Preventive Conservation: Predicting the Effects of Dampness on Paper-based Collections in Historic Buildings

Anna Bülow PhD
National Archives

Belinda Colston PhD CSci CChem FRSC
School of Life Sciences,
University of Lincoln

David Watt BSc (Hons), Dip Arch Cons (Leic), PhD, MSc, FRICS, IHBC
Hutton+Rostron Environmental Investigations Limited, UK.

Introduction

The conservation of both historic buildings and their contents is a dichotomy too often present within the historic cultural environment – the conservation needs of one are often in conflict with the conservation needs of the other. This is of particular concern where valuable archival collections are involved.

The need for a wider understanding of building performance, and particularly the interface between buildings and their uses, can be demonstrated by various examples of inappropriate adaptation and unsatisfactory working conditions. This problem can be especially damaging when the building is of architectural or historic interest, and unsuitable compromises are made in its use.

This project, supported by The Council for Museums, Archives and Libraries (Resource), looks at the potential problems of housing valuable archival collections within historic buildings and aims to develop a predictive computer model for simulating the conditions within historic buildings and monuments used for library and archive purposes. The model will diagnose the possible effects of a single change (e.g. indoor environment, air quality, pollution, decay, human interaction etc) on the well-being of the building and its contents, and assist in the future management and aftercare of these valuable resources.

By making use of data collected from various libraries and archive repositories, as well as results from previous research, the various mechanisms of deterioration and decay associated with dampness will be assessed for both building fabric and collections. The resulting data and information will be used to compile a database of cause and effect, and utilised in the design, initiation and testing of the predictive model.

Since this work is intended to recognise the special needs of libraries and archives, consideration is being given to a wide range of relevant building types:

- cathedral (e.g. Lincoln Cathedral);
- church or chapel;
- large domestic (e.g. Cardiff Castle);
- small domestic (e.g. Brontë Parsonage Museum);
- industrial (e.g. Fakenham Town Gasworks Museum);
- institutional (e.g. John Rylands Library; an Oxbridge College); and
- purpose-built.

In order to identify the best case studies for our purposes, a questionnaire was sent to a range of suitable libraries and archives throughout the UK and results have been evaluated.

Case studies

Two very different case studies were chosen for in-depth monitoring of environmental conditions. Data collection was carried out in order to identify relationships between external and ambient conditions in a room, and those experienced within glass-fronted bookcases. Due to the different buffering capacities of materials, wooden and metal bookcases were compared.

- Unstable environment (Guildhall Museum, Leicester): small, frequently visited, external door often left open. Varnished hardwood bookcase.
- Stable environment (Brontë Parsonage Museum, Haworth): small strongroom, infrequently entered. Metal bookcase.

The studies focussed entirely on humidity and temperature conditions.

Six data loggers, each logging hourly, were placed in various locations:

- External – providing reference data on external conditions
- Internal – providing data on ambient conditions
- Bookcase – 2 data loggers were placed within the bookcase: one on a filled shelf containing 8 books (including 2 dummy books), the other on an empty shelf).
- Dummy books – 2 data loggers were placed within dummy books – one inside a 17th century rag-paper book (384 x 245 x 50 mm) and one inside a 19th century book made of lignin-containing groundwood paper (235 x 165 x 44 mm). These were intended to provide data on buffering capacities of books and indirect moisture content of lignin-containing and lignin-free papers in relation to shelved microenvironments.

The gaps between the leading edges of the shelves and glazed doors of the book case were sealed using a closed-cell polyethylene foam gasket to isolate the shelved microenvironments from one another.

Figure 1 : Hanwell data logger inside 17th century rag-paper 'dummy' book

Figure 2: Positioning of dummy books and data loggers within the hardwood bookcase. Polyethylene gasket was used to isolate the internal environments.

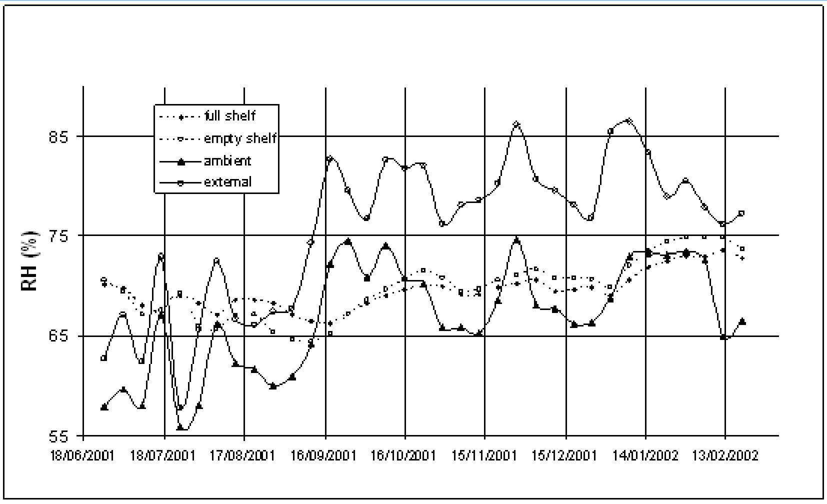

Figure 3: External and internal environmental conditions compared with those within both empty and full hardwood bookcase shelves. The RH data have been averaged over 7 days.

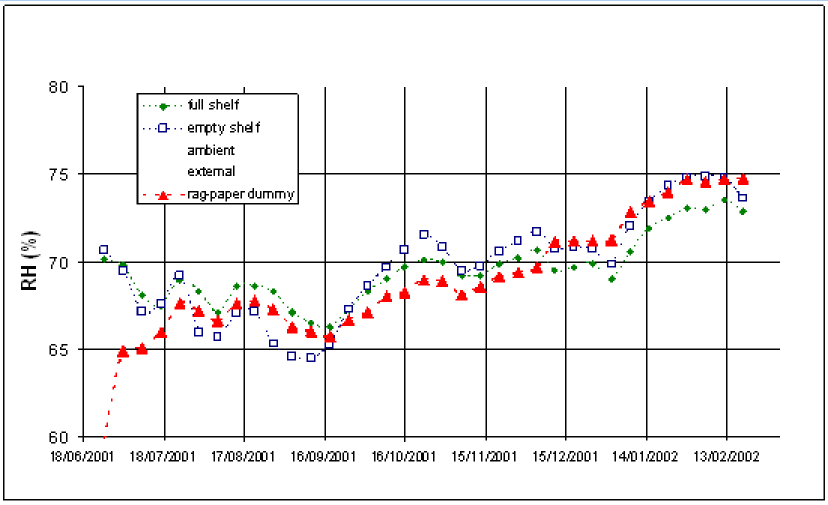

Figure 4: Changes within the internal environment of the 17th century rag-paper 'dummy' book as it reaches equilibrium. The RH data have been averaged over 7 days.

Publications from research

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