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**Condition Survey of the Circulating Collection: Joseph Anderson Cook Memorial Library,
University Of Southern Mississippi**

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Master's Research Project, May 2009

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Introduction

In the late 1970's, there was an increased interest in quantifying the number of books that needed preservation attention in academic libraries (Brown, 2005, p. 1). As major libraries established preservation programs, they needed ways to identify priorities, allocate resources, and determine policy that would guide their efforts to mitigate collection damage (Brown, 2006, p. 1). Preservation librarians in charge of establishing these early programs developed the first condition surveys to evaluate the collections under their guardianship. Today, this type of survey continues to be important for libraries creating a long-term preservation policy or designing a preservation program that will address the current and future needs of their collections.

Building on the foundation of condition surveys that span the last 30 years, the current research provides library administrators at The University of Southern Mississippi's Joseph Anderson Cook Memorial Library with information that can be used to plan mitigation strategies, create preservation policies, and further develop the existing preservation services to ensure that the collection remains accessible for future students and scholars. This survey serves as a pilot project to determine whether additional research in this area is warranted. It also provides a statistically valid set of data that indicate the current condition of the collection and an estimate of the collection's future deterioration.

A proportional stratified random sample was identified to ensure the results were representative of the overall population. In addition, the paper in each book was tested for acidity using a pH pen and all the observations were recorded on a standardized survey form to facilitate statistical analysis. This form contained questions designed for comparison with

past surveys to increase the overall understanding of collection condition within the field of preservation, as well as questions that specifically targeted local concerns within Cook Library. Unfortunately, the current survey suffered from a problem common to many recent preservation condition surveys – limited direct comparison value due to a lack of consistent methodology used over the past 30 years. This problem was addressed by designing the survey so that important areas could be compared to the most comprehensive of the studies conducted by Yale University and parts of other important studies that have been conducted more recently.

Statement of the Problem and Subproblems

Cook Library, the main library of The University of Southern Mississippi, has performed routine preservation on circulating materials for over a decade; however, a collection survey was never conducted to identify problem areas or provide direction for this work. The Bibliographic Services Department has a small in-house preservation work area that is loosely associated with the bindery preparation operations, but as in many small to mid-sized libraries, the person in charge of these operations has limited training in preservation and is directed by a daily routine, rather than a defined plan or policy. Due to budget reductions, a more systematic approach to preservation needs to be considered for Cook Library to continue providing preservation care for its collections.

Anecdotal evidence suggests that the circulating collection at Cook Library is deteriorating, suffering from years of neglect and outdated preservation treatments, but a systematic study had not been conducted to support this conclusion. This survey provides the data necessary to assess the level of damage that exists in the Cook Library circulating collection by examining a sample of books in the collection for age and circulation history, types and condition of cover material, origination of binding,

types of physical damage, paper acidity level and degree of brittleness of the paper.

Research Questions

- R1. What was the age distribution for the books examined in this study?
- R2. What was the age distribution of the circulating books and un-circulated books?
- R3. When did the sample volumes circulate?
- R4. Who bound the books in the sample, and what are the primary materials used for the book covers in this study?
- R5. What type of cover material is most often damaged?
- R6. Do publisher or third party bindery books get damaged more frequently?
- R7. What percentage of books contain acidic paper and/or brittle paper?
- R8. What types of damage are found in the circulating collection? In what percentages can they be characterized as: environmental damage, intentional patron damage, and damage from age or use?

Definitions

For this research, a survey is defined as a standardized collection review that is conducted on a statistically significant number of randomly selected books from the circulating collection. The survey is designed to identify the condition of the books in a way that supports statistical analysis, so when data are analyzed, the results reflect the conditions that exist throughout the collection.

A book is defined as an individual volume that is either a paperback, a paperback stiffened with Kapco[®], or covered rigid board, but excluded pamphlets, binders, or other containers that would generally not be considered books.

Serious damage is defined as any physical condition that reduces the usability or affects the structure of a book in a way that will get worse without intervention. Examples of this type of damage include missing covers, torn spines, loose text blocks, split text blocks, damaged hinges, loose pages, and active mold. When these types of damage are

present, the item should either be treated by preservation or replaced.

Acidic paper is defined as paper with a pH lower than 6.8 that has been identified using a chlorophenol red Abby pH Pen[®] and marking the edge of the textblock as outlined by Butler (1990) to allow access to the inner fibers of the paper (p. 542). If the paper is acidic, the mark turns yellow, and if the paper is neutral or alkaline (a pH above 6.8), the mark turns purple. This test does not indicate if a buffering agent is present, so a purple reading only indicates the paper is not acidic at the time of testing, but it may become acidic in the future.

Brittle paper is the result of several factors associated with paper aging; the most important is the chemical process of acid hydrolysis (Nickerson, 1992). A simple fold test, where the corner of a text block page is folded back and forth, provides a good estimate of the brittleness of the paper. For this survey, breaking after three double folds or less is considered brittle, and beyond three double folds is considered not brittle.

Mutilation is defined as intentional damage to a book and is identified in this survey as volumes with highlighted text, pencil or pen marks, food or beverage stains, or torn papers.

Environmental damage often occurs within the library setting and is defined as fading due to exposure to ultraviolet radiation (fluorescent lights or direct sunlight), water damage, mold, or a build-up of dirt and dust due to a lack of stack maintenance.

Binding is defined as the exterior protection of a book that safeguards the information that is contained in the text block. Three types of bindings were identified in this survey: original publisher's bindings, bindings applied by a third-party binding company, and bindings applied by the in-house preservation personnel. The differences were generally easy to identify based on the types of materials used or the process used to apply the binding. This identification is used to determine the best processes to use in the future. Two areas of special interest have been identified: in-house repairs that have caused

additional damage to the book and a bindery process called over-sewing that negatively affects books as they become embrittled (Walker et al., 1985).

Limitations and Delimitations

The current survey is narrowly focused on the physical condition and paper pH level of the circulating collection of books located in Cook Library, floors two through five. Although the sample size is large enough to be statistically significant in discussing the entire collection, a more detailed study in the future is recommended in order to identify sub-groups to increase the accuracy of the preservation services. The survey focused on books in the circulating collection, even though many other types of formats are located in the stack area. This creates a relatively consistent sample in order to increase the accuracy and reliability of the limited sample.

Assumptions

It is assumed that the evaluation process is consistent, data entry is accurate, and data analysis produces valid results.

Significance of the Research

A condition survey had not previously been conducted on the circulating collection at Cook Library. This survey produced results that can assist library administrators in making informed decisions about the future preservation of the circulating collection. The survey size was significantly large enough to decide whether an additional, larger survey should be conducted by the library, or if additional mitigation efforts to stabilize and further repair the collection should begin. Historically, the condition survey has a solid foundation and has shown the power to formulate new policies, increase preservation funding, establish preservation programs, increase the number of preservation personnel, and even build new buildings to house library collections (Brown, 2006; Teper and Atkins, 2003).

Literature Review

Research that forms the Foundation for the Current Study

The Matthews (1995) article states that preservation is an integral part of any library and needs to be planned and managed like any other library activity. According to Ogden and Adams (1997), the initial planning is accomplished by conducting a condition survey of the library's collections to gather empirical data to provide direction and support for building a preservation program. The characteristics that most surveys try to identify are the amount and type of physical damage found in the collections, the percentage of books or documents with acidic paper, and the percentage of paper that is embrittled. As O'Neill and Boomgaarden (1995) point out, there have been few considerations for consistency when designing condition surveys with differences occurring in scope, objectives, methodologies, and findings (p.396) during the past 30 years. This makes it difficult to compare results, but the characteristics listed above are generally the main concerns, once all of the specialized aspects of the surveys are separated.

Even when institutions have tried to use the same methodology, care must be taken to decide what information the survey should gather. Two surveys that used the same methodology are Buchanan and Coleman (1982) at Stanford University and Chrzastowski, Cobb, Davis, Geil and Kruger (1989) at the University of Illinois at Urbana-Champaign. Unfortunately, the data collected provide little in the way of useful information. Chrzastowski et al. (1989) report the following results of the two studies based on three separate criteria: condition of the paper, condition of the binding, and condition of the boards and covers (p. 578). Even in the context of the paper, these are arbitrary categories and provide limited direction for the preservation departments to move forward, although it may help generate support from the administration. Table 1 (next page) shows the results of the survey.

Table 1 – Comparison Study of Two Surveys			
	Good Condition	Moderate Condition	Poor Condition
Urbana-Champaign	29%	34%	37%
Stanford	33%	41%	27%

Additional studies have broken new ground and provide valuable information for the preservation profession and possible templates for future research, but they offer limited comparison to the current survey. The University of Illinois at Urbana-Champaign has conducted at least five different surveys that address different parts of their collections. In addition to the study above, Gillie and Teper (2005) published a condition survey of the score collection and Teper and Ereksen (2006) created a condition survey to look at the rare and special collection materials. These specialized surveys show the flexibility of adapting condition surveys to different problem areas within the library, but cannot be used for comparison with the current study.

The two University of Illinois at Urbana-Champaign studies that provide information useful to the current study reviewed two very different collections, the main research library stacks, and the undergraduate library collection. At The University of Southern Mississippi, books that would be found in these two types of collections are housed together in Cook Library. Because they represent similar core collections, the details regarding physical damage, acidity, and brittleness that Teper and Atkins (2003) review in their study of the main library stacks will be used for comparison with the results from Cook Library. The study by Ward and Teper (2005) found that the undergraduate collection was in terrible condition with extensive damage to the exterior and interior parts of the books. If extensive damage is

found in Cook Library, this article may provide some foundation for a comparison that is not found in the other literature.

In addition to the Teper and Atkins (2003) study at University of Illinois at Urbana-Champaign, the core studies for comparison data are Walker, Greenfield, Fox and Simonoff (1985) at Yale University; Nainis and Bedard (1986) at Georgetown University; Bond, DeCarlo, Henes and Snyder (1987) at Syracuse University; Baird, Krentz and Schaffner (2003) at the University of Kansas; Mead and Baird (2003) at the University of Kansas; and Starmer and Rice (2004) at the University of Tennessee. The lack of consistency in designing these surveys leads to some difficulty in comparison, but the following table, Table 2 on the following page, of primary findings from these studies is useful.

These articles are useful in identifying some common methodologies that have been successful in conducting large-scale assessments of library materials. The use of representative samples, accurate surveying instruments, and identification of bias are three major points identified in the articles. Important topics appear repeatedly throughout the literature: increased levels of damage to collections where preservation has not been a priority, a high percentage of books containing acidic paper that are becoming embrittled, and the fact that libraries that started preservation programs early are more likely to have administrative support and a culture of preservation.

Table 2 – Core Studies for Comparison			
	Physical Damage	Paper Acidity	Embrittled Paper
Urbana-Champaign	25%	90%	36%
Yale	13%	83%	37%
Georgetown Law	26%	60%	24%
Syracuse	25%	86%	12%
Kansas	14%	66%	10%
Kansas Law	17%	65%	12%
Tennessee	24%	68%	17%
Averages	21%	74%	21%

A Review of Statistical Methods and Sampling Procedures

Due to the importance of the sampling procedures and statistical theory that validate the research, it is necessary to review articles about random sampling in libraries and statistics in general. The earliest article available was written by Drott (1969), and it sums up the need for statistical sampling to gather useful information when resources are limited to collect that information (p.119). Drott explains that in order for this process to work, a sample needs to be calculated before the survey begins and that each item in the population must have an equal chance of being selected (p.120).

DeCandido (1995) expands the explanation of why each item having an equal chance is important in sampling. The basic idea is that whatever conditions that exist in the entire population will exist in a similar proportion within the sample (p.9) provided the sample is of a statistically significant size. There are limitations to the accuracy of this information, which is described as a confidence interval and a tolerance level, and is written, for example, as 95 ± 5 percent. Drott (1969) provides the details as follows: “a 95 percent confidence means that there is only one chance in twenty (5%) that the actual percentage” is different than the sample (p.120).

A common sampling technique called stratification (Chrzastowski, et al., 1989; Mead and Baird, 2003;

Teper and Atkins, 2003; Nickerson, 1992; Walker, Greenfield, Fox, and Simonoff, 1985) occurs in different variations (collections, processes, floors, subject areas, and buildings, respectively) in major articles and throughout the preservation survey literature. Stratification allows for more accurate samples to be selected by creating sub-groups (strata) that are more homogenous than the entire population.

There are two ways to approach these strata. One way is to treat each stratum as an entire population by selecting a statistically significant sized sample from each. The second method is to divide the overall population sample proportionately among each identified stratum. The first method requires a considerably larger sample, but it will allow the researcher to discuss the results of each stratum in finer detail. The second approach requires a much smaller sample, while ensuring that elements from all the different strata are proportionately represented, but this will only allow the researcher to discuss the results at the level of the overall population.

Identifying the sample within a library can occur in many different ways, and it seems that each survey team created their own unique process. Ultimately, it does not matter how the sample is identified as long as it is random and representative of the population. A typical example is demonstrated by Teper and Atkins (2003), where they generate a

random number for the floor, section, shelf, and item on the shelf counting left to right (p.213). Often, additional numbers beyond the sample size need to be generated due to random numbers that do not correspond to a sample item. The process needs to be well designed since this is the foundation of the study's validity.

Damage and Paper pH

Barrow and Church's (1959) groundbreaking study identified four major causes of acidity in paper: oxidation, acid hydrolysis, photochemical stimulation, and environmental pollution. A reliable indicator of the level of acid is the pH test. A variety of ways to measure pH in paper have been used in condition surveys over the years. If a specific reading of pH is desired, a drop of distilled water and an electronic pH meter can be used, such as Sheehan (1990) did at the Trinity College Library in Dublin. Most studies in the United States use one of two types of acid indicating pens that use either chlorophenol red or bromocresol green to produce a color change for either the presence or absence of acid (Nickerson, 1992).

Acidity is generally correlated with brittleness or the future onset of brittleness in paper. Generally the more acidic the paper is, the more embrittled it is when tested using a standard fold test. Since acid buildup is an autocatalytic process that will accelerate over time, unless there is a dramatic reduction in temperature (near freezing) and humidity or the paper goes through a deacidification and buffering process, the presence of acid will generally predict future paper embrittlement (Walker et al., 1985).

When paper becomes embrittled, treatment options are considerably reduced because the paper loses flexibility and tends to break instead of bending. The simple act of paging through a book can cause serious damage and loss of information due to pages breaking. Even deacidification will not help books that have become embrittled because even though the acid production may be halted, the flexibility will not return. The only solutions are replacement, reformatting, discarding, or placing the book in a phase box and only allowing supervised access (Barrow and Church, 1959).

A survey of physical condition is a gauge that evaluates the condition of a collection at a certain point in time based on the damage that is found. Since the first survey conducted by Stanford University in 1979, a pH component has been included in most condition surveys because it offers a predictive quality that provides insight into the future condition of the collection (Buchanan and Coleman, 1982). There have been two studies that have specifically looked at the use of pH in condition surveys. Butler (1990) examines a study conducted at Brigham Young University that explains details of the procedure used to test the acidity of the paper in books acquired by the library in 1987. This was followed by an article by Nickerson (1992) which looks at three universities, Brigham Young, Yale, and Syracuse, that performed pH testing during condition surveys and compares the findings.

Nickerson (1992) found that all three studies reported similar levels of acidity, but a range of brittleness suggested that something other than acidity was also affecting the paper deterioration (p.110). He proposed that additional environmental factors over the life of the materials, such as storage conditions, may account for this difference. This conclusion echoes comments made by Sheehan (1990), when his results regarding acidity and brittleness at Trinity College Library in Dublin were appreciably different than those found in early studies at Yale, Syracuse, and Urbana-Champaign. Sheehan found that even though acid levels were high throughout the sample, the level of brittleness was low, especially in the decades around 1900, when brittleness was consistently high in the other studies.

Additional support for environmental factors is evident in a more recent study by Baird and Schaffner (2003), where changes in the storage conditions of a portion of a Ukraine library showed a considerable increase in paper brittleness over the part of the collection that was not moved (p.324). These findings reinforce the idea that there is no clear explanation for what regulates the rate of deterioration in paper and they show the need for continued research. Overall, these studies point to the general predictive component that pH plays in

preservation surveys and the importance of including this component in the current research.

Summary

Reviewing the literature places the current research in perspective. The current study is not new in concept; preservation surveys have been conducted for decades around the world. What is noteworthy is that this study examines a collection that has not been surveyed to date. In addition, the use of the Library of Congress Classification System to stratify the collection is also a unique feature of the current study.

The range of published condition surveys offer guidance and possible expectations for the current study, and they suggest ways to conduct sound, statistically meaningful research. The difficulty arises when trying to compare the findings of these various surveys because of the many differences between them. The available research was helpful for creating a valid and reliable survey that benefits Cook Library by identifying problem areas and will help plan mitigation strategies, create preservation policies, and further develop the existing preservation services.

Methodology

Data Collection

The research data were collected using a standardized survey form. One form was filled out for each book that was identified during the random sampling process. Data from the forms were entered into Microsoft Excel 2003 for analysis. The forms were held for the duration of the study in order to validate potential discrepancies or errors located during analysis. The specifics regarding the sampling procedure, data analysis, and survey instrument are discussed below.

Data Collection Instrument

The survey form was created specifically for this research, and a copy of it is included in Appendix A. Also included in the appendix is a set of guidelines that explains the decision-making process for filing out the form. One survey form was completed for each book that was sampled. The form was designed to record standardized responses for the condition of the outside and the interior of the book. Additional information regarding the last date of circulation and imprint date was also recorded. The sample location and collection information was located at the bottom of each form to facilitate the sampling process.

Sample Determination

The sample was selected from the total population of 484,415 circulating books in Cook Library. The number of books in this population was calculated using the Reports Module of the UNICORN System by Bibliographic Services Librarian Kathy Wells on November 24, 2008. Using an online sample size calculator, the sample size of 385 was calculated at a confidence level of 95 percent with a ± 5 percent tolerance interval ("Sample Size Calculator", N.P., 2008).

Bibliographic Services Librarian Kathy Wells also ran reports to determine the number of books in each of the 21 categories of the Library of Congress Classification System. Because different subject areas tend to be more homogenous in the physical structure of the books they contain, and since each category is non-overlapping, each subject area was considered a stratum for the purposes of sampling. This type of sampling technique is known as proportional stratified random sampling, and it is commonly used to improve the reliability of the sample by ensuring that each stratum is sampled proportionate to the stratum population (Nickerson, 1992). Table 3 (following page) shows how the total population sample was divided across the different strata.

Table 3 - Strata, Populations, and Sample Sizes		
Strata	Population	Sample
A -- General Works	3520	3
B -- Philosophy. Psychology. Religion	28949	22
C -- Auxiliary Sciences Of History	4045	3
D -- World History	28223	22
E -- History Of The Americas	22534	18
F -- History Of The Americas	13201	10
G -- Geography. Anthropology. Recreation	13336	11
H -- Social Sciences	67624	54
J -- Political Science	13295	11
K -- Law	12482	10
L -- Education	44738	35
M -- Music And Books On Music	11081	9
N -- Fine Arts	13093	10
P -- Language And Literature	93325	74
Q -- Science	49830	40
R -- Medicine	25881	21
S -- Agriculture	3421	3
T -- Technology	20137	16
U -- Military Science	1921	2
V -- Naval Science	455	0
Z -- Bibliography. Library Science. Information Resources	13324	11
Totals	484415	385

Use of the Library of Congress Classification System to create strata will be beneficial if administrators at Cook Library decide to move forward with a full scale survey. When each stratum is sampled at 95 ± 5 percent, the level of detail increases and the results will be statistically significant for each of the 21 strata. This type of information could identify which collection areas most need preservation attention, and the average age of collection areas, as well as assist in collection development throughout the library.

Sampling Procedure

Beginning with Library of Congress classification "A" for General Works the number of shelves in each stratum was determined until the entire collection was completed. This process was repeated for each of the 21 strata. Once the number of shelves was known for each stratum the process of generating sample locations began.

The following example may help clarify the steps in this process. There were 644 shelves in stratum "A" and the sample size was 3, so two random numbers

were generated to locate each book. The first number was a shelf number (1 is at the beginning of the stratum and 644 at the end) and the second number was the book number (going from left to right on the shelf). Using the random number generator in Microsoft Excel 2003, the parameters were set so that a number between 1 and 644 was generated, and this was repeated for a total of 6 numbers (3 extra numbers in case duplicate pairs were generated or there was not a corresponding book for the location). The average number of books per shelf was estimated at 50, so the random number generator was set to generate 6 numbers between 1 and 50 to locate the book on the shelf.

After generating the sample for stratum “A,” a table of random numbers was used to locate the sample book. Each list of sample numbers was sorted by shelf number after the required sample size was reached in order to expedite the sampling process. The number series appeared on the survey form in the “Sample Number” box. The following table lists the random numbers used for stratum “A” as an example.

Biases

Several potential biases were identified that could affect the accuracy of this sampling technique:

1. If a book was checked out or not shelved in its appropriate call number order at the time of sampling, it was excluded.

2. Since some shelves may contain more than 50 books, those books in excess of 50 were excluded from the sample.
3. Shelves that contain only bound journals were excluded.
4. Empty shelves and shelves that did not contain books were excluded.
5. Possible errors may have occurred during the determination of the strata population if errors existed in the database indicating another type of media as a book.

Data Analysis

The data analysis began with transferring the data from the survey forms into Microsoft Excel 2003. The Excel spreadsheet had headings for each field of the survey form so that the data could be transferred for analysis. There were two fields of interval data: last date of circulation and imprint date that helped describe the usage and age of the collection. The remaining data fields were all nominal data. Either the feature was present or it was not, and it was entered into the spreadsheet as “1” for yes and “0” for no.

Once the data were entered and saved, the analysis began. The results are primarily single variable descriptive statistics that answer the research questions. This is considered univariate analysis, and was useful in creating tables and charts that describe percentages of different types of damage.

Table 4 – Random Numbers for Stratum “A”		
	Shelf Number	Book Number
1.	17	13
2.	496	17
3.	586	47
<i>(Extra Random Numbers)</i>		
4.	23	27
5.	254	38
6.	260	26

As Walker et al. (1985) point out, the most interesting results were found at the intersections of data and for those questions it was necessary to use more than one variable in order to understand the effect that materials, damage, and age have upon books. This analysis made it possible to describe the circulating collection in greater detail, thus providing considerable insight into the types of damage that currently exist. It was also possible to identify some combinations of factors that impacted the collection in positive or negative ways. Additional data that were analyzed regarding previous repair techniques and paper acidity provided insight into the future problems with the collection as these books continue to deteriorate.

Results

R1 - What was the age distribution for the books examined in this study?

Recording the imprint date of each volume sampled provided an age range of 186 years for the overall sample. The oldest book in the sample was printed in 1819, and the most recent publication was issued in

2005. The median imprint date was 1972. Figure 1 provides a visual distribution of all 385 books in the sample.

R2 - What was the age distribution of the circulating books and un-circulated books?

Recording the imprint date and most recent circulation date of each volume sampled allowed the creation of two sample categories: circulated books and un-circulated books. The oldest book that circulated in the sample was printed in 1890 and the most recent publication was issued in 2005. The median imprint date was 1978 for circulating books. Figure 2 (next page) provides a visual distribution of the 225 books in this category. The range of circulated books in the sample was 115 years, which is 71 years narrower than the 186 year overall range of the sample. The oldest un-circulated book in the sample was printed in 1819 and the most recent was issued in 2003. The median imprint date was 1961 for un-circulated books.

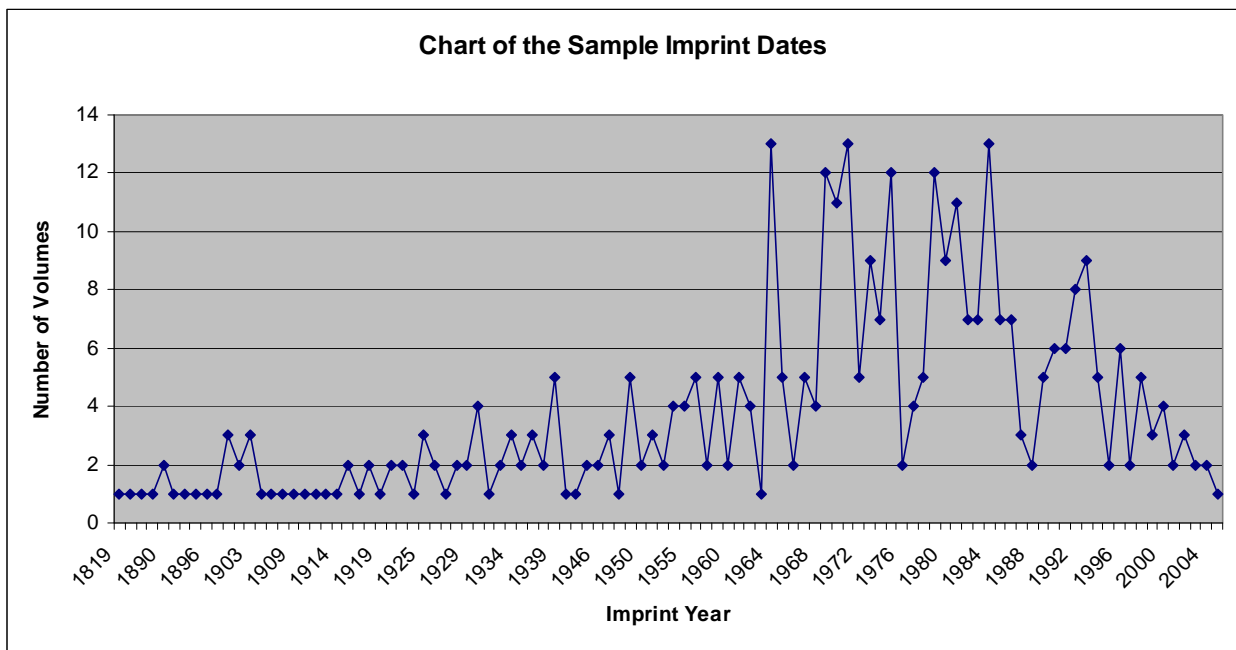


Figure 1 - Imprint Distribution

Figure 3 provides a visual distribution of the 160 books in this category. The range of un-circulated books in the sample was 184 years, only 2 years

narrower than the 186 year overall range of the sample.

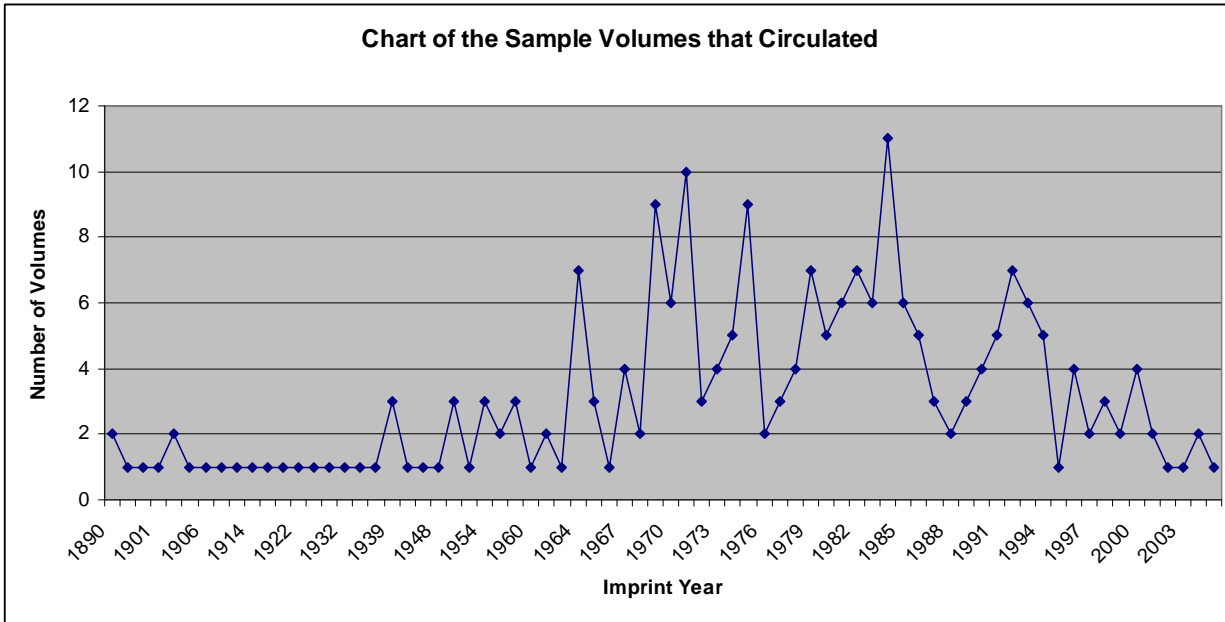


Figure 2 - Circulated Volume Distribution

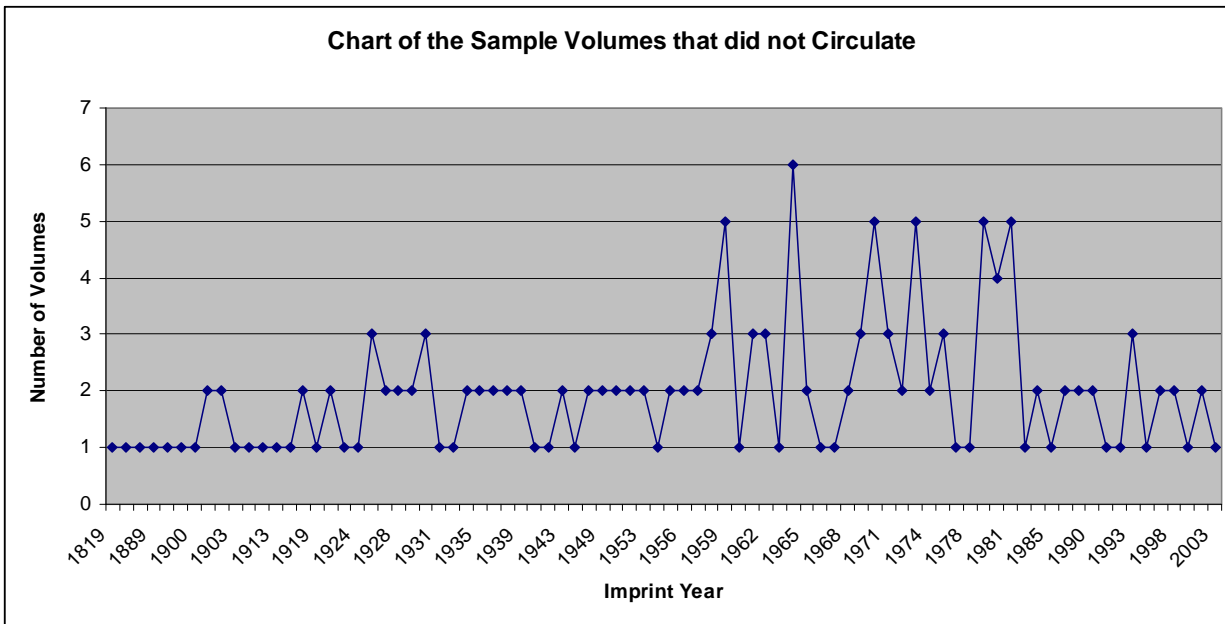


Figure 3 - Un-circulated Volume Distribution

R3 – When did the sample volumes circulate?

Since this is a circulating collection, it is useful to know how many of the sample volumes have circulated in the last 5, 10, or 15 years and how many volumes have never circulated. When evaluating a collection for preservation, a damaged volume that has not circulated in many years may be a candidate for withdrawal rather than repair.

Two interesting and unexpected results, detailed in Table 5 and Figure 4, were discovered upon analysis of the data. The first was a relatively high rate of circulation within the collection, with 58.44 percent of the sample having circulated in the last 15 years. The second notable result was a trend showing an increasing rate of circulation, with the highest levels occurring in 2006 and 2007. While many institutions are experiencing declining circulation rates, it appears that Cook Library is experiencing the opposite trend.

	Sample	Percent
Circulated 0 - 5 years	89	23.12%
Circulated 6 - 10 years	84	21.82%
Circulated 11 - 15 years	52	13.51%
Never circulated	160	41.56%
Totals	385	100.00%

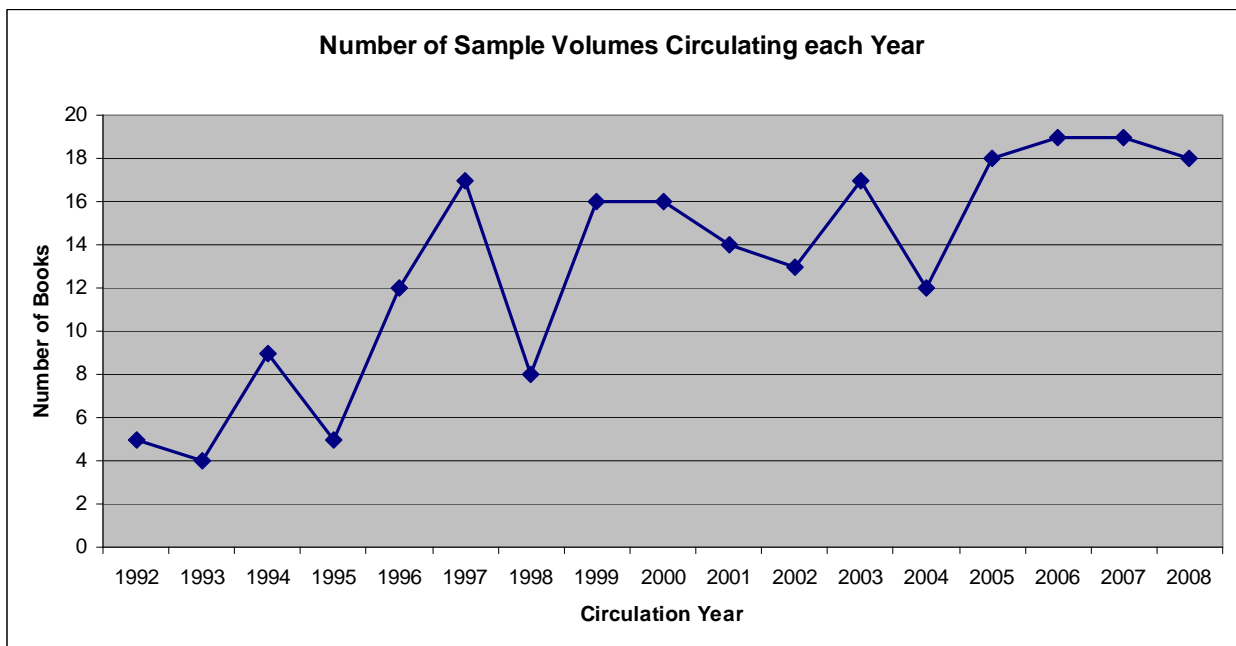


Figure 4 - Rate of Circulation of the Sample Books

R4 – Who bound the books in the sample and what are the primary materials used for the book covers in this study?

Table 6 provides information about the binders and binding materials used to construct the sample books. The most common books found in the collection were publisher bindings constructed using cloth over rigid boards (62.08%), followed by books bound at a third party bindery using rigid boards covered with buckram (16.10%).

It is noteworthy that other types of cover materials, such as leather, plastic, and vellum, observed during the survey process, did not appear in the sample.

R5 – What type of cover material is most often damaged?

Books are covered with a variety of products, such as leather, cloth, paper, buckram, and vellum, and each wears at a different rate. It is useful for collection development librarians to know what products are the most resistant to damage so that can be factored into purchasing decisions.

Most of the paper and cloth covers found in the sample were applied as a publisher’s binding material. Within the sample, the paper and cloth had sustained considerably more damage than buckram, suggesting that books sent to the bindery will be better protected on the shelf than books that are shelved directly from the publisher. Table 7 provides the percentages of each type of cover material found on damaged books in the sample.

Table 6 – Bindings and Materials	
Publisher Binding	
Rigid Board w/ Cloth	62.08%
Rigid Board w/ Paper	8.57%
Rigid Board w/ Buckram	0.26%
Soft Cover w/ Paper	3.64%
Soft Cover w/ Kapco	1.82%
Bindery Binding	
Rigid Board w/ Buckram	16.10%
Rigid Board w/ Cloth	6.23%
In-house Binding	
Rigid Boards w/ Cloth	1.04%
Rigid Boards w/ Paper	0.26%

Table 7 - Percentage of Cover Material Damage		
Paper	Cloth	Buckram
30.91%	19.48%	3.17%

R6 – Do publisher or third party bindery books get damaged more frequently?

There was a considerable difference in the amount of damage found in the publisher’s bindings versus the books that were bound by a third party bindery. Table 8 shows the percentage of books that had no damage, versus the books with serious damage found throughout the sample. Based on the findings, it would be in the interest of the library to buy soft cover books and have them sent to the bindery rather than buy the publisher’s hard covered book. This type of preventative action would save the library money in the long term by reducing preservation costs to repair the damage sustained to the less durable publisher’s bindings.

R7 - What percentage of books contain acidic paper and/or brittle paper?

Acidic paper generally becomes brittle as it deteriorates over time. Determining the number of books that contain acidic paper provides an estimate of how many books will become unusable in the future due to brittleness. Once paper becomes embrittled, few repair options are available. Even if the paper is deacidified to stop further deterioration (at a considerable cost), the flexibility of the paper cannot be restored, so the book will either need to be placed in a limited access status or be reformatted for patron access.

Cook Library, like most library collections, contains a considerable number of books printed between 1850 and 1950, when the use of acidic paper was common in book production. In this survey, 80.26 percent of

the books sampled were acidic and 22.08 percent of those were also brittle. These findings are slightly higher than the averages found in the comparison studies found listed in earlier Table 2, which were 74 percent acidic and 21 percent brittle. When these percentages are extrapolated from the sample to circulating collection, there are approximately 106,949 circulating books that can suffer severe damage from simply paging through the book and 388,790 books that will become increasingly brittle in the following decades.

R8 – What types of damage are found in the circulating collection? In what percentages can they be characterized as: environmental damage, intentional patron damage, and damage from age or use?

The physical damage identified during the survey is divided into three primary categories and charted as percentages of the sample in Figure 5, and actual number of books in the collection expected to exhibit these damages appears in Figure 6. The environmental damage is noted with two categories: ultraviolet radiation (UV) damage and water damage. The UV damage presents as fading and weakening of the cover material, and is the result of extended exposure to sunlight or fluorescent lighting. For a general comparison, Starmer and Rice (2004) at the University of Tennessee and Bond et al. (1987) at Syracuse University also reported UV damage and water damage for their collections. The level of water damage at Cook Library (3.12%) was slightly below the 3.8 percent average of the two reports, but the level of UV damage was considerably higher (29.61%) than their average of only 15 percent.

Table 8 - Publisher's Bindings vs. Bindery Bound Books		
	Publisher	Bindery
Serious Damage	23.13%	2.33%
No Damage	32.99%	73.26%

The second category of damage, intentional patron damage, is divided into three categories: torn pages, pen/pencil marks, and highlighting of text (as seen in Figures 5 and 6). Since Cook Library is both an undergraduate and a research library, the level of patron damage in the collection was of interest after reading that Ward and Teper (2005) found 58 percent of the undergraduate library books at the University

of Illinois at Urbana Champaign had damaged pages (p.22). The current survey results revealed some form of intentional damage in the sample books at 15.84 percent. These results are more in line with the research collection at Urbana Champaign of 11 percent (p.22), and similar results found by Starmer and Rice (2004) at the University of Tennessee.

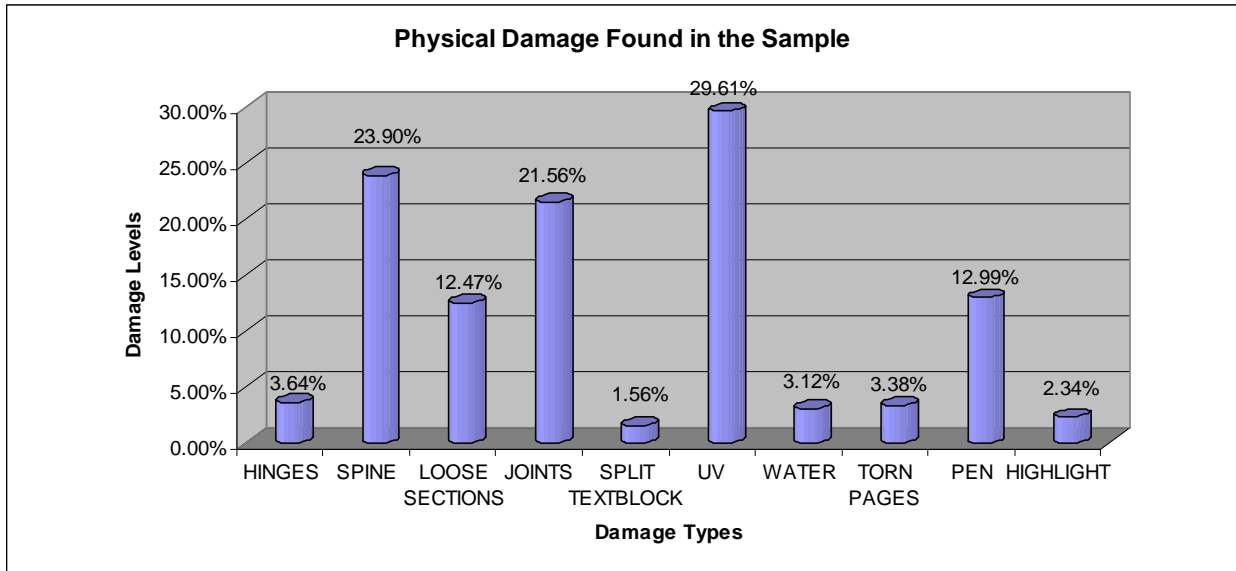


Figure 5 - Types of Damage Found in the Sample

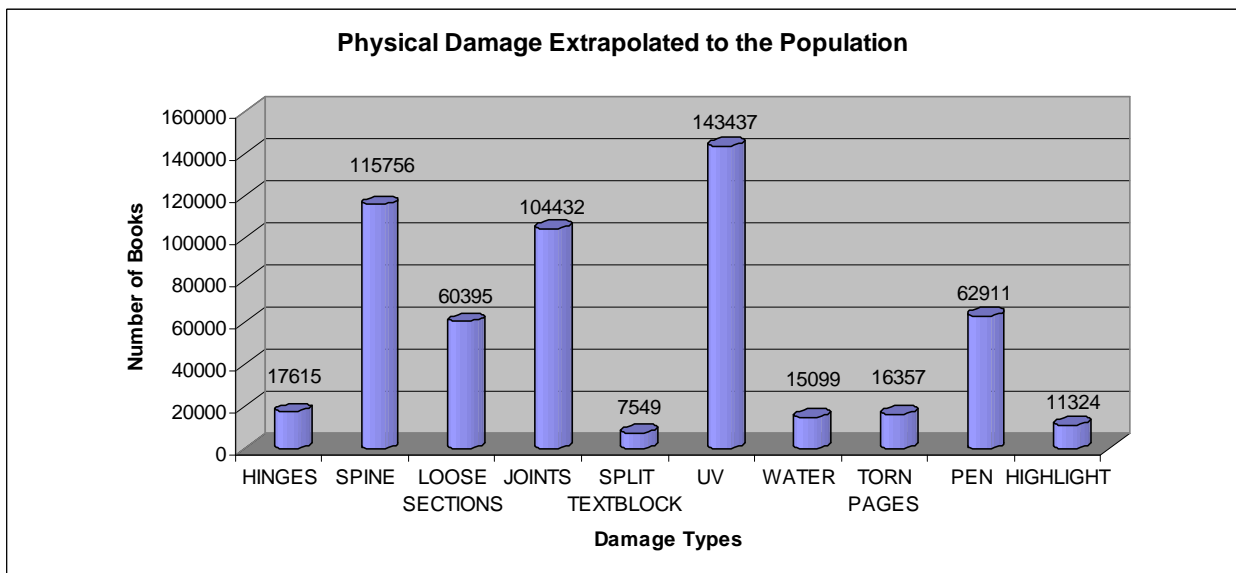


Figure 6 - Physical Damage Expected in the Population

The third category, damage from use or age, is generally the area where most preservation programs are involved. Five areas of damage were identified in the current survey: hinges, joints, spine, loose sections, and split textblock. It would seem that the greatest consistency between various condition surveys would be the type and amount of damage that occurs, but this is not the case. The exact details that are recorded vary greatly, making it difficult to interpret from one report to the next. For this reason, only the results of the current survey are discussed.

On a positive note, all of the volumes in the sample had the covers attached to the textblock, although in some cases this attachment was tenuous. The most serious types of damage identified were the number of loose sections (12.47%) and split textblocks (1.56%), since these require the most time and/or money to repair. Much more widespread, and perhaps more critical, are the number of joints (21.56%) and hinges (3.64%) that are failing. Once these parts of a book fail, the covers fall off and the textblock rapidly deteriorates. The highest rate of damage discovered was spine damage at 23.9 percent. This is a fairly easy in-house repair that is not exceptionally time consuming, but the sample

predicts an estimated 115,756 volumes need this repair, which is a formidable challenge for even a well established preservation program.

Discussion

Based upon the random sample, the circulating collection at Cook Library suffers from many of the conditions that are found in other university collections. At least half of the books are over 35 years in age, 76 percent are bound in a publisher’s binding prone to damage, and 80 percent have acidic paper. Use of the collection appears to be increasing, possibly in response to record attendance levels at the University. This will continue to put a strain on the collection where 57 percent of the books already exhibit some degree of damage (Table 9), with 18 percent of those in need of immediate attention. In addition to increased use, future damage will increase as the collection becomes increasingly brittle due to books that received repairs in the past that will adversely affect their use as they age (Table 10). Although these repairs are not currently causing damage, they are not appropriate for long term stability of the collection because they will cause increased damage as the acidic paper in the books becomes embrittled with time (Table 11).

Table 9- Levels of Damage Found in the Sample		
Serious	Minor	None
18.44%	38.96%	42.60%

Table 10 - Source of Future Damage	
Repairs	Oversewn
8.57%	4.68%

Table 11 - Reason for Future Damage		
	Repairs	Oversewn
Acidic	93.94%	100.00%
Brittle	27.27%	61.11%

When the sample data are extrapolated to the circulating collection, the enormity of the problem becomes obvious: in addition to the estimated 89,334 books that need immediate attention, the future combination of books with current minor damage (188,728), damaging in-house repairs (41,521), and oversewn textblocks (22,648) will far exceed the ability of the current level of preservation and bindery operations to handle the repairs.

Using the results of the sample data, an attempt was made to suggest a narrower focus of targeted preservation efforts based on circulation. The result of the comparison of damage levels found in circulated versus un-circulated books was contradictory to what one might expect, which is that books that leave the building would be placed at a greater risk for damage. According to the survey, there is no noteworthy difference in damage levels found between the books that circulated versus the books that never circulated. In fact, the books that did not circulate actually showed a slightly higher rate of serious damage, as noted in Table 12.

This result is difficult to interpret because it is unknown if books with more serious damage are not circulating due to the damage, or if the damage occurs while the volumes are used within the library. It has been suggested that damaged books are less appealing to patrons, and this may be the case here, but the difference is not great enough to draw any conclusions. This area could be a topic for future research.

The age of the book in relation to the level of damage has not been specifically discussed in the literature, and it provides some interesting, although inconclusive results upon analysis of the data, as reported in Table 13 and Table 14 with the complete descriptive statistics included in Appendix 2. The results are included here as a baseline for future research as a longitudinal study that could provide a predictive element regarding future damage or embrittlement of the collection. The current results merely indicate median imprint dates for levels of damage, acidity, and brittleness that are interesting, but not overly useful.

Table 12 – Damage in Circulated vs. Uncirculated Books

	No Damage	Minor Damage	Serious Damage
Circulated	41.78%	40.89%	17.33%
Uncirculated	43.75%	36.25%	20.00%

Table 13 - Age of Book vs. Level of Damage

	Median Imprint of Sample
Serious Damage	1956
Minor Damage	1970
No Damage	1979

Table 14 - Age of Book vs. Acidic and/or Brittle Paper

	Median Imprint of Sample
Acidic and Brittle Paper	1929
Acidic Paper	1973
Non-acidic Paper	1992

There may be a connection between the median imprint date of uncirculated books (1961) and the median imprint date of serious damage (1956) showing that books with more damage are less likely to circulate, but there is currently not enough data to substantiate this conclusion. Similar reasoning could find support at the other end of the spectrum, with the median imprint date of 1978 and 1979 being found for books that have circulated and books that are not damaged, respectively.

Another consideration for a future survey is the relationship between acidic paper and imprint date. If the median imprint date for books containing acidic paper or acidic and brittle paper became later over time, it might be possible to find support in the data that the collection is suffering from chemical deterioration, thus strengthening the argument for tighter environmental controls to slow the process. It is expected that future uses of this data will be more beneficial than the current uses listed above.

Currently, the results indicate that books with an imprint date of around 1956 exhibit the most serious forms of damage and are in the greatest need of repair. Since most damage is cumulative, the books with minor damage and an imprint date near 1970 could benefit the most from preventative treatment. The current median imprint date of 1973 for books that have acidic, but not embrittled paper could be used to identify books that could benefit from deacidification. Books that are already embrittled with a median imprint date of 1929 would benefit from a phase boxing initiative.

Conclusions

Summary

It is important to understand what type of damage exists in the collection in order to select appropriate solutions. The current survey provides the data necessary to make a preliminary assessment of the condition of the circulating collection in Cook Library. The average book in the circulating collection is over 35 years old. Recent circulation data indicate that the collection has experienced a trend towards more

use each year for the past 15 years with nearly 60 percent of the collection circulating at least once.

The majority of the books are bound with publisher's binding over rigid covers, which according to this study are the most prone to damage. Consideration should be given to purchasing more soft covered books and having them bound at a bindery, as the survey indicates these volumes are not damaged as often. Additional attention should also be paid to soft-covered paperback books, because the study shows they also incur high rates of damage.

More than half of the books in the collection have some form of damage and around 18 percent need immediate repair. Approximately 80 percent of the books contain acidic paper and 21 percent of the books have already become embrittled. This type of damage can only be mitigated by an expensive deacidification program or slowed by better regulation of temperature and humidity levels in the library. In addition to the books that are damaged by use, a large number that have been repaired will incur further damage as the volumes age due to the nature of the repair.

The employment of a part-time preservation staff person and several student employees is inadequate to deal with the scope of the preservation problems in Cook Library, in addition to preservation issues at the other campus libraries. Recently, steps have been taken to increase the number of new volumes that are purchased, but attention should also be paid to existing collections and a commitment made to maintain this valuable university asset. Now that data concerning the condition of the circulating collection are available, a plan can be developed to address the problems.

Appropriateness of the Study

The study builds upon a long history of condition surveys and can provide the administration of Cook Library with information beneficial to the library and the circulating collections. Without empirical data regarding the collection, any action taken can only be based on a "hunch" or what someone "thinks" is

happening based on their experience. This approach can address some issues, but it is not precise or pragmatic. Now when discussing the condition of the collection, library staff and administrators familiar with this study can say, with 95 ± 5 percent certainty, that they are aware of the collection's condition and can take the appropriate action based on facts.

Recommendations for Improving the Study

The study could be improved in two ways. The first recommendation would be to alter the sample generation by changing the average number of books per shelf. In most cases the number of books per shelf was closer to 25 rather than 50, which resulted in a large number of rejected book locations. This large rejection rate caused the survey to take much longer than necessary. The second recommendation would be to create a more detailed section of the survey form to better identify the types of damaging repairs so that specific changes could be made to the preservation workflow. Analyzing the results based on the current form made it appear as if all in-house repairs cause damage, which is not entirely accurate.

Recommendations for Future Studies

The current study indicates there are serious condition problems within the circulating collection that need to be more closely examined so that appropriate action can be taken. The lack of appropriate preservation policies currently impacts the collection in a negative way that will worsen over time. Ignoring the problems will not solve the crisis. Issues such as the size of the preservation program and how books are routed for repair can be dictated by the findings of a larger study. The current survey makes it clear that problems exist, and an additional larger survey will allow the administration to make informed decisions on how to solve the problems.

A comprehensive survey will provide the needed information about areas of the collection that need immediate attention. The future study can build upon the results and tools used in this study. The sample size and initial shelving count used to create the sample locations has been included in Appendix 3, in combination with the survey form and guidelines found in Appendix 1, removing the need to start from scratch. This study provides a starting

place that library administration can use to develop policies designed to ensure the long-term preservation of the Cook Library circulating collection.

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Appendix 1

Sample Number:	Collection:
Last Date of Circulation:	Imprint Date:

DESCRIPTION:

Covering:

<input type="checkbox"/> Buckram	<input type="checkbox"/> Cloth	<input type="checkbox"/> Paper
<input type="checkbox"/> Soft	<input type="checkbox"/> Kapco	<input type="checkbox"/> Rigid

Binding & Textblock:

<input type="checkbox"/> Original Binding	<input type="checkbox"/> Bindery	<input type="checkbox"/> In-house Recase	<input type="checkbox"/> Damaging Repair
<input type="checkbox"/> Joints Damaged	<input type="checkbox"/> Hinges Damaged	<input type="checkbox"/> Spine Damage	<input type="checkbox"/> Oversewn
<input type="checkbox"/> Split Textblock	<input type="checkbox"/> Loose Sections	<input type="checkbox"/> Water Damaged	<input type="checkbox"/> UV Fading
<input type="checkbox"/> Pencil/Pen Marks	<input type="checkbox"/> Highlighted Text	<input type="checkbox"/> Torn Pages	
<input type="checkbox"/> Brittle Paper	<input type="checkbox"/> Acidic Paper	<input type="checkbox"/> Serious Damage	<input type="checkbox"/> No Damage

Guidelines

A sample number and collection letter was initially filled in on the 385 sample forms. Once in the stacks, the shelf number listed on the form was located by walking down the rows of stacks and counting each shelf that contained library materials. When identified the books were counted to select the sample volume. If other formats were present on the shelf, they were not counted. If the shelf and volume numbers did not correspond to a book another location was selected from the list of extra random sample locations generated earlier.

The last date of circulation was recorded from the date due slip. If there was no circulation information a zero was recorded. The imprint date was recorded next. The description of the book was completed in the following five steps.

- 1) Look at the primary material that covered the exterior of the book and the type of cover. (example: paper / rigid boards, cloth / rigid boards, etc).
- 2) Identify who bound the book, was it the publisher, third party bindery, or in-house. If in-house, will the repair result in future damage? (pressure sensitive tape in the joints, book tape on the spine, etc).
- 3) Record the types of physical damage found in the book. (example: damaged hinges or joints, torn spine, sections coming loose, etc)
- 4) Use the pH pen to test for acidity on the bottom of the book by drawing a 1/2 inch line parallel to the cover and record the color change and fold a page corner back and forth three times to identify brittleness.
- 5) Record "No Damage" or "Serious Damage". These categories refer to physical damage. The book could have acidic or brittle paper and still receive a "No Damage" status. Serious damage was selected if there were multiple forms, or one very serious form, of damage that needed the immediate attention of preservation.

Appendix 2

Books with Serious Damage	
Median Age	1956
Range	91
Minimum	1900
Maximum	1991
Count	71

Books with Acidic & Brittle Paper	
Median Age	1929
Range	100
Minimum	1884
Maximum	1984
Count	85

Books with Minor Damage	
Median Age	1970
Range	117
Minimum	1884
Maximum	2001
Count	150

Books with Acidic Paper	
Median Age	1973
Range	185
Minimum	1819
Maximum	2004
Count	224

Books with No Damage	
Median Age	1979
Range	186
Minimum	1819
Maximum	2005
Count	164

Books with Non-acidic Paper	
Median Age	1992
Range	53
Minimum	1952
Maximum	2005
Count	76

Appendix 3

Data Needed for Comprehensive Survey of Cook Library			
Strata	Population	Sample Size	No. of Shelves
A -- General Works	3520	346	644
B -- Philosophy. Psychology. Religion	28949	379	1852
C -- Auxiliary Sciences Of History	4045	351	296
D -- World History	28223	379	1696
E -- History Of The Americas	22534	378	1047
F -- History Of The Americas	13201	373	854
G -- Geography. Anthropology. Recreation	13336	373	905
H -- Social Sciences	67624	382	4838
J -- Political Science	13295	373	885
K -- Law	12482	373	2241
L -- Education	44738	381	1905
M -- Music And Books On Music	11081	371	951
N -- Fine Arts	13093	373	886
P -- Language And Literature	93325	383	4609
Q -- Science	49830	381	6191
R -- Medicine	25881	379	2282
S -- Agriculture	3421	345	291
T -- Technology	20137	377	1893
U -- Military Science	1921	320	95
V -- Naval Science	455	209	32
Z -- Bibliography. Library Science. Info. Resources	13324	373	920
Totals	484415	7599	35313