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Authors	Yasuhisa Kondo, Akihiro Kaneda, Yu Fujimoto, Yoichi Seino, Hiroshi Yamaguchi, Tomokatsu Uozu
Citation	Revive the Past: Proceeding of the 39th Conference on Computer Applications and Quantitative Methods in Archaeology, Beijing, 12-16 April 2011,, , pp. 326-333
Pub. date	2012, 3

The CEDACH DMT: a Volunteer-Based Data Management Team for the Documentation of the Earthquake-Damaged Cultural Heritage in Japan

Yasuhisa Kondo

Tokyo Institute of Technology and Japan Society for the Promotion of Science, Japan.
kondo@archaeo.cs.titech.ac.jp

Akihiro Kaneda

Nara National Research Institute for Cultural Properties, Japan.

Yu Fujimoto

Doshisha University, Japan.

Yoichi Seino

Kyoto University, Japan.

Hiroshi Yamaguchi

International Research Center for Japanese Studies and Japan Society for the Promotion of Science, Japan.

Tomokatsu Uozu

Otemae University, Japan.

Abstract:

The Great East Japan Earthquake and tsunami on March 11, 2011 caused immense damage not only to the residents and social infrastructure, but also to cultural heritage. In order to document the endangered heritage and support cultural resource management (CRM) associated with the restoration activities, a self-motivated group of archaeologists, historians, and CRM specialists established the Consortium for Earthquake-Damaged Cultural Heritage (CEDACH). This paper reports current activities of its data management team (DMT). The team's first task was to create a portal website and a web-based geospatial information infrastructure, the CEDACH GIS, to document the damaged and endangered heritage. We are also developing a data management system (DMS) to support local CRM inspections. Currently, we need more channels for liaising with other organisations involved in the same task for our long-term activities.

Key Words: *Great East Japan Earthquake, Cultural Resource Management, Geographical Information Systems, Consortium for Earthquake-Damaged Cultural Heritage, Data Management Team*

Introduction

The Great East Japan Earthquake and cultural heritage

The magnitude 9.0 earthquake and tsunami hit

the vast areas of East Japan on March 11, 2011. It caused immense damage not only to the residents and social infrastructure (Shibahara 2011) but also to cultural heritage across those areas (Fig. 1) (Enomae and Higashijima 2011). In the press release 171 on November

24, 2011, the Ministry of Education, Culture, Sports, Science and Technology stated that at least 725 registered cultural assets were damaged, including five national treasures, 159 important government-designated cultural properties, and 90 historical sites (http://www.mext.go.jp/a_menu/saigaijohou/). The whole situation has not yet been fully grasped because these numbers exclude prefecture-designated, municipality-designated, and undesignated cultural assets. It is underlined that archaeological sites and artefact scatters, legally referred to as 'buried cultural properties', are in imminent danger from the removal of tsunami debris and construction works. It also has to be noted that, on the ground of extraordinary circumstances, the Agency of Cultural Affairs decided to allow urgent recovery works in the registered sites without notifying the cultural resource management (CRM) division of the concerned municipal offices as per the special measures of the Cultural Assets Preservation Act on March 25, 2011 (Agency of Cultural Affairs 2011). Expeditionary actions were needed.

CEDACH: the Consortium for Earthquake-Damaged Cultural Heritage

In order to document and protect cultural properties damaged and endangered by the earthquake, tsunami, and reconstruction works, a self-motivated group of archaeologists, historians, and CRM specialists established a Consortium for Earthquake-Damaged Cultural Heritage (CEDACH). The founders communicated and discussed on Twitter and Facebook, which resulted in the first meeting held at Nara in just 10 days after the quake. The consortium decided to organise two task forces – a data management team (DMT) and a technical support team (Fig. 2). The DMT is managing a portal website to share information with CEDACH members, CRM officers and affiliated organisations, and developing a web-based geospatial information infrastructure, the CEDACH GIS, to document the endangered



Figure 1. A historical building of Tsuchiura Castle (Ibaraki Prefecture) damaged by the Great East Japan Earthquake. Photo courtesy of Takachika Kimoto.

cultural heritage. In addition to these, DMT is designing a data management system (DMS) to help on-site inspections that local CRM officers, volunteers, and non-profit organisations (NPOs) will carry out with the technical support team. The CEDACH is administrated by a number of 'core members', but also welcomes volunteers with professional knowledge and skills to run projects. This paper reports on current activities of the CEDACH DMT and discusses its future tasks.

Portal Website

User-friendly portal

As its first activity, the DMT created a portal website (<http://cedach.org/>) to share information with the CEDACH members, CRM officers inside and outside of the disaster areas, affiliated organisations, and the general public. The site is created and run on Drupal (<http://drupal.org/>), an open source content management system (CMS), which enables us to create an intuitive and user-friendly graphical interface. The main contents are weblog style entries such as offline meetings, events, and press releases. Google Calendar and Google Maps are embedded to enhance the function of groupware. Every member is eligible to edit and

post entries. The portal also displays a timeline of tweets associated with CEDACH activities and RSS feeds from CEDACH Google Groups and Tumblr (see below).

Mailing list

The CEDACH employs two mailing list services in accordance with the nature of topics. Google Groups mailing list (<https://groups.google.com/forum/#!forum/cedach>) is used for public posts on general issues, while freeml (<http://freeml.com/>), a Japanese mailing list service, is selected for closed posts on administrative matters. Both mailing systems are actively used: there were 228 posts for Google Groups and 245 entries for freeml in May 2011. Both services also contribute to quick decision-making by a majority vote system.

News archiving

A large number of first-hand reports and accounts on the situation concerning the earthquake-damaged cultural heritage were posted on Twitter and Facebook (Matsuoka et al. 2011). However, tweets in Twitter disappear shortly, and access to the Facebook forum is limited to Facebook users. Alternatively, the CEDACH employs Tumblr (<http://tumblr.com/>), a charge-free simple blog service in order to clip and archive information and pictures of endangered cultural properties, as well as online news and press releases (<http://cedach.tumblr.com/>). There were 35 posts in May 2011, which meant one post per day in average.

Social media

The CEDACH takes full advantage of the social media that have rapidly widespread and penetrated into academic community in recent years (Ako and Kondo 2011; Oguchi et al. 2011).

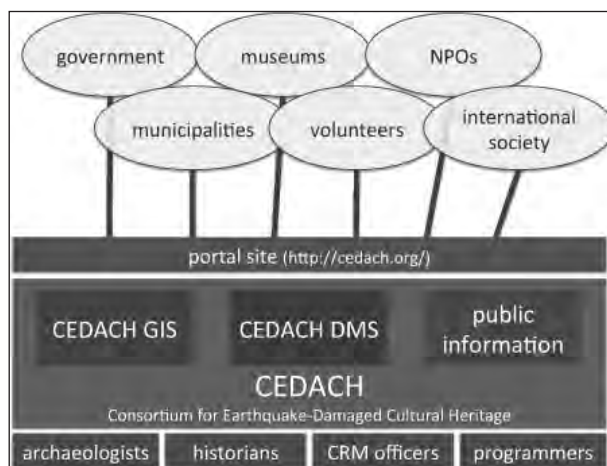


Figure 2. Organisation of the Consortium for Earthquake-Damaged Cultural Heritage (CEDACH).

The CEDACH has an official Twitter account (<http://twitter.com/cedach>) to distribute news and announcements. When tweets are re-tweeted by followers, they will be distributed to the Internet community which is as broad as real society. Similarly, meetings and workshops are broadcasted by means of Ustream (<http://ustream.tv/>), a charge-free live video streaming service.

CEDACH GIS

Purposes

As mentioned above, the principal purpose of the CEDACH GIS is to provide an information infrastructure for the documentation of the endangered cultural heritage, including built structures, monuments, historical materials, and archaeological sites, regardless of designation by the state, prefecture, and local municipality. The CEDACH GIS deals with two categories of geospatial information—base map sources and survey data (Fig. 3). The GIS map source includes: 1) topography, 2) aerial and satellite imageries captured before and after the tsunami, 3) intensity distribution of the earthquake, and 4) the locations of the cultural heritage that are registered by

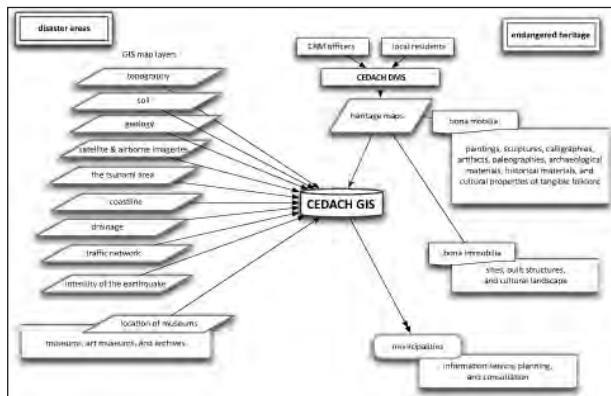


Figure 3. Data structure of CEDACH GIS.



Figure 4. Google Maps implemented by CEDACH GIS. The distribution of archaeological sites in Miyagi prefecture (after Morimoto 2003).

CRM offices. These types of information are required to analyse the geographical extent of the damage and to plan field rescue projects and inspections. The survey data is collected and inputted into the system by the technical support team and affiliates.

Volunteer-based projects

At the moment, a number of CRM officers and university students are working as volunteers to check the location of buried cultural properties in the earthquake and tsunami-hit areas, based on the nation-wide database hosted by the Nara National Institute for Cultural

Properties (<http://mokuren.nabunken.go.jp/Iseki/>). This project is being carried out in preparation for a future on-site collaboration and risk assessment (see section Issues and Challenges). Spreadsheets are prepared for each prefecture in the disaster area (Aomori, Iwate, Miyagi, Fukushima, Ibaragi, and Chiba, from the north to south). The sheets are shared and edited by means of Google Spreadsheet, a charge-free cloud application. Using this system, the volunteers are checking the geocoordinates of registered sites one by one, with reference to: 1) the Google Maps that displays the point features of sites created by means of Google Fusion Tables API (Figs 4 and 2) Watchizu, a map-browser system hosted by Geospatial Information Authority of Japan (<http://watchizu.gsi.go.jp/>). It is noted that the volunteers autonomously improve the workflow and update an operation manual on their own decision.

Preliminary analysis

The DMT is doing a pilot study to assess influence of the tsunami on archaeological sites by means of GIS. Figure 5 shows the area inundated by the tsunami and archaeological sites of the Onagawa Bay, Miyagi Prefecture. The background aerial photograph was taken on March 19, 2011 and georectified by the Geospatial Information Authority (<http://saigai.gsi.go.jp/h23taiheiyo-hr/>). Landward limit of the tsunami inundation was crosschecked with the information provided by the Geospatial Information Authority (<http://www.gsi.go.jp/kikaku/kikaku60003.html>), the Tsunami Damage Mapping Team, the Association of the Japanese Geographers (<http://danso.env.nagoya-u.ac.jp/20110311/>), and the OpenStreetMap Japan (<http://openstreetmap.jp/>). The archaeological sites are plotted on the basis of the geocoordinates recorded in the nation-wide database mentioned above. The tsunami flooded up to approximately 15m above the original sea level (Disaster Control Research Center, Tohoku



Figure 5. Tsunami areas (polyline) and sites (dots) in Onagawa, Miyagi Prefecture. See the text for the data source.

University 2011) due to the topographic setting in which small coastal plains are surrounded by steep hills and mountains. The map indicates that there are a number of sites located in the proximity of the inundated area. In this map, the sites are represented by centroids. However, those should be replaced by polygons that approximate the geospatial extent of settlement or artefact scatter in order to assess whether and how the tsunami influenced the sites more precisely. For this purpose, the CEDACH is planning to create the high-resolution polygon features of sites based upon the prefectural CRM maps and database.

CEDACH DMS

The CEDACH is also developing a data management system (DMS) to support on-site inspections of the endangered cultural heritage. It conforms to the international standard authorised by the International Organization for Standardization in order to ensure global applicability. To this end, the data acquisition method is designed to achieve a balance between technical standardisation and urgent on-site projects undertaken in various, and at times extremely difficult, circumstances. The fact that the potential users are local CRM officers and volunteers involved in rescue and



Figure 6. A screenshot of Survey Data Archivist (SDA) for Client.

inspection activities, and that some of them may have limited computer-, database-, and information-handling skills should also be taken into account. Such users would be too busy to be deeply involved in the redesigning and updating of the tool. Therefore DMT attempts to apply the methodology of 'working-oriented approach' (WOA), in which the system is designed to fit the on-site workflow and all data acquired in day-to-day fieldwork are managed as 'survey data objects' (Fujimoto 2010).

The CEDACH DMS will be an improved version of a field survey system named 'Survey Data Archivist (SDA) for Client' (Fig. 6) (Fujimoto et al. 2011). SDA for Client is based on the concept of WOA and is compliant with the ISO 191XX series. The application schema requires slight modifications to fit the on-site inspection of damaged heritage in order to meet the needs of local CRM specialists.

Issues and Challenges

Information handled as effectively as possible

The nature of information on the damaged and endangered cultural heritage is ever-changing. Early reports and rumours about the damage

of specific cultural properties (Matsuoka et al. 2011) are being gradually replaced by an increasing amount of information on the governmental policy concerning the restoration process and the activities of other organisations. The DMT is collecting such information manually by browsing the Internet and newspapers for instance, and the identification and classification of the source of such information have to be properly implemented. The information about our activities should be as open as possible to the public. At the same time, the protection of personal data is at highest priority. Therefore, the urgent formulation of a guideline for information handling and security is essential.

Liaison with affiliated organisations

The earliest movements to rescue cultural properties were carried out by local research communities such as the Conservation Network for Historical Documents in Miyagi (<http://www.miyagi-shiryounet.org/>). The official rescue operation for cultural heritage led by the Agency for Cultural Affairs has been carried out at several local museums since the beginning of April 2011. Multi-organisational task forces of the Cultural Property Rescue Project (Matsui et al. 2011) are working in several parts of the disaster area to conserve the cultural properties heavily damaged by tsunami. Furthermore, the Cultural Heritage Online (<http://bunka.nii.ac.jp/>), a large-scale database of cultural heritage in Japan, hosted by the Agency for Cultural Affairs, incorporates GIS and disaster information (Takao 2011). Several ‘crisis mapping’ projects were launched to assist the rescue and recovery activities in the disaster area by means of GIS and related mapping services (Miyazaki 2011). Some CRM offices have already started rescue excavations associated with restoration works and others are still planning. The CEDACH communicates with those organisations and projects to share information concerning the current situation

and needs and will devise a best solution and liaise with them.

Long-term activity

The reconstruction process of the devastated communities and their infrastructure has just started, and it may well take tens of years before those will have been fully restored. Therefore, the DMT designed the CEDACH GIS to be functionally fit for a long-term restoration process and constantly changing situations. In the near future, the CEDACH GIS will be able to provide useful information on the location and current status of buried cultural properties and other heritage that may be threatened by the urban redevelopment. Predictive modelling (Verhagen 2007) will be applied to the assessment of risk to destroy buried sites based on given distribution of sites and environmental parameters such as elevation, distance to coastline, geology, precipitation, temperature, and local history of natural disasters.

Education for the younger generation is also of vital importance for such a long-term project to be successfully accomplished. The CEDACH invites undergraduate and graduate students majoring in archaeology and related fields to a series of hands-on workshops on the GIS-aided CRM. They will hopefully play a key role to support local CRM in the near future.

Conclusions

This paper has reported the cloud-based GIS and information infrastructure that the CEDACH DMT is developing to support the documentation of the earthquake-damaged cultural heritage. The systems are still under construction, and subject to change in accordance with the progression of the project. GIS is a speciality of the CEDACH and is expected to play a key role in the conduct of CRM in the disaster areas.

CRM in the aftermath of such an immense disaster is literally an unprecedented task never before undertaken by modern humans and societies. The authors hope that the methodology and tactics the CEDACH is developing can be used and applied for CRM in disaster situations that take place anywhere in the world. Therefore, the authors would like to keep international colleagues informed of the on-going activities and to be in constant collaboration with international CRM communities.

Acknowledgements

The authors are grateful to Dr. Koji Mizoguchi (Kyushu University) and Dr. Simon Kaner (Sainsbury Institute for the Study of Japanese Arts and Cultures) for editing the original text, and also to many CAA participants who gave constructive comments and even offered help. The earlier version of this text was posted to ISPRS SC Newsletter (Fujimoto et al. 2011). Editorial comments from two anonymous reviewers were quite encouraging and useful to improve the text. The information on the CEDACH is as of June 30, 2011, and is subject to change. Note: The URLs indicated in the reference and list of websites are valid as of November 30, 2011.

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