenic) of loss of architectural and archaeological assets in Italy (Fiorani, Cacace, 2020). Moreover, based on these national databases, additional regional-scale databases were defined.

For the purposes of this research, the WebGIS - Cultural Heritage of Emilia-Romagna. (Regional Secretariat for Emilia-Romagna, 2022) has been a fundamental support to the census phase. In fact, the cataloguing of abandoned built heritage, which will be described in the following paragraphs and which led to the populating of a specific online WebGIS ministerial platform (MiC, 2022), involved the use of the vocabularies already used in the aforementioned Italian databases (and in particular the regional one). Indeed, the goal is to take advantage of ontologies already shared at the national scale and avoid the aforementioned risk of misunderstanding. Specifically, the database was developed in Italian language and the vocabulary was translated for this publication. Instead, with regard to data necessary for the purposes of the census, but not present in the databases consulted, for example the state of conservation of the buildings, shared parameters were defined in advance, which will be explained in the following paragraphs.

1.3 Italian policies for conservation of abandoned Cultural Heritage and an applied research on three provinces

The issues related to the concept of sustainability in the project of architectural restoration have been recently addressed at the Italian national level, with the aim of opening a new reflection on how to develop the project of restoration and enhancement of abandoned cultural property, which also takes into account social, economic and community aspects, in order to achieve harmonization, balance and coherence between the historical and cultural values of the property and context and the vision of the present and future of the place.

The protection of abandoned cultural assets is among the strategic objectives of the Ministry of Culture – "Direzione

generale Archeologia, Belle Arti e Paesaggio" (DG ABAP), which since 2019 has launched, through the Superintendencies, a reconnaissance of abandoned cultural assets in the national territory with the aim of restoring and enhancing them in order to make these assets usable through reopening to the public, to return them back to the community.

The present paper shows an applied case of information system aimed at managing a particular category of assets, those in a state of abandonment - i.e., currently totally or partially without continuous use, regardless of the state of conservation. More specifically, the paper illustrates the studies carried out within the framework of two research agreements for the census of abandoned enlisted assets, owned by public institutions, in the Provinces of Piacenza, Parma and Reggio Emilia (Fig. 1), stipulated with the respective Heritage Departments. This project was carried out in coordination with the Universities of Bologna, Ferrara and Parma, that have been in charge of the census of assets in their respective territories. The need to proceed with a census of abandoned cultural heritage derives directly from the implementation of legislative provision No. 32/2022 of "Direzione Generale Archeologia Belle Arti e Paesaggio" based on the MIBACT-MEF interministerial decree rep. 583/2020. The purpose of this research, carried out between September and December 2022, is to increase the cognitive framework of cultural assets in a state of abandonment, and then to transfer the results to the dedicated ministerial WebGIS platform (MiC, 2022), with the aim of defining priorities to optimize conservation policies for CH. The final goal is to identify the assets that are most in need of a conservation and reuse intervention, in order to return them back to their community. The results of the census, which will be presented in this article, are also available on the open-access WebGIS platform mentioned above.



Figure 1. Localization of the Provinces of Piacenza, Parma and Reggio Emilia in Emilia-Romagna Region (North of Italy).

2. CENSUS OF ABANDONED BUILT HERITAGE ASSETS

2.1 Collection of the data, taking advantage of existing GIS database

A first phase of identification of abandoned built heritage was possible thanks to reports from the owner institutions (State Property Office, Province, Municipalities, Curia etc.). A second phase consisted of verifying the state of use of the rest of listed buildings, through onsite inspections and further examination in collaboration with the Heritage Departments.

Due to the large number of buildings to be checked (nearly 2 thousand) and the need for their unique identification, the cataloguing of abandoned assets has been based on the data stored in the existing regional WebGIS database (Regional

Secretariat for Emilia-Romagna, 2022). This choice was based not only on the need to start from datasets, relating to protected property, that existed and were reliable, but also on the wish to create uniformity between adopted denominations and vocabulary, thus attempting to work in a perspective of interoperability between the existing regional database and the ministerial database, on a national scale, which is being completed. The latter unfortunately does not seem to have been designed in an interoperable key with other databases currently already in use by the same Ministry, such as Risk Map (MiC, 2023) and SIGECWeb (ICCD, 2023). As mentioned above, the risk is further fragmentation of knowledge and lack of use the collected data. In order to design an interoperable database, the first step of the cataloging phase was the check of which fields, in attribute tables of the shapefile downloaded from existing regional WebGIS database (Regional Secretariat for Emilia-Romagna, 2022), could be useful. The adopted fields are shown in Table 1.

Field	Description
ID code	Unique identification code of the asset, consisting of the ISTAT code of the municipality and of a sequential number.
Name	Main name of the asset.
Other name	Other name of the asset.
Property	Type of ownership (public, private, ecclesiastical, mixed) .
Province	Name of the province in which the property is located.
Municipality	Name of the municipality in which the property is located.
Address	Main address of the property, including house number if available.
Type of protective restrictions	Description of the type of protective restrictions (decree or <i>ope legis</i>).
Decree	Name of the decree that the protect the asset.
Category	Classification by functional macro-types.
Typology	Classification of formal types of architectural construction.
Chronology	Century of construction of the asset, expressed in Roman numerals.

Table 1. Fields, of attribute tables of regional WebGIS, used for this research.

In detail, the Table 2 shows the correspondence between the category field, which is used for the next step of statistical data analysis, and the related typology sub-field. Due to the wide typological variety of the assets surveyed, in the regional database, only the typologies of abandoned assets are shown below.

Category	Typology
Cemeteries	Cemetery
Industrial Buildings	Industrial Building, Furnace, Slaughterhouse
Military Buildings	Barracks
Church Buildings	Church, Convent/Monastery, Oratory, Rectory
Residential Buildings	House, Palace, Villa

Rural Buildings	Rural House, Barn
Individual Architectural Elements	Memorial Building, Cheese factory
Fortress	Curtain walls, City gate/Arch, Castle, Tower
Buildings for water mains	Mill/Hydraulic Building
Road Infrastructure	Bridge
Civil Buildings	Hospital, School, Town hall
Theaters	Theater

Table 2. Denominations used for the fields Category and Typology.

2.2 Definition of shared methodologies and ontologies for the original data

During a second phase, a physical model was developed to add the necessary fields – and related consistency domain - for the specific census (Tab. 3).

Field	Description	Consistency
Abandoned	Specify if it is an abandoned asset or not.	Domain: -YES -NO
State of conservation	Indicate, according to the proposed qualitative scale, the state of conservation of the property.	Domain: -poor -avarage -good -excellent
Existing projects of conservation	Enter any reuse or restoration projects in this field.	Domain: -YES -NO
Type of project	Enter in this field the level of detail of the project, in compliance with Italian technical laws, if any.	Domain: - feasibility - executive - definitive - in execution
Cadastral identification	Enter map sheet number, parcel number, sub-parcel number.	

Table 3. Physical model of the added original fields.

This physical model was shared with the research team, in order to guarantee the uniformity of the data collected. In fact, it was necessary to define a shared methodology, with a focus on the identification of univocal vocabulary - not established in advance by the ministerial platform - to ensure that future evaluations are as objective and shared as possible (Acierno et. al., 2017). For example, a shared qualitative scale was defined for describing the state of conservation of the buildings surveyed in the different territories (Tab. 4). This qualitative scale was also shared with the other Universities, involved in the research agreement, and applied on the whole territory of Emilia. Thanks to the adoption of a uniform judgment criteria, it will be possible in the future to carry out coherent analyses of the state of conservation of assets, on a large scale.

Poor	Widespread collapse or in a state of ruin.
Average	Local collapse or damage to structural

	elements, as well as advanced surface decay.
Good	Surface cracks and stationary decay of surfaces.
Excellent	No damage.

Table 4. Qualitative scale of the state of conservation.

3. CRITICAL CONSIDERATIONS AND STATISTICAL REWORKINGS OF THE COLLECTED DATA

Afterwards, as a result of the cataloguing carried out, it was possible to make some critical considerations and statistical reworkings of the collected data. The analyses showed that, out of 1983 buildings considered, 105 were abandoned (Fig. 2), which is about 5% of the listed public heritage in the provinces examined. In particular, abandoned buildings are equally distributed among the three provinces: 37 assets in Parma, 38 in Piacenza and 31 in Reggio Emilia. Moreover, the following paragraphs illustrate the statistical analysis, which finds out a higher frequency of abandonment for some specific building types and with recurring locations.

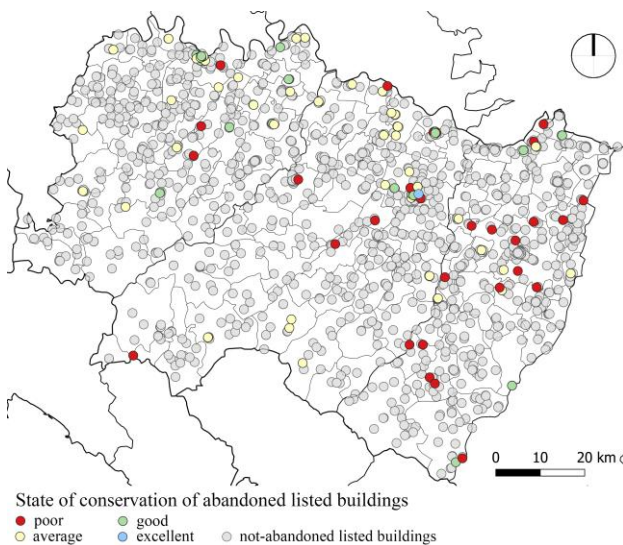


Figure 2. Thematic map of the abandoned buildings, classified by state of conservation.

3.1 Analyses and queries of data by attribute

The analyses focused especially on two fields: typology and state of conservation. In particular, it was found that the most frequently abandoned typologies are the industrial buildings (which include furnaces and slaughterhouses, dating back to the first half of the 20th century) and rural buildings (Fig. 3), which today are no longer adequate to perform their original function. Fortified architectures (castles, towers or city walls) are another typology that is in a state of frequent abandonment, especially when located in areas of difficult accessibility (Fig. 3), as will be better illustrated in the following section. Furthermore, it is possible to note that although in percentage the religious buildings are the least abandoned, numerically there are as many as 22 church assets without use, second only to residential buildings (29 assets). Numerically, there are also numerous abandoned buildings, that belong to the "civil structures" typology (Fig. 3). In this case, there are 12 abandoned buildings, including 9 schools (belonging to the typical typology in use in the 1920s, which today are no longer in compliance with standards), 2 town halls (located in current districts, which were once municipal offices), and finally the old Hospital in the historic center of Parma.

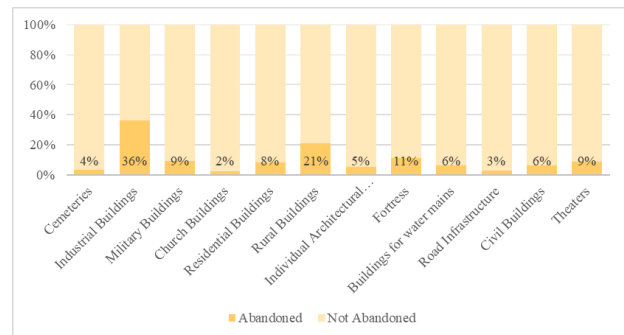


Figure 3. Bar graph of the percentage of abandoned typologies.

In addition, the analysis of the "state of conservation" field shows that 76% of the abandoned built heritage is in poor and average condition and only about 24% is in good or excellent condition (Tab. 5), proving the importance of continued use of the asset for its preservation.

Poor	29,5%
Average	46,6%
Good	22,8%
Excellent	0,9%

Table 5. Distribution of the state of conservation

Afterwards, a comparison between state of conservation and typology was carried out. At the moment, no significant correlations seem to arise in this regard, because there are no typologies in a worse state of conservation than others. therefore the cause of poor state of conservation is to be found in other factors.

3.2 Analyses and queries of data by location

For more in-depth analysis, a GIS database was designed, with the open-source software QGIS. Indeed, thanks to the georeferencing of the collected data, it was possible to verify the subsistence between the state of abandonment and the location of the asset at large scale. In detail, the field of architectural category was compared with the number of inhabitants of the urbanized areas and altitude of the municipality, in which the assets are located. The shapefiles used to populate the database, and from which subsequent considerations are then derived, are shown in Table 6.

Name of shapefile	Geometry	Source
Urban area (locality)	polygon	ISTAT database
Municipality	polygon	ISTAT database
Province	polygon	ISTAT database
Listed Buildings	point	WebGIS of Emilia-Romagna Region

Table 6. Shapefile upload in the designed GIS database.

In particular, the attribute table of the "Urban area" shapefile contains data on the number of inhabitants, on which some considerations could be carried out. From the original "Listed Buildings" shapefile, only records related to abandoned assets were then selected, through a query by attribute of the "Abandoned" field.

Analysis by number of inhabitants of urbanized areas. The aim of this query is to verify if there is a correlation between the state of abandonment of the built heritage and its location outside of major urban centers. This query by location shows that 63% of the abandoned assets are located in non-urbanized areas or within smaller towns, i.e., with less than 10000

inhabitants (Fig. 4). Among the typologies widely present in both urbanized and rural areas, for example church and residential buildings, it is interesting to note that the state of abandonment is greater outside of major urban centers, i.e., where there are probably fewer opportunities to define an effective and lasting reuse project. In particular, 64% of church buildings and 59% of residential buildings are located outside major centers (Fig. 5). The same bar graph also shows that military buildings are all located in urban areas. This is because this category includes former barracks, located in the historic center of the city of Piacenza, which are currently in a state of abandonment, because they no longer conform to their original use.

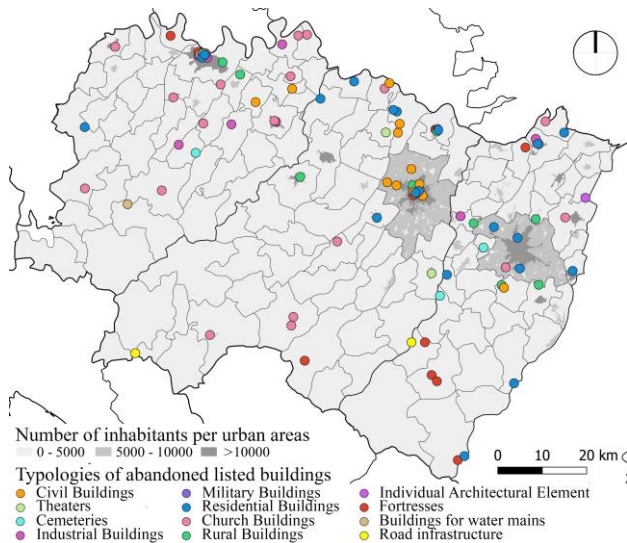


Figure 4. Thematic map of the typologies of the abandoned assets and number of inhabitants per urban areas.

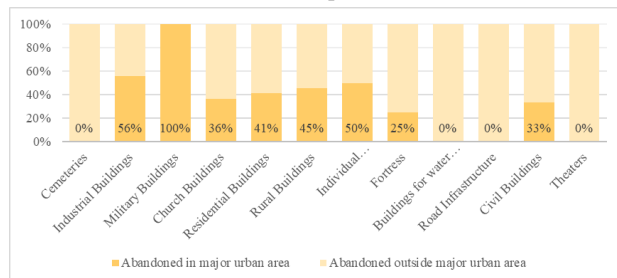


Figure 5. Bar graph of the percentage of the typologies of the abandoned assets and number of inhabitants per urban areas.

The analysis by altitude of the municipalities was carried out in order to see if it is possible to identify a recurrence among the abandoned typologies and the type of territory. For this reason, the three provinces were divided into four altitude bands (Fig. 6), with mountainous areas being located in the South and flat areas in the North. In the mountain areas, it was possible to identify the abandonment of fortifications (Fig. 7), particularly watchtowers, because, in order to perform their function, they are generally placed in points of difficult accessibility. The theme of difficult accessibility in mountainous areas also recurs for the types of Buildings for water mains and bridges. Certainly the problem of abandonment of mountainous areas is a very broad issue involving not only listed buildings, but entire smaller towns (Oteri, Scamardi, 2020). However, most of the abandoned properties are in the middle range (40-90 m above sea level), where the larger urban areas are located.

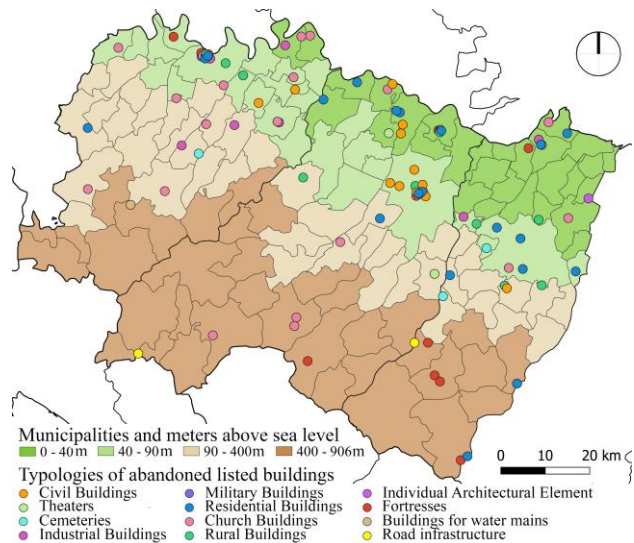


Figure 6. Thematic map of the typologies of the abandoned assets and meters above sea level.

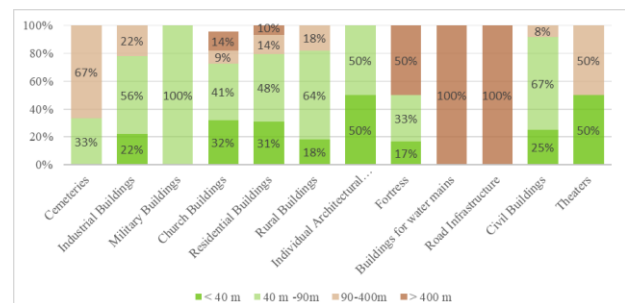


Figure 7. Bar graph the percentage of the typologies of the abandoned assets and meters above sea level.

4. CONCLUSIONS

The paper showed the results of the census of abandoned built heritage assets, carried out between September and December 2022, in the provinces of Piacenza, Parma and Reggio Emilia. In particular, thanks to the design of a specific GIS database, it was possible to define some statistical correlations between typologies, state of conservation and location.

The analyses carried out represent a first step of knowledge, that will necessarily need to be further investigated. In the future, further analyses could be carried out, for example regarding the accessibility of the built heritage and its proximity to major road axes, in order to understand, and thus prevent, the causes of abandonment and also to improve the management of public funds for the buildings, that can be successfully re-functionalized and thus provide a service to the community. Moreover, a further cause of abandonment could be related to damage produced by the earthquake, which widely affected the North area of the province of Reggio Emilia in 1996 and also in 2012. In addition, future censuses, including private buildings, may provide additional data to define more reliable prediction of the risk of abandonment, in order to act with planned conservation strategies. In this regard, the study underlines the importance of a common and shared ontology to guarantee the interoperability of the collected information, optimizing activities and available resources for the conservation of abandoned architectural heritage. Indeed, another focus point of the project is the interoperability with existing information systems, which represents an important milestone for the studies on the digitalization for conservation.

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