



## **Statistical tools for the evaluation of preservation need**

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### **Abstract:**

*This paper discusses and illustrates the use of statistical tools for identifying and evaluating preservation need, and for prioritising actions to address these needs. The examples used are the Preservation Assessment Survey (PAS) method, managed as a service by the National Preservation Office from 2001, and used in over 200 UK and Ireland libraries, archives and museums, and the collection risk assessment method developed by Robert Waller at the Canadian Museum of Nature which has been used extensively in North America and in several UK institutions. Both methods have been used at the British Library to inform preservation priorities. The data from PAS was used to create a national picture of preservation need for libraries and archives in the UK, published in 2006. This paper outlines the results both for individual institutions and the high-level findings from the aggregated data, highlighting ways in which institutions have been able to use the survey results to raise the profile of preservation, improve internal preservation planning, and to attract external funding. The collection risk assessment method has been used recently by the British Library to look at the physical risks to collection items resulting from use and the functions that enable and facilitate use which may have a physical impact on the item. The high-level findings will be used in the formulation of a stewardship strategy for the library's collections*

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### *Introduction*

The British Library (BL) has used two different, but complementary, statistical methods for assessing preservation need. The first, the National Preservation office (NPO)'s Preservation Assessment Survey, has been in use since 2001, mainly in the UK, and I will describe its methodology, implementation and outcomes in some detail. The collection risk assessment method developed by Robert Waller at the Canadian Museum of Nature has been used at the BL more recently to extend and complement the earlier work and will be described more briefly.

### *The NPO Preservation Assessment Survey*

In 1995, the National Preservation Office (NPO) annual conference, *Piecing together the jigsaw: the framework for a national preservation strategy for libraries and archives*, London: National Preservation Office, 1996, debated the future needs and direction of preservation management, and the advances needed to develop a national preservation strategy. A national strategy, a shared, collaborative approach to the long-term support and survival of collections, was the goal, and a critical component for the development of the strategy was a national overview of preservation needs. The opportunity to achieve the statistical overview was provided by a research report commissioned by the British Library Research and Innovation Centre in 1995 published in 1998 P Eden et al., *A Model for assessing preservation needs in libraries*, London: British Library, 1998 (British Library Research and Innovation Report 125) The report recommended that the NPO should:

- Undertake a full pilot test of the assessment model
- Develop and test software
- Investigate the desirability of developing the needs assessment for archives

### **Developing the methodology**

Between 1998 and 2001, the NPO undertook 12 pilot studies, using the model in a variety of types of library, with varying degrees of support, and with different staff skill sets. From these pilot surveys we concluded an optimum process: participants would be given printed guidance, should attend training courses delivered by the NPO, and it was recommended that both library/archive/curatorial and conservation skills were deployed, preferably by two staff members working together.

The research model covered libraries only. The Public Record Office (now the National Archives) seconded a member of staff to the development of a parallel archives model. Sampling methods being used in archives in the UK and the Netherlands were examined, and the applicability of the library model to the materials and physical storage arrangements found in archives was assessed. A single, harmonised model was produced, with extended guidance on sampling from archives, and the inclusion of relevant storage and environmental standards.

A software package to manage the data was developed, using Microsoft Access. This programme was chosen, after investigation of other options (notably FoxPro and its application Calipr) because of its wide availability in UK institutions, and because it was fully supported by the British Library. Development was undertaken by Julia Foster at the NPO.

In July 2001 the survey model was formally launched as a service from the NPO. The software is delivered under licence, for single use. A charge is made to cover the creation of a tailored database and a report for each institution generated from the collected data. Take-up from both libraries and archives was enthusiastic. Between 2001 and 2005 over 200 surveys were completed, most by UK libraries and archives, and a few from overseas.

The model had been designed to facilitate an assessment of national needs and priorities and the research team suggested that further guidance should be sought from a statistician on the cluster sampling needed to permit analysis by sector and region. This guidance was commissioned in 2002 (Claire Creaser, *The national picture of preservation needs. A sampling strategy for the National Preservation Office*, Loughborough University, 2002). In outline, Creaser devised a stratified cluster sample for libraries (public and academic) and archives (local authority and special repositories) in the English regions, Scotland, Wales and Northern Ireland. This required surveys from a minimum of 96 institutions. Following further discussion it was agreed to exclude collections for which preservation was not a prime concern, such as student loan collections, and public library lending stock. The category of special libraries, not included in Creaser's typology, was added to the aggregation, since we were very aware that many have nationally significant collections and often have equally significant preservation problems. National libraries and archives were not included in the aggregation, but the NPO has completed surveys of several UK national libraries and archives.

Between 2001 and 2005 over 200 surveys were completed. 97 were selected for aggregation to create the national picture. Aggregation of data and stratification according to the cluster sample outlined by Creaser was undertaken in 2004 and 2005 by Julia Foster. The statistical criteria were met in most respects. Only in the distribution across the English regions was there insufficient data to create full regional pictures. This remains a target for further analysis. The findings were formally published in February 2006 as *Knowing the Need* (<http://www.bl.uk/npo/pdf/knowning.pdf> ).

### **How it works**

The Preservation Assessment Survey (PAS) provides a snapshot of the way a collection is managed and the types of damage it shows. It is based on a sample of approximately 400 items selected from the library/archive as a whole or from a defined collection or 'population' within the institution's holdings. A sample of 400 items gives precision to  $\pm 5\%$ , with a confidence level of 95%.

Three alternative and equally valid methods of identifying the items are used: simple random sampling, systematic sampling, and stratified sampling. Although a simple random sample may be the 'purest', it is rarely used, since it requires a sampling base, such as a catalogue, in which all collection items are represented, without duplication- and this is rarely found. The systematic method, which spreads the sample evenly throughout the collection, selecting items at a set interval, is the most commonly used. Stratified sampling is used in collections which are complex either in layout or types of material.

Once the sample has been identified, a set of fifteen questions is completed for each item. These cover key areas of preservation: access, use, accommodation, usability and value and importance. The second section consists of a brief condition assessment, noting the damage exhibited by the item. Although PAS is not a full condition survey, it can give indications concerning conservation needs and can help prioritise action.

Fig. 1. The input screen for the Preservation Assessment Survey.

The preservation questions are framed around known risk factors for library collections. Where applicable the response is measured against national standards such as BS5454:2000, *Recommendations for the storage and exhibition of archival documents*. The answers are weighted and scored according to the impact of each factor, the highest scores being given for the level of use and physical condition and usability. The program performs a number of calculations to create a graphic preservation profile for the collection surveyed, showing the distribution of the 400 items across five bands from very low to very high priority. We have found that most items in most collections fall into the low/medium and medium bands. Significant numbers of items in the medium or medium/high bands usually indicate that there is a need for urgent and significant preservation measures. This visual representation allows immediate comparison between collections and has high managerial impact.

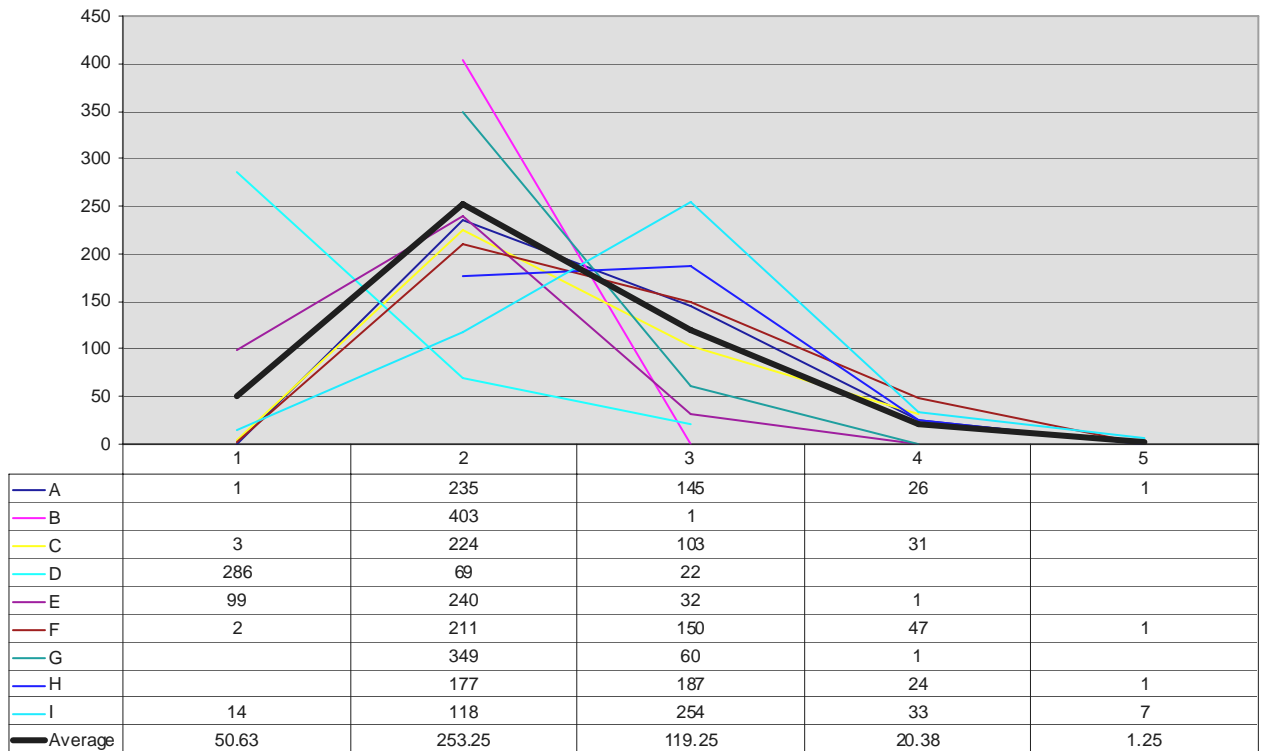


Fig. 2. In this graph, nine separate surveys are compared. Band 1 is very low priority, Band 5 is very high. The average (dark line) shows that some collections are worse and some better than average.

As a further step, changes to the preservation factors are modelled, to show the impact of individual and combined improvements in preservation practice. These are known as the 'What if?' reports. Modelling changes is a powerful planning tool for individual collections. On the national scale it offers the future opportunity to track progress against the 2005 findings of preservation need.

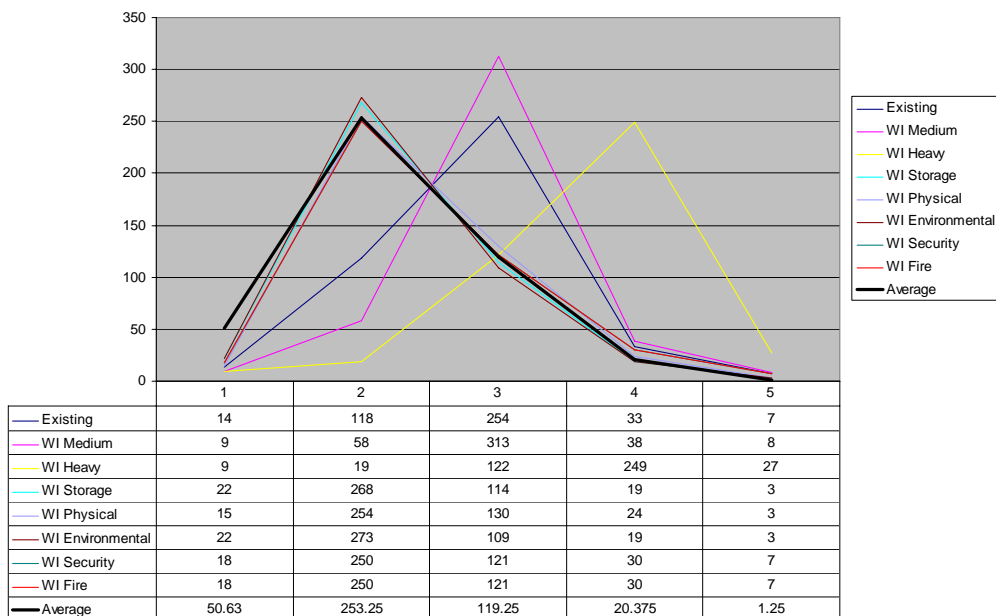


Fig. 3. In this graph representing a single collection, the impact of changing the individual preservation factors (level of use, storage, physical protection, environment, security and fire protection) is shown. All changes are beneficial except increased use.

### *Knowing the need*

The national aggregation of preservation need in UK libraries and archives published in 2006 summarised the findings and headlined the principal issues. The report incorporates survey data from 97 collections from 79 institutions. It records information about 43,682 separate items (books, documents, photographs, etc.), the sample representing an estimated total population of 28 million items.

<b>HANDLING</b>		
■ Staff and users are routinely given guidance and information about the safe handling of materials.	<b>Adequate</b>	65%
	<b>Inadequate</b>	35%
■ Aids such as book supports, map weights, etc. are available and used where appropriate.		
<b>STORAGE</b>		
■ Preventive measures are taken to protect the item from hazards.	<b>Adequate</b>	50%
	<b>Inadequate</b>	50%
■ Good housekeeping procedures, such as vacuuming and shelf-cleaning, are routinely carried out.		
■ The item is stored at least 150mm off the floor.		
■ Primary protection is suitable for the item.		
■ Oversize material is on suitable shelving.		
<b>ENVIRONMENT</b>		
■ Relative humidity and temperature are routinely monitored in the area in which the item is normally kept.	<b>Adequate</b>	34%
	<b>Inadequate</b>	66%
■ Visible and ultra-violet light is controlled in the area in which the item is normally kept.		
■ Temperature and relative humidity levels in the area in which the item is normally kept usually fall within the ranges recommended in BS 5454:2000.		
<b>SECURITY</b>		
■ An assessment of security risks to the collection of which the item is a part has been made and steps have been taken to redress any inadequacies.	<b>Adequate</b>	73%
	<b>Inadequate</b>	27%
<b>FIRE</b>		
■ The item is protected by an automatic fire detection system.	<b>Adequate</b>	86%
	<b>Inadequate</b>	14%
<b>WRITTEN DISASTER CONTROL PLAN</b>		
■ The item is covered by an up-to-date, written disaster control plan, and staff are trained in its implementation.	<b>Adequate</b>	54%
	<b>Inadequate</b>	46%

The analysis of the key areas of preservation across both libraries and archives shows that there are deficiencies in many key areas, but the greatest is in environmental monitoring and conditions. A high percentage of

material (66%) is stored in environmental conditions which do not meet the stated standard. We found that many institutions had no monitoring in place, and therefore no knowledge of what control or impact reduction measures were needed. When data is stratified to allow analysis across sectors, we find that 58% of items in archives have inadequate environmental monitoring and conditions, and 88% of items in libraries have inadequate environmental monitoring and conditions

When looking at condition and usability, we found that overall 54% of material was in good condition, 33% fair, 10% poor and 3% unusable. Poor or unusable material is inherently unstable - it is actively deteriorating or likely to suffer further damage in normal use. 13% of all material was unstable. We also found that unstable material was more likely to be at risk from poor preservation practice than stable material.

The data we collected allows us to indicate the general level of cataloguing backlogs. Overall, 74% of items are catalogued. 26% of catalogued records are accessible on the internet. In libraries, 82% of material is catalogued. In archives, 66% of material is catalogued.

Physical damage is more common in certain categories of material: newspapers and parchment documents showed high levels of damage. Analysis of damage to bindings showed that slight damage is very common, and that 9% of all material has significant binding damage. In the population represented by these surveys, 2.5 million bindings are significantly damaged.

Perhaps surprisingly, we did not find large amounts of brittle paper. Only 3% of material had significantly brittle paper. However, we found that 68% of material was created after 1850 and therefore likely to become brittle in the future, and 68% of this material was kept in inadequate environmental conditions. This material is at high risk of deterioration.

**BRITISH LIBRARY** **Action points**

- Environmental monitoring
- Storage
- Packaging
- Surface dirt
- Disaster planning
- Stabilisation of bindings
- Addressing the future risk of acidic paper



We found that action was needed in certain key areas:

- Environmental monitoring
- Storage
- Packaging
- Surface dirt
- Disaster planning
- Stabilisation of bindings
- Addressing the future risk of acidic paper

### **Using the statistics**

Client libraries receive a report containing a statistical analysis of the quality of the preservation of their collection, and the types and degree of damage discovered, and recommendations for action to target weaknesses. They have used their assessments in different and very constructive ways. We anticipated that they would be used for developing action plans, preservation policies and annual workplans, cost modelling, justifying investment and initiating conservation projects, and indeed they were. We have now reached the stage at which libraries are seeking to repeat surveys in order to assess the impact of changes made as a result of the survey, or of a move to new accommodation. Less tangible but perhaps even more important is the impact of hard data in decision-making; the persuasiveness of good statistics for top management and funding bodies cannot be underestimated. A user survey in 2005 also revealed unpredicted benefits such as providing documentation for succession planning, support for 'one-man bands', increased motivation and the confirmation of existing perceptions. One user said of her statistics that she 'reflected on them quarterly'- what a active and forward-looking use.

The data from the national aggregation is used as a comparator for individual surveys: each institution is compared against national data and where possible with a subset of a relevant category such as higher education or special libraries. Users say this is one of the most useful features of the survey.

As a method of assessment, the PAS has proved its worth for large collections where it would be impossible to make an item-by-item assessment, and where a big picture is needed for strategic decision-making. We have been asked many times whether it can be used on very small collections, and of course it can, but its strength lies elsewhere. It can be frustrating if its method is not fully understood: sampling a large collection inevitably means that some apparently important material is not selected for assessment, and the user must accept that this will happen. Participants must be willing and able to devote time to the process, since it is much less effective if spread over months rather than when done over a dedicated period of a few weeks. The user must also realise that the statistics are to be used and exploited- to be reflected on quarterly, perhaps- not simply shelved and ignored.

### *PAS at the British Library*

At the development stage, we used the parts of the BL, including the Newspaper Library, for pilot surveys. Between 2000 and 2004 the BL

undertook further surveys: firstly a 'Broad Brush' survey of the entire library, then individual surveys of thirteen collection departments: newspapers, early printed books, philatelic collections, music, manuscripts, Asia and Pacific collections, modern serials, modern monographs, official publications, science and technology, sound archive, maps, and document supply collections.

The table below illustrates the comparison between the condition of material in the collection departments, with newspapers being least stable, and maps most stable.

**LIBRARY HSLIB** **Results: condition (as % stable/unstable)**

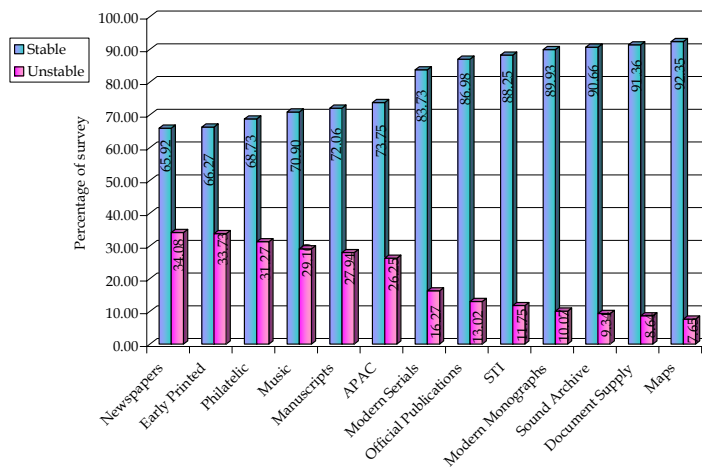


Fig. 4

The next table shows a further series of comparisons, across the five preservation priority bands.

## Results: preservation priority bands (%)

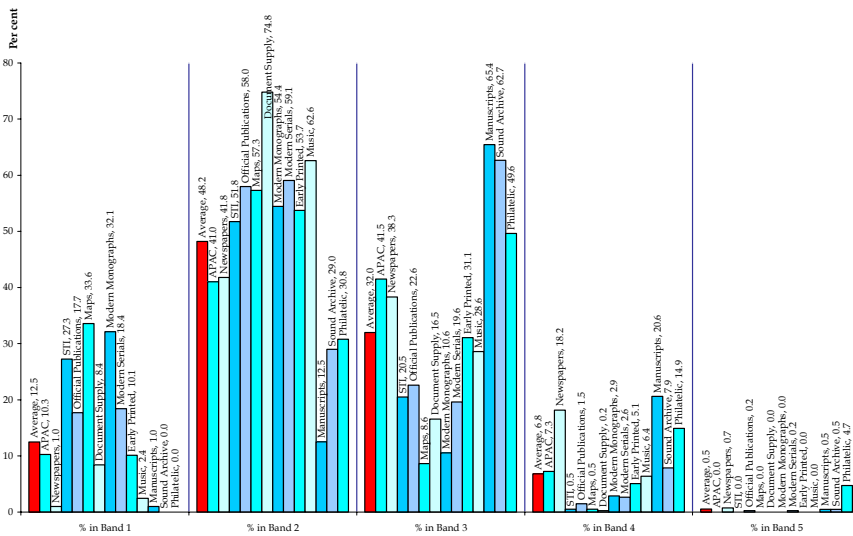


Fig. 5

These surveys have led to both large-scale conclusions and smaller-scale answers to ad hoc preservation questions. At the macro level, a baseline figure for overall collection condition has been established, and the BL data contributes to the national picture of preservation need. At the local level, this data contributes to preservation funding decisions, in the distribution of the annual budget across the library, and to assess the cost-effectiveness of particular preservation measures, for example the purchase of a board-slotting machine, and the potential impact of using mass deacidification processes. Key figures that have emerged are that 86% of the British Library's collections in stable condition, but that 5% of collections are 'unusable'- both figures clear indications for the direction of preservation policy. The findings concerning the newspaper collections provided critical decision-making information when the future of the BL Newspaper Library was under review.

### *The Collection risk assessment method*

## Collection risk assessment method

Ten risk agents:	Each risk factor is evaluated according to
Physical forces	Frequency
Thieves and vandals	Severity
Fire	Impact
Water	
Pests	Each risk may be mitigated by
Contaminants	Avoidance
Radiation (principally light radiation)	Blocking
Incorrect temperature	Detecting occurrence
Incorrect relative humidity	Responding to occurrence
Dissociation (loss, misplacement, cataloguing errors)..	Recovery

3

In 2008, the BL undertook a further assessment of the risks to its collections, using a method developed by ICCROM, CCI and Robert Waller at the Canadian Museum of Nature, based on the joint Australian/New Zealand standard AS/NZS 4360:2004, *Risk Management*. This method addresses the question: what will be the condition of a collection at some future moment, if no actions are taken, or if new actions are taken. It assesses the 'loss of value' in collections resulting from ten risk agents: physical forces, thieves and vandals, fire, water, pests, contaminants, radiation (principally light radiation), incorrect temperature, incorrect relative humidity and dissociation (loss, misplacement, cataloguing errors). Each risk factor is evaluated according to frequency, severity and impact, giving an overall magnitude of risk. Each risk may be mitigated, as appropriate to the magnitude of the risk, by avoidance, blocking, detecting occurrence, responding to occurrence, and recovery. The methodology, as described in Robert Waller's *Cultural property Risk Analysis Model*, Goteborg, 2003, is quantitative, and uses some complex mathematical modelling to evaluate the frequency, severity and extent of loss in value. In its full form, it is clearly a very time-consuming process: Waller estimated in a paper given at the IIC congress in 1994 that four person-years would be needed to complete the risk assessment at the Canadian Museum of Nature.

Following a course held in Romania in 2007, a risk assessment specifically of the physical risks to BL collections resulting from use and the functions that enable and facilitate use was undertaken. The areas considered were: acquisition, processing and placing; retrieval, reader and staff use of collections; imaging processes and practices; exhibition and loan; conservation and preservation. Patterns of use and functions of the collection were mapped, risks identified and evaluated. Magnitudes of risk were calculated according to a scale which assesses frequency, severity and extent between 1 and 5, which are totalled up to give a maximum magnitude of risk

of 15 points. A score of over 7.5 points is taken to be of medium or greater priority.

Using this method, it was shown that physical handling was the greatest risk to the collection, with each book being handled by up to 10 pairs of hands between retrieval and delivery and return to storage. It also emerged that a percentage of books ordered are not collected by readers, thus being brought out and returned to store without having been used.

The second greatest risk was dissociation, i.e. separation between the object and knowledge about the object, which can mean loss or misplacement or other form of unavailability, lack of cataloguing or foliation, poor tracking of movement of the object, etc.

Work is in progress to develop actions to mitigate the highest risks, and there will be further analysis of areas of activity which affect the condition of the collections. For example, there is already considerable emphasis on security, and the implementation of measures to minimise unnecessary movement of stock.

The findings of the full risk assessment will be vital in the development of the new strategy for the stewardship of the Library's collections, together with the recently completed Risk Assessment for Digital Material

(<http://www.bl.uk/aboutus/stratpolprog/ccare/introduction/digital/riskassessment.pdf>) and an analysis of future publishing trends. From these sources, the planning assumptions for the care of the British Library's 150 million physical items and 300 terabytes of electronic material will be established and the new stewardship strategy will be defined.

#### *Two complementary methods of assessment*

Both of these methods of assessing preservation need and priorities use an assessment of risk- Waller's method is explicit, but implicit also in PAS is the evaluation of a collection against a set of defined risk factors. The defined risks are very much comparable: with the exceptions of radiation and contaminants, Waller's ten agents of deterioration, based on the classic list of agents drawn up by Stefan Michalski, are embedded in the fifteen preservation questions of PAS. PAS also embodies a definition of significance, which is a particularly difficult exercise, and not always entirely achieved, but which we consider vital in libraries, where the significance of items is fully recognised to be relative to the functions and research orientation of the collection.

Waller's methodology aims to rank the magnitude of these factors in a particular collection by scoring and weighting them according to frequency, severity and impact. PAS includes a fixed scoring system based on the known or assumed impact of risk factors. Both methods draw conclusions on the nature and magnitude of risks to a collection which will lead to recommendations for priority actions to mitigate the impact of the risks.

In comparing the two I think it is fair to say that Waller's method is more rigorous and scientific, and may reach more robust conclusions, but is certainly time-consuming and does require some expert preservation knowledge (and statistical talent). On the other hand, PAS was designed for ease and speed of use by the non-expert, and produces fairly robust but widely indicative results, useful both for the first preservation assessment of a collection and in support of established preservation services.