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ABSTRACT

This paper provides clarification of issues important to the preservation of paper materials and presents practical steps for any librarian to take in preserving the library collection. In order to deal with a manageable subsection of this complex issue, the paper concentrates on three interrelated aspects of paper preservation: the nature of the problem, the extent of the damage, and recommendations for action. An examination of the problem discusses the causes of deterioration, the validity of current scientific methods of preservation, various complicating factors, and current tools available for creating a solution. A consideration of the extent of the problem covers examining the useful life of an item, determining how many books need immediate attention, and estimating costs involved in preservation. Recommendations for future action include microforming materials, full involvement by librarians in planning, and developing local and national plans. Appendices contain a directory of supply companies, a chronology of paper from circa 105 AD to 1981, an extensive reference list, and the author's vita. (THC)

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Paper Preservation: Nature, Extent, & Recommendations

by

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To Max Westbrook—teacher, poet, papa.

INTRODUCTION

"We are in danger of losing more than a century of the human record....Books containing the acidic seeds of their own destruction continue to be produced by the millions, storing up problems for the future, failing to provide a permanent record of our own times."[1]

If that does not arouse concern then consider Richard Smith's statement that "it is very optimistic to believe that libraries, in the year 2000, will be able to circulate very many of the books published between 1900 and 1960."[2] R.D. Rogers, university librarian at Yale, dramatized the danger in yet another way when he observed that: "At Yale we sweep up a book a day from our stacks. Unfortunately the pieces weren't of the same book."[3] Many librarians, the guardians of this priceless heritage, continue to regard the problems of paper preservation as greatly exaggerated, too massive to concentrate on, or less important than the daily fight to maintain services. Welsh, of the Library of Congress (which receives about 1150 new books each working day), points out that the acidic destruction of books is "the greatest crisis facing scholarship today."[4] A careful, realistic, open-minded examination of several facets of our rapidy deteriorating collections of paper records might well persuade socially conscious, farseeing, prudent librarians to emulate the Dutch boy by plugging the leaks so the dam does not break. Carolyn Morrow encapsulates the prevailing trend well when she points out that: "Preservation can no longer be dismissed as a luxury program for a few elite research libraries."[5]

The problems of paper permanence are tightly interwoven with resource sharing, shrinking budgets, cooperative cataloging, printers' inertia, a rapidly changing technology, and many other far-ranging aspects of library science. "Conservation is a popular topic, or, more accurately, discussing conservation is a popular activity. The demand is heard that something should be done about conservation, but the concept is often hazy and there is no clear understanding of its content, its scope or to whom the demand should be addressed.[6] This paper intends to provide some clarification of this "hazy" concept and some practical steps for virtually any librarian to take. In an effort to deal with a manageable subsection of the complex issue, this paper concentrates on three interrelated aspects of paper perservation: the nature of the problem, the extent of the damage, and recommendations for action. The nature of the problem involves examination of the causes of deterioration, the validity of current scientific methods, various complicating factors, and our current tools for creating a solution. An examination of the extent of the problem involves an understanding of the "useful life" of an item, a realistic determination of how

many books need immediate attention, and what cost is involved. Recommendations for future action include microforms, librarians' full involvement, local plans, and national plans. Concentration on these three broad aspects of the paper preservation issue should supplement an understanding of the complexity of this problem even though familiar topics—such as paper history, practical application, and rare book restoration—will be only briefly mentioned [7]

NATURE OF PRESERVATION PROBLEMS

In 1970 Richard Smith noted that the "disintegration of books has been predicted by generations of librarians, but the books still stand upon the shelves, embrittled perhaps, but intact. To explain this, we must understand that the real-life rate of deterioration is not a straight line. It is an exponential curve...."[8] This basic characteristic of paper deterioration remains a necessary aspect of any real understanding of the nature of this problem. With that basic premise in mind, an examination of the causes of paper deterioration can be useful in understanding this complex issue.

Causes of Paper Deterioration

Paper is not an inherently weak material; although "it is not as durable as parchment, paper can match its permanence if it is manufactured and stored properly."[9] Four factors affect the "proper" storage of books: biological causes (such as vermin, mold, and fungus), physical elements (such as heat, light, and moisture), defects (such as originally acidic paper or ink), and human abuse.[10] Indirectly, if not absolutely, man is the source and instigator of these problems: man as manufacturer, user, amateur conservator, and custodian sets up the conditions which encourage or retard deterioration.[11] "Men are unquestionably the greatest enemies of the materials on which they record their thoughts."[12] With the exception of stone and metal written records, all documents are:

> Vulnerable: clay to worms; papyrus to insects and moisture; bark, wood and palm leaves to termites and other insects, and leather and linen to rot and insects....It has been reported that some three thousand years ago, papyrus scrolls were dried and unrolled after every rainy season to determine whether the rain had washed off the ink writing. For protection against the insects, humidity and dust, the Egyptians, Greek, and Romans stored their scrolls in cylindrical boxes of wood and ivory....[13]

Kathpalia estimated over 20 years ago that as much as 20% of the world's books may have been destroyed by rodents.[14]

Acid

The turn of the century saw a new era with man as the researcher when Edwin Sutermeister tested six papers manufactured between 1896 and 1901 for acidity and strength. In 1929 he retested the samples and reported that:

> "all of the acid samples were badly discolored and absolutely without strength while the lime mud sample was much whiter and seemed as strong as ever." He concluded that "the nature of the fibert content...[is] not the vital [factor] but that the damage is probably due to the acidity caused by the alum used in sizing."[15]

What Sutermeister suspected in 1929 was confirmed by W.J. Barrow 30 years later. In a series of experiments, lasting until his death, Barrow noted that "the acidity of the weakest papers is, on the average, from six to ten times as great as that of the strongest."[16] He also found that the "principal sources of this acidity are probably from alum rosin sizing, residual chlorides from the bleaching, and a breakdown in some of the oxidizable carbohydrates found in chemical wood fibers."[17] In other words, it was only indirectly true that the change from rag (or linen) to wood affected the quality of paper. A brief elaboration from the Cunhas amplifies this fundamental problem:

> Paper deterioration became serious in 1774 when Karl William Scheele, a Swedish apothecary, isolated chlorine, which, within a short time, was being used for bleaching paper....The important fact about acid in paper is that since acid is catalitic and nonvolatile even small amounts can hydrolyze very large amounts of cellulose. The insidious thing about sulfur dioxide is that...much of the gas penetrates deeply into the fibers of paper in books and then is oxidated into acid, therefore initiating damage between the covers of books that have been unopened for years and in which one would expect the paper to be reasonably safe....Sulfur dioxide is by no means the only source of acid in paper. An equally dangerous source is the potassium aluminum sulfate (alum) in alum/rosin size....Major sources of acid in paper are sulfur dioxide in polluted air, lignon in wood pulp, alum-rosin sizes, residual bleaching chemicals, iron gall ink, and migration from other materials.[18]

With Barrow's work as a basis, other scientists have continued to explore the acidity of paper.[19]

After the impact of acidity became commonly accepted, further work determined the rate of acidic deterioration. "The physical properties of a paper change little during the greater part of the cellulose degradation...until it reaches a critical range below which the 'paper rapidly loses strength and becomes embrittled if the degradation continues.'"[20] As the "average pH of the papers produced in the last three decades of the [nineteenth] century was low,..." a large number of books are already well past the critical range.[21]

As research continued, new sources of acid were discovered outside of the actual papermaking process. Barrow noted a clue to this new source of trouble when he observed that "books stored in urban areas are more acidic than those kept in rural locations...."[22] As the city pollutants grew more severe, new research found that the "quantity of acidic materials that develops in books during library storage as a consequence of natural degradation processes or by the absorption of air pollutants, may exceed the quantity introduced as aluminum sulfate during papermaking."[23] By 1973 Lyth Hudson's conclusion was commonly accepted as valid: "[acidity] in paper normally arises from sizing...[but] may also be picked up from the atmosphere, particularly from sulphur-dioxide."[24]

An accurate understanding of acid's effect on paper has helped in work toward the creation of a nonacidic, even alkaline, paper. As was discovered early on, many papers which are "mildly alkaline or neutral, have held up beautifully for the past 300 to 800 years."[25] Some practitioners have gone so far as to note that today the "term 'acid-free' is both dated and nebulous....For example, there are 'acid-free' (i.e., pH neutral or higher) papers which will quickly become acid and 'acid-free' papers which contain substances such as sulfur and lignon which will harm photographic artifacts."[26] Such viewpoints emphasize the fact that original acid is only one of the factors involved in this complex problem.

Temperature

Temperature remains a critical factor in any discussion of paper strength as higher temperatures speed up the chemical reactions caused by acidity which ultimately speeds up the deterioration. Feller reported that "a particular paper...will lose half of its strength...in 490 years when stored at 78 [degrees] F. If it is stored at 86 [degrees] F., this paper should deteriorate to the same degree in 88 years."[27] He also warned that "radiators, electric lights or anything else that raises the temperature of the rooms where books and manuscripts are kept thus will speed up the deterioration of the paper and bindings in a highly predictable manner."[28] Mary Ritzenthaler noted that it "has been estimated that the useful life of paper is approximately cut in half with every 10 [degree] F increase in temperature."[29] Unfortunately, Hudson's comment on this problem is still essentially accurate: "storage temperature is important but has been largely ignored...."[30]

If high temperatures are harmful to books it does not necessarily follow however, that freezing them wholesale solves the problem.

> If we assume that the lowest temperature possible is the best for the preservation of books, there are at least [two] factors which dictate lower

> limits. The obvious one, of course, is people ...If books were stored below a certain temperature, moisture would condense on them, causing damage, when they were brought out into a "people-area" for use.[31]

As a general solution for long-term use, the problems of extremely cold temperatures (incompatability with patrons and staff, moisture damage, and lengthy waits for the slowly warmed materials) must outweigh the benefits gained in preservation. Unfortunately, the "conditions which make a favorable environment for people are not the same as those which are conducive to the preservation of library materials, the oft-repeated myth to this effect notwithstanding."[32] Nevertheless, the effect is so dramatic that cold storage may well serve as a temporary emergency measure to preserve endangered materials. Merely "lowering normal storage temperature by 25 [degrees] c. can increase a paper's life ten times."[33] Since temperature strongly interacts with acidity in the deterioration of paper, any long-term solution to the problem must account for both of these factors.

Other Causes of Paper Deterioration

A large number of other factors add to the problem of paper deterioration and often receive separate treatment in the literature.[34] The worst of these follow: excessive humidity or dryness, rough use, pollutants, vandalism, and the extremes of both light and dark.[35]

Only one item has been removed from that list in this century and that is fiber content, long thought to be a factor in paper permanence. However, "rag content itself is no guarantee of permanence."[36] The other factors prove all too common in research libraries. "Fluorescent lamps..., unless filtered, tend to fade bindings and manuscripts more rapidly than the 'old fashioned' fixtures that they may have replaced."[37] While light affects paper, three factors "control the degree to which light causes damage to library materials." These are distribution, intensity, and duration.[38] Many of these factors are even more damaging in combinations. "For example, the rate of many chemical reactions is dependent on both temperature and water. Thus, the combination of high temperature and high humidity accelerates the action of alum-rosin sizing to generate sulphuric acid in paper."[39] The air surrounding library materials hosts several damaging agents, such as dust and fungus spores.[40] "All impurities in the air are harmful to books....[Therefore the] Library of Congress has specified a minimum filtration efficiency of 95 percent."[41] Such guidelines or standards are not commonly spelled out quite so specifically, but all of these factors are generally recognized as dangerous.[42]

Summary of These Causes

The major causes of paper deterioration, acid and temperature, are compounded by other factors such as light, humidity, dust, and fungus. Any effort to solve these problems involves a complex array of interdependent aspects of library service. If lights are lowered or put on timers then both staff and patrons suffer some degree of inconvenience. If buildings are redesigned to avoid windows that pour light, heat, and dust on bookstacks then budgets, aesthetics, and comfort are brought into play.[43] Temperatures low enough to cause any significant retardation of deterioration may also retard the patrons' ability to turn pages. Systematic inspection for fungal and rodent damage may require more staff time than is available. While these problems are certainly not insurmountable, they are involved in any serious attempt to completely alleviate the causes of paper deterioration. As true now as it was over a decade ago is the Cunhas's conclusion that the "reasons for this catastrophe are now understood and there is an increasing awareness by librarians that something must be done."[44]

PROBLEMS WITH TEST VALIDITY

Serious research into the causes of paper deterioration implicitly assumes the use of valid testing procedures. The two basic methods used in testing paper strength are the MIT Folding Endurance Tester[45] (or some variation of it), and the artificial aging test.[46] Even though these two are in common use and most of the modern permanence claims are, in some degree, based on them, they frequently fail to deliver sharply accurate information. "In spite of much research work, it is impossible to predict the permanence of individual samples really precisely from artificial aging tests, though the factors to affect aging are fairly clear."[47] In 1976, for example, P. Lunar and R.D. Cardwell conducted some research into the accuracy of the folding endurance and aging tests. They concluded that it "remains...to correlate the more complex mechanical tests such as folding endurance with preruptive behavior....Rankings in stability obtained at elevated temperatures should be extrapolated [carefully]...."[48] The development of the Arrhenius method of artificial aging may only have spiked the existing controversy. As E.L. Graminski et al. reported in 1978, "the predictions of permanence [based on the Arrhenius approach] may be just as misleading as those obtained in the single temperature method....The results of this investigation clearly demonstrate the need to establish the optimum temperature and moisture conditions for accelerated aging tests for paper."[49] However, Wilson and Parks reported in 1980 that their "Comparison of Accelerated Aging of Book Papers in 1937 with Thirty-six Years of Natural Aging"

showed that the "changes...that occurred during accelerated aging...correlated well with changes...that occurred after 36 years of natural aging."[50]

Conflicts Among Experts in the Field

Even more disturbing are conflicts among experts in the field. Despite the general acceptance of his work, even Barrow's "conclusions that acidity is the major factor in causing deterioration have been queried by some others. Dixon and Nelson...concluded that acidity...is of second importance and the structure of the sheet appears to be the determining factor."[51] These differences, it must be remembered, refer to the degree of accuracy in general rather than to the ultimate conclusion. While such debates among active scientists are inevitable in virtually any new field, this intermittent questioning of the basic tests may prove detrimental to large-scale preservation efforts.

Paul Banks noted in 1974 that "scientists disagree even about what the optimum [relative humidity level] is, leaving aside any practical considerations."[52] In a project centered on locating different copies of the same books in libraries throughout the country, Norman Schaffer found that the "physical condition of a given book...[varied] considerably, presumably because of variations in the amount and kind of use and in the conditions of storage."[53] In 1964 Gordon Williams flatly stated that "use...is a significant factor in paper deterioration."[54] Nevertheless, Smith contradicts them both when stating that his "findings also suggest that the makeup of the original paper, the location of the library and its storage practices are more important factors than use by patrons is in determining the useful life of research library collections."[55] While most librarians, publishers, and scientists agree with the dismal conclusion that the papers of this century are weak, Leonard Shatzkin points up the positive side of the picture when he notes that some of "today's papers...are considerably stronger than the papers used 100 years ago or even...twenty-five years ago."[56]

Summary of Test Validity Problems

These differences seem relatively minor, however, as general agreement remains intact on the main issue. "Although there are unresolved technical arguments about the validity of artificial aging tests, everyone agrees that acid causes paper to disintegrate."[57] The paper in books of this century and much of the last century, will not last as long as the need for those books lasts unless effective measures are taken soon. When discussing a need for these materials in the centuries to come, Morrow's point is well taken when she states that, despite various controversies, "over the accuracy of acceler-

ated aging tests, recent research implies that the correlation, while not exact, is accurate enough for long-term predictions of paper permanence or impermanence."[58] Warren Haas underscored the real issue in all of this conflict among experts and tests when he wrote that, quite simply, "our knowledge of the chemical reasons for the deterioration of book paper is still imperfect."[59]

These problems will ultimately affect libraries in several ways. Members of Congress may look at the inner conflicts and be that much less willing to appropriate funds for a solution. Librarians may use these rather minor variations as a handy excuse to put off dealing with paper preservation in their own libraries. It remains possible that the ultimate damage may result: on the basis of incomplete or inaccurate information—such as an erroneous relative humidity level—the nation may set aside the sole copies of certain valued books only to lose them. For all of these reasons the conflicts among experts and the questionable validity of accepted testing methods must be examined, researched, and so far as is possible, resolved.

COMPLICATING FACTORS

Most of the problems of paper deteroration are well understood. "Recognition, however, does not mean action."[60] While understanding the causes of paper deterioration and debates within the field are useful, various other aspects of the nature of paper preservation complicate any planned solution still further. Six major questions deserve attention although many others still exist.

What is Being Saved?

First, what exactly is being saved or preserved? One sector holds that "our 'first principle' then, is that information is different than books."[61] In that case the book remains important only if the physical record offers information in itself. The other sector obviously holds that the book must be preserved if at all possible. In this case the book is always intrinsically important if only as the authoritative source for all copies. One proponent of this philosophy stated that:

> Ideally, selection should be based on both distinctive bindings and covering, as well as noteworthy content....a book's value can be found in what may be called special production editions. Such include: (1) authoritative, (2) first, (3) facsimile, (4) enlarged, (5) illustrated, (6) limited, (7) exclusive, (8) deluxe or gold-edged editions.[62]

No matter whether the principle of saving the book or the contents is more important, most librarians would agree that "library materials should be rationally selected for discard on the basis of need rather than discarded because chemical reactions have caused them to deteriorate beyond use."[63]

This question implicitly involves another issue. What does it mean to be "preserved"? Gordon Williams states that "our problem is to insure the *continuous availability*...of all significant written records."[64] Any plan which preserves books without providing a method of easy access may hoard material but it probably fails to save it in any sense that patrons or librarians would find meaningful. In examining the options available "we must exercise the greatest critical judgement in determining in what form we will preserve materials or their intellectual content...."[65]

Which Items Get Saved?

The second question so intertwines with the first that they deserve examination in tandem. Is every written item to be saved or only a portion, and if so, then what portion? Certainly "it would be madness to spend a dollar a page to deacidify, laminate and rebind a dog-eared government pamphlet on poultry-raising or a crumbling city directory."[66] Librarians also recognize that policies "based on the assumption that all materials must be retained indefinitely will ultimately result in sizable parts of those collections becoming unsalvageable because preservation resources have been spread too thin."[67] While most librarians would agree, the question remains: who decides what is to be forever lost to humanity? How is such a decision to be made? Is its inherent use as an artifact reason enough to save a copy of Barbara Cartland's 187th romance novel? What might be lost if such a decision continues to be left to the random, uncoordinated attempts of private, local preservation efforts? Gordon Williams warns that the "needs and interests of research libraries are sufficiently similar that under the pressure of immediate needs libraries would make similar [weeding] decisions, with the consequence that all examples of some significant books would surely be lost."[68] As cooperative efforts among libraries expand, data on what has already been saved becomes increasingly available. "The whole clearinghouse concept which is rapidly emerging is a very important way of getting information into collection development."[69] The proponents of disparate answers to these two questions—what physical items to preserve and which of the possible items to choose—are virtually legion.

PROFESSIONAL COMMITMENT

No matter how many armchair preservationists propound theories, however, the real bottom line may well appear in the third factor. What is the current level of commitment and involvement on the part of individual libraries and professional organizations? Is it strong enough to form the wellspring of any realistic attack on the problem? "Professionalization means...an outlook that includes not only the technical aspects of a field, but the theoretical, philosophical and ethical context in which the field operates."[70] The most consistent and long-standing supporter of paper preservation work remains the Council on Library Resources (CLR) which funded by the W.J. Barrow Laboratory during its existence as well as various projects for the Library Technology Program of the ALA.[71] The Association of Research Libraries (ARL) has had a Preservation Committee since 1960. *Preservation Education in ARL Libraries* (SPEC Flyer No. 113, April 1985) is the ARL's latest effort to make preservation education materials available. The Library of Congress' *Information Bulletin* has carried short news items on the topic since 1970, and the Library of Congress established a Preservation Research Office in 1970.[72] The *RTSD Newsletter* has carried Ann Swartzell's preservation column since September of 1984.[73] In 1980 the National Conservation Advisory Council published a report on U.S. treatment facilities "for those individuals who are unfamiliar with the conservation field and who may have trouble identifying the kinds of services that are available."[74] The Research Libraries Group (RLG), funded by NEH, started a project to be completed late in 1983, "intended to prevent duplication of filming efforts....Among other activities of the RLG Preservation Committee were the completion of a draft preservation manual and specifications for the preparation, production, inspection, labeling, and storage of films produced by the cooperative preservation microfilming project expected to begin in the spring of 1983."[75]

In 1983, the NEH offered $400,000 for preservation project grants. In spring of 1985 the "National Endowment for the Humanities...established an Office of Preservation to provide national leadership and grant support for efforts to preserve rapidly deteriorating research materials....Formal guidelines, including application forms, are available from NEH."[76] The Andrew Mellon Foundation gave New York Public Library (NYPL) a $750,000 grant in 1983 to allow them to microfilm various special materials.[77] "The Exxon Education Foundation has made available $1.5 million to [CLR] for a long-term program to preserve essential holdings of American research libraries."[78] At the Library of Congress the watchwords are "phased preservation"—i.e., stabilize, prioritize, and conserve.[79] Other

than these efforts, no matter how worthwhile in themselves, no major national plans have been set in motion. No major American research library has established itself as a working model of in-house preservation work.[80] As Haas said in 1978: "To date there is no evidence that the problem of preserving the human record will somehow be solved in the natural course of events."[81]

Technology

The futuristic solutions provided thus far demonstrate how rapidly the technology changes. Any solution to this problem must be flexible enough to accommodate the possible results of ongoing research into permanent diazo microforms, permanent papers, plastic papers, and optical disk storage.[82] Video and optical disk technology, discussed at the First Annual Preservation of Library Materials Conference as sponsored by *Microform Review*[83] are under consideration at the Library of Congress. Optical disk storage, now being phased in at the Library of Congress, can store about 316 books on two sides of an optical disk.

> Among the disks' advantages are random access to information, preservation, and the ability to reproduce one disk from another with "master" quality. Problems associated with disk use are legion and include: publishers' roles, copyright law, organizational and functional changes in libraries, indexing, materials selection, methods of loading the disks, the future of classification, public attitudes toward new technology, distribution problems, and the bottom line of most new ventures, cost.[84]

As some librarians have pointed out: "Although the technology for optical *digital* storage of information exists, its practical application and cost efficiency in libraries is yet to be demonstrated."[85] Bill Welsh, deputy librarian of Congress, believes that this new tool:

> is the best technology we have today for compact storage and retrieval. It offers random access. It's interdepartmental in organization. It seems permanent as a storage medium, and makes perfect copies. You can enhance the image. An item can be shared simultaneously, remotely. It puts an end to the not-on-shelf problem forever.[86]

Even patrons may find technological advances in preservation research that affect their interaction with books. "Morgan Data Conversion...has the contract to create a device that will enable bound volumes to be photocopied face up and open no more than 90 degrees. A grant of $64,400 from the National Endowment for the Humanities will support the effort."[87] "It is significant that the latest developments in the field of plastic papers aim at products for the printing industries....[They] have characteristics of good printablility."[88] This particular material may not make a

drastic change in this field but no solution should box librarians into a corner. "The technology of conservation and restoration is so far advanced that it can be assumed that no fundamentally new developments, so novel and improved that they would justify delaying all efforts currently feasible, are expected."[89] Nonetheless, the technology in use today changes enough to warrant some consideration of this question in any proposed solution.

Library Education

The educational system of library science is involved in the problem of preservation as ignorance within the profession continues. "Europe has led America in the training of conservators....Although courses in conservation are not proliferating, there are courses being offered or in the planning stages throughout the United States...."[90] In 1976 George Cunha recommended required graduate courses in conservation.[91] Enid Thompson's "Teaching a Basic Course in the Conservation of Documentary Materials" offers practical information on the content of one such educational program.[92] Although the course runs only three weeks, its format is unique and its bibliography useful. Paul Banks described the lack of prepared librarians and students delicately when he noted that "the field of library conservation is...a developing field."[93] In 1982 "Columbia's School of Library Service announced the first university degree program in the country to train library conservators and preservation administrators, bringing in Paul Banks from the Newberry Library in Chicago to direct the program."[94] "Courses, units or workshops on various aspects of preservation are offered at 85% of the accredited library schools...."[95] In any attempt to plan for the future, much less to effect such a plan, a "limited" number of professionals with the basic knowledge to be of any real value must effect the results.[96]

Other Industries

Papermakers, printers, and publishers are intricately involved with the continuing problems of low quality paper. As one paper executive put it, the "truth is that the average commercial printer...does not give a damn...[about] paper permanence....Unless the world can make it worth his while (in dollars and cents) to exercise a preference for permanent papers..., then we will get nowhere in overcoming his indifference."[97] Books absorb only a tiny portion of all the paper produced in today's disposable society. Persuading papermakers to address what must seem to them a rather small problem may prove difficult. (For a brief overview of the problems and benefits of conversion to alkaline sizing from the paper manufacturer's viewpoint see the following article: "Alkaline Sizing Con-

version" by J. Keith Poden.[98]) Of course the CLR is right when they work on the "premise that no single group—librarians, paper manufacturers, or publishers—is responsible for the preservation problem or for the solution."[99]

Other Factors

Finally, a host of other related factors affect the issue of paper permanence. As Pamela Darling points out:

> We must develop uniform condition descriptors, a common terminology for categories of treatment, and shared sets of criteria for screening materials and sending them down this or that path to restoration, format conversion or oblivion. To avoid wasteful duplication of effort,...we must divide up the universe and assign primary responsibility for preserving chunks of it to many different libraries....preservation information is still scarce, scattered, primitive, and often inaccurate, the creation of a comprehensive data base on the topic cannot by itself solve the preservation problems of the nation's libraries and archives. Information is valuable only when put to use. Information is a tool, but people do the work.[100]

The lack of cohesive, professional planning makes it difficult to focus the issue. The government, on all levels, remains essentially apathetic at best, and no one has made any concentrated effort to arouse an inflamed interest. Peter Sparks of the LC has repeatedly stressed the need to "market" preservation in the private sector as well as in the government.[101] The general public remains unaware that their cultural heritage—as recorded on paper—turns slowly to dust, despite articles in *U.S. News and World Report*,[102] *Historic Preservation*, *Science 81*, *Chemtech*, and *The New York Times*.[103] Publishers' opposition to solutions involving resource sharing or permanent paper requires recognition. The impact of compact storage/retrieval systems on the bibliographic control mechanisms of shared resource systems deserves consideration. Perhaps the most important factor is the current economic situation, which appears to be settling in for a permanent stay. Any large-scale solution—on an individual or national basis—will cost a great deal more than is available in current library budgets.

CURRENT TOOLS

No matter how discouraging a look into the budgets may prove, however, an examination of the current tools for a solution is encouraging. Three tools, perfected in varying degrees, may well have some role to play in

solving the paper problem—i.e., permanent paper, microform, and the mass deacidification of books.

Permanent Paper

On 11 December 1959, "the Standard Paper Manufacturing Company of Richmond produced five tons of a fine 60-pound book-paper, the first paper deliberately manufactured as a strong, stable ('permanent') paper for general use at a competitive price."[104] Invented by and produced under the eye of W.J. Barrow, Permalife was the first paper designed to overcome the acidity of wood-based, alum-sized papers. Although it is made from wood and carefuly sized for good printability, Permalife "has a life expectancy of 2000 years, at which time it reaches the one-fold stage. But it would take an additional 2000 years to reach the 0.001-fold stage; during the second 2000 years, the material could still be photographed, though not handled. Thus Permalife's *actual* life is more like 4000 years. Lowering the storage temperature by 25 [degrees] C could bring this to 40,000. Lowering the temperature another 25 [degrees] (to -15 [degrees] C) would make it 400,000!"[105] While Permalife prints well, costs what other wood pulp papers do, and lasts for hundreds of years without special temperatures, it looks like any acidic paper. "Since Permalife's debut in 1960, manufacturers have marketed a variety of other reasonably-priced papers meeting 'permanent/durable' specifications, including Acid-free Offset, Milletex, Printone, Silkote, and Waylife."[106] "Fortunately, the economics of the process are sufficient to prompt many of the producers to switch to alkaline production...."[107] Despite the availability of acid-free papers, most books today are printed on poor quality papers which will not outlast the authors whose works they record.

> However, 300 years of experience suggest that the possibility is unlikely of finding an all-round answer through use of permanent papers. Three reasons are: (1) a sufficient quantity of high quality material is not available at a price readers are prepared to pay, (2) the reader is not in a position to recognize and enforce his demands, or (3) the books will not necessarily be stored and used under conditions promoting permanence.[108]

Microform

The potential of Permalife is matched, if not exceeded, by that of microform—a far more compact medium.[109] Efforts are well underway in this field.

> The A.R.L. Microform Project was established in 1981 to coordinate cooperative cataloging ventures that will provide bibliographic access to

titles produced in large microform sets. A.R.L. coordination will ensure that there is no duplication of effort, that standards are followed, that the work is evenly distributed and that the records are available to all libraries in convenient forms.[110]

Teague reported in 1975 that it is believed "that [microform] will last one-hundred years" if it is silver halide.[111] Pamela Darling goes even further with her claim that "artificial aging tests indicate that microfilm which is properly made, processed, stored and handled will be usable for hundreds of years—just as long as high quality acid-free paper...."[112] The use of vesicular and diazo films for short-term storage and daily patron use has proven most satisfactory. Although far more compact than books, the drawbacks to this tool include the minimal equipment required for use (readers and printers), negative patron response, wide variations in formats, and a few other less serious problems.[113] "The reluctance to apply microforms as a tool for preservation can be traced to the old stereotype that 'libraries are places for books.'"[114] Darling's comment is probably not quite so accurate today as in 1974 but it certainly holds true in many institutions.

Mass Deacidification

If Permalife and microform show encouraging signs of promise then mass deacidification processes show strong signs of success. "Deacidification is the process of neutralizing the acids which cause 80-95% of the deterioration in paper and introducing an alkaline residue to prevent acid attack from occurring again in the future."[115] One of the most effective processes in action today, Smith's Wei T'o Nonaqueous Deacidification System, became fully operational in December 1981.[116] Smith estimates the cost of his currently functioning Wei T'o plant at about $500,000 and its potential output at "5,000 books per week if it is operated around the clock...."[117] On 28 September 1984 President Reagan signed PL 98-427 to authorize the Library of Congress to spend $11.5 million to build their own, diethyl zinc, mass deacidification plant at Fort Detrick, Maryland.[118] Smith also points out that the LC plant cost of $11.5 million is exclusive of staff, supplies, and operating funds, and that its expected output is set at 10,000-20,000 books per week. "If the $11.5 million were used to build...5-10 updated, efficient, full-scale Wei T'o systems, 5,000,000 to 10,000,000 books could be deacidified every year compared to the average of 780,000 books per year which the LC system hopes to deacidify."[119] In a recent interview with Bill Welsh, Arthur Plotnick pinpointed the conflicts between the two processes when he asked Welsh for his response to Smith's claim that Wei T'o "is simpler and cheaper" than the LC process. Welsh noted that "we've issued papers in response, and we convinced Congress that our method was

preferable for our particular needs. In doing so, we sharpened our look at both processes, and in fact we do use Wei T'o for some work." Plotnick notes that: "A House of Representatives Report (98-938) to accompany H.R. 5607 gives the Library's argument against non-aqueous and aqueous liquid techniques for mass deacidification, 'which are known to cause transfer of certain inks, dyes, and other soluble materials between pages and between books....this problem could lead to very difficult pre-selection workloads and damage to materials that were not selected out.'"[120] In 1976 Gordon Williams reported that it "now seems probable that deacidification of bound materials is practical on a wholesale scale at a cost of less than a dollar a volume."[121] While this promising statement is still unsubstantiated by any long-term, large-scale work, between Wei T'o and LC it is closer to reality.

In addition to cost and volume considerations, various application factors must be considered. Many volumes still have to be unbound as the process damages bindings; problems with illustrations and certain inks are not totally solved either. Smith argues that the LC diethyl zinc system, despite its effectiveness in "preventing biological attack," does not properly protect paper fibers against oxidative attack. "This difference alone may limit the effectiveness of the L.C. system to 50-75% of the potential increase in book life available through use of the Wei T'o system."[122] And it must also be remembered that: "Deacidifying a brittle book leaves you with a brittle book."[123] Smith states that: "Wei T'o cannot promise that badly embrittled paper can be made usable, but we believe ...t books containing partially deteriorated leaves can be strengthened sufficiently to be serviceable for decades if not hundreds of years."[124] David Darragh reported test results indicating "that deacidification is beneficial when papers still have sufficient strength to register 10 folds or more on the 45 [degree] fold setting on the M.I.T. Folding Endurance Tester."[125] LC reports that mass deacidification "would probably benefit no more than 65% of the brittle books in library collections, since deacidification does not restore strength to paper already embrittled. For all such brittle volumes there appear to be only two feasible preservation procedures: 1) low temperature storage, and, 2) microfilming to preserve the intellectual content."[126] When Barrow instigated work in his field in 1959 he created a simple, relatively inexpensive method with the output "of one person...—estimated at 2,500 pages per day."[127] Although research has progressed to the point that output is estimated by volumes rather than pages, it is still too costly (in both labor and materials) and too slow.[128]

Carolyn Harris reviewed the various mass deacidification processes in her excellent article "Preservation of Paper Based Materials."

VPD, or vapor phase deacidification, [only raises] the pH to 5.6—not high enough to be really effective. No buffering agent is left in the paper, so there are no long-term effects. .The primary problem with VPD is that the main agent...hydrolyzes [into] a well-known carcinogen...one of the discredited projects of the Barrow laboratories is the morpholine mass deacidification process. ..The Council on Library Resources (CLR) which has put more than $1.67 million into the Barrow laboratory, has patented the process, and vested the patent in the Research Corporation, a non-profit firm which handles many academic patents. .The process would probably add ten years to the life of a book, but it would have to be repeated at intervals in order to preserve a book over a longt. period of time... The most important issue with respect to morpholine is the risk to the health of both staff and patrons which might accrue....Beside the fact that the morpholine process doesn't really work, and that it is a health hazard, in a humid atmosphere it smells like dead fish....Peter Sparks...is strongly committed to putting the diethyl zinc process into operation... [Diethyl zinc is explosive in the presence of water, needs special and extremely accurate equipment.] The problems of available chambers, liability, safety and environmental risks related to its use will have to be solved. It looks like they will be, and this process probably has the most possibilities on a truly mass scale....[As the Wei T'o process requires wetting paper, some books can not be processed. Since only Richard Smith has written about the process, some objective data would be useful.][129]

Although its objectivity may be somewhat subject to question, a January 1985 report by Joyce Banks might provide an informed commentary on Wei T'o. Banks, a rare book and conservation librarian, will publish a "detailed report giving the viewpoint of the National Library of Canada...[in] *Conservation Administration News*.[130]

Richard Smith continues work on the "Chicago Process" which should not only provide deacidification but "protection against living organisms, paper strengthening and prolonged storage."[131] If such a complete package of protection should prove practical for mass application at a reasonable price then it may change the focus of any national preservation plan and would certainly affect local plans.

NATURE OF PRESERVATION PROBLEMS: SUMMARY

While mass deacidification may be the tool many librarians pin their hopes on, microforms and permanent paper remain more fully developed and accessible. The use of any of these tools, or a combination of them, must account for the factors involved in and causes of paper deterioration, if a total preservation plan is to completely alleviate the problem. Acid and temperature affect microform and permanent paper, as well as being factors in any deacidification plan. While microforms may well prove more resistant to fungus, insects, rodents, and vandalism than paper, microforms are more susceptible to fires, smoke, and water damage. The validity of the evidence is still in doubt, to some degree at least, on all three

of these tools. Finally, those factors which affect the nature of the paper preservation problem merit attention when any plan for large-scale work is proposed. Understanding the complex, interrelated facets of this problem remains a hurdle in any attempt to solve it.

EXTENT OF PRESERVATION PROBLEMS

While many librarians find it daunting to seriously examine the nature of the preservation problem, examining the extent of the problem proves even more formidable. First of all, any attempt to scan this aspect of the issue must be tempered by the realization that, other than Yale, no single, major research library has conducted a full-scale appraisal of how many items need what degree of attention at what prices for which treatment; and there has certainly been no national attempt to do so. What remains, therefore, is a series of estimates, warnings, and a few facts to put the problem in perspective. And all estimates must be continually revised upward as every "year about 1% of the books in research libraries become brittle and can no longer be circulated."[132] While these pieces of information are none the less useful for being so severely incomplete, the void of solid, factual data does need to be filled.

Permanence and Durability

Perhaps the first step in understanding how many bound volumes are unusable is to determine what scientists and papermakers refer to as "unusable." Two qualities repeatedly discussed in the literature are "permanence" and "durability." Two definitions of these terms, when taken in tandem, help explain the distinction nicely. "'Permanent', when applied to a paper, means its shelf life; 'durable', to its ability to withstand use in a printed and bound book."[133] "Permanence is the capacity of paper to retain its original characteristics, and durability reflects the ability of paper to stand up in use."[134] Librarians are, therefore, usually interested in the durability of their books but will be interested in the permanence of the only remaining copy of a significant work. Smith holds that "permanence is a far more important characteristic than durability for paper in books of research library collections where books are used infrequently and retained over prolonged periods."[135]

In terms of use, two facts help define the point at which a book becomes unusable, assuming the paper to be acidic and the storage conditions "typical." "Measured by the number of users, the average library book can survive about 25 readings before wearing out...."[136] Researchers might find

the following estimate more useful: "deacidification is beneficial when papers still have sufficient strength to register ten folds or more on the 45 [degree] fold setting on the M.I.T. Folding Endurance Tester....If the paper has less than ten 45 [degree] folds, it is almost in a state of dust and probably would not stand up to the deacidification treatment."[137] Keeping in mind the earlier note that the deterioration of paper follows an exponential curve, this information helps in the recognition and selection of those books in need of treatment.

Estimates

In 1907, Cyril Davenport recorded that "there is no doubt that the large majority of our modern books will not be in readable condition in about a hundred years' time from the date of their publication."[138] That is, if anything, more accurate today. Estimating the number of items requiring immediate preservation remains difficult. The most useful yardstick is still the "investigation, directed by William Barrow, [which] indicated that nearly all (97 percent) of the books printed in this century had a life expectancy of less than fifty years."[139] This now famous prediction, made in 1959, continues to prove true in many of this country's major libraries. In 1964, for example, "Robert E. Kingery, preservation chief of the New York Public Library, told [*Laboratory* magazine] his institution should be spending $12,000,000 a year to keep its priceless collection from going to pieces."[140] Obviously such an estimate may be lowered by modern, cheaper methods of preservation and altered by inflation, but it remains a daunting figure. As reported in 1975, in "the Library of Congress there are approximately six million volumes which are no longer accessible for the patron because of deterioration...."[141] In 1977 an LC survey showed that "almost forty percent of its 17m books are already too brittle to be loaned."[142] Another study of 2000 books "from the University of California libraries showed 28 percent to be weak or unusable. Stanford's study corroborates these findings; 26 percent of its titles in the humanities and social sciences were found to be embrittled. Preliminary results from Yale's survey of more than eighteen thousand volumes in the Sterling Library reveal that over 86 percent of the book paper had pH values lower than 5.4 and 45 percent was so brittle that it broke off at the corners after two double folds."[143] The final report stated that "37.1 percent of the books sampled overall had brittle paper (i.e., broke after two double folds) and that 82.6 percent of the books overall had acidic paper (i.e., a pH of below 5.4)....although approximately 80 percent of the nonbrittle books were acidic."[144] A 1976 estimate by Peter Waters, restoration officer of the Library of Congress, indicated that it would take a practicing staff of 200 about 57 years just to treat the LC materials in the rare collections that are in serious need of attention."[145] To

look at it another way, "3,000 tons of books...require emergency treatment."[146] Or again, in 1976, LC "has estimated that keeping only 10 percent of the 6 million books (i.e., 600,000 volumes), and restoring 20,000 per year, will require 30 years and 18 million dollars."[147] Other libraries are in similar condition. "In 1979, a survey of the books in Stanford's Green Library revealed that approximately 26 percent were in such poor condition that they needed special care."[148] Libraries interested in conducting a similar survey can find a program for setting up a preservation survey in Pamela Darling's *Preservation Planning Program*.[149] "In the N.Y.P.L. it is estimated that more than half of the collection has reached...an advanced stage of embrittlement."[150] In libraries with no system for pulling fragile books from circulation, the number of books being used which should be in intensive care is disturbing, to say the least.

Cost of Preservation Care

The cost of preservtion care depends on so many variants which are unique to each library that a bottom line estimate for the "average" item is virtually meaningless. A few of the involved factors include the following: the choice of deacidification or microfilming or both, the amount of equipment needed, the choice between training the current staff and sending the material out, and access to any arrangement with a resource-sharing system which allows the library to weed low-use items in the assured knowledge that another copy would be available if needed. The condition of certain materials requires weighing on option against another, considerations of staff and equipment aside. "Photocopying onto acid-free paper generally costs less than the production of a negative film, and the cost of binding is roughly equivalent to the cost of generating a positive film copy for use as a service copy."[151] Such papers are available from Xerox, Howard Paper (Permalife), Olin, Allied Paper Mills, Mohawk Paper Mills, and others.

One of the most useful guides for estimating the cost of any preservation project is the bill from a similar project. In 1979, for example, a special library replaced its journal collection with microform and reported on the costs involved. The "replacement of 3,365 journals freed...16% of the total shelving available." In total, the project "cost $158,209 including reader/printer and storage equipment to convert 248 titles to microfilm cartridge backfiles...[at] an average of $638 per title."[152] The costs of preservation on an individual basis will vary so enormously that any estimate of the "average" preservation program would be of little practical value. An estimate of how much a national center for resource sharing and preserva-

tion would cost however, could prove well worth the time and money invested in it.

"In 1903, 5 percent of the Library of Congress budget was allocated for preservation services."[153] Eighty years later, David Wilson found that same percentage to be roughly accurate for several major research libraries. Eighteen libraries were queried concerning the percentage of operating budgets and percentage of material budgets spent on preservation in 1982 and forecasted for 1990 and 2000. "Excluding specialized institutions...and some smaller college libraries, the remainder—almost all academic and/or research libraries—are now devoting 11 to 20 percent of their materials budget, and 4 to 8 percent of total operating expenses, to their preservation efforts."[154]

The cost of mass deacidification continues to fall somewhat but the projected lows have not been met.

> The Wei T'o system has been in production for four years at the Public Archives of Canada. The cost of treating an average book is currently $3.47 per volume. This cost includes the two person staff, chemicals and supplies, and maintenance. It does not include cost of floor space, equipment deterioration, or utilities.[155]

Smith predicts that the cost will "drop substantially as the system is more efficiently used and credit is received for reclaimed solvents....The cost of deacidification in a larger, full scale Wei T'o system would be well under $2 per book, presumably in the best cost range of $1.78 per book estimated for the LC facility...."[156] In March of 1985 Richard Smith offered the following cost comparison. "In summary, the cost of deacidifying one book will be between $7.96 and $15.85 using the LC system, between $2.46 and $5.07 using the Wei T'o system, and the cost of deacidifying one book is now $11.23 in the manual Princeton system."[157] Outside of the Wei T'o and LC systems, mass deacidification is not available on a large scale. Until an affordable system is established, whether commercial, nonprofit regional, or other organization, most libraries will have to be content with single item deacidification using expensive, mail-order, adaptations of the larger systems. (Robert Parliament, conservation librarian at Princeton, reports that their adaptation of the Wei T'o materials "is a middle ground between the one-off approach and mass treatment systems."[158])

While librarians concern themselves with the useful life span of an item and the cost of replacement, the other side of the coin involves considerations of the paper industry. Their interest in the paper preservation problem is not the same as that of librarians obviously, but they are the source of the problem in that they create and print on the acidic paper. Their

concerns and efforts merit assimilation in any complete examination of this issue.

Essentially two facets of paper production most strongly affect the role of papermakers and printers in the paper preservation issue, the amount of paper used in printing and the problems printers face when handling alkaline paper. Very little of the paper produced today is used in making materials which librarians would find significant. Even setting aside acidity, papers "containing groundwood should be avoided entirely since groundwood deteriorates rapidly."[159] Librarians need to realize that of:

> the sixty-five million tons of paper produced in the U.S. annually, only fifteen million tons are white paper, that is to say, writing and printing paper. Of this about 0.8 million tons...are book paper....For further perspective,...a single newly installed paper making machine has a typical capacity of about 100,000 to 150,000 tons of paper annually.[160]

Therefore seven machines could produce all the paper used in library books annually. Even this figure is misleading however, as "about 75 percent of the paper used in book publishing...today [is] for books in categories that...should be exempt from the paper specifications for [low acidity]. The remaining 25% are an important part of book production and would justify the effort and expense to give them indefinite life."[161] Actually, only two new paper machines are needed to produce the paper used in significant library books each year.

> Alkaline papermaking with its potential savings in fiber, energy, water and chemicals is a practical and proved option. A significant additional benefit is the accompanying improvement in paper permanence....Mills that have converted to alkaline sizing have been able to reduce water consumption by more than fifty percent....Alkaline papermaking provides several opportunities for conserving papermaking raw materials and thus should become more prevalent in the years ahead.[162]

It is encouraging to note that "in 1980 about 25% of paper manufactured in America for use in book production was acid-free (about 250,000 tons of a total of 840,000.)"[163] Another encouraging sign is that vendors "now feature alkaline paper in their catalogs and dwell on its virtues. More purchasers should specify alkaline paper. More purchasing agents should be familiar with the appropriate specifications."[164] In 1981, CLR's Committee on Production Guidelines for Book Longevity surveyed 430 publishing companies on their use and awareness of acid-free paper. Although vendors and papermakers appear to be moving forward in this area, a mere 18% of the commercial publishers queried bothered to respond at all to the survey. Most respondents were academic presses. "More that three-fifths of those who responded are willing to include a statement identifying acid-free paper on the copyright pages of their new books."[165]

While book paper accounts for very little of the papermaker's trade, it would, obviously, account for a far greater proportion of the printer's trade. As acid-free paper is a relatively new creation it still needs refining and printers still need training in how to use it. There are a variety of costly "traps a printer may stumble into unless such papers come to him with better information and warnings."[166] Unfortunately the "printer operates in a highly competitive market with a rather mean profit margin."[167] If enough librarians vocalized their demand for acid-free products however, this tight market might prove an advantage as it forces printers to learn the trick of printing on permanent papers. Some people do claim that neutral "paper is more costly [because] the chemicals are more expensive; the papermaking machines cannot run so fast; limited numbers of producers inhibits competition...."[168] However, with increasing evidence that neutral paper causes less pollution and "pollution abatement" such a major problem in the paper industry, competition may increase.[169] As for the problems of the chemicals and the speed of the presses, continued research into the mechanics of the situation may well provide fruitful solutions to rather simple problems.

Extent of the Preservation Problems: Summary

The extent of the paper preservation problem cannot be defined and limited by stable statistics. The variations of individual libraries, the level of involvement from papermakers and the problems of printers combine to make any dollars and cents estimate of the cost or number of items practically useless. Nevertheless, the tip of the iceberg shows through enough to warn of serious dangers in the years and decades to come. Several studies could be undertaken to estimate the cost of specific programs or portions of programs. How much, for example, would it cost to locate one, usable copy of every significant book in the libraries of this nation? How much would it cost to install an in-house microform center in an established library for the sole purpose of filming rare books? How much would it cost to complete a survey of a major research library to estimate the number of books requiring rebinding? How much would it cost, in capital expenditures alone, to set up a permanent cold storage center, properly designed, for the housing of a single copy of "every" significant work? The answers to these and many other cost-related questions which partly comprise the paper preservation issue, could be determined by a careful examination of current materials, the complex factors involved in labor, overhead, capital expenditure, and the possible solutions.

RECOMMENDATIONS FOR PAPER PRESERVATION

While further research into specifics of the extent and nature of the paper preservation problem might change some of the recommendations for action, various plans are worth studying as they encompass virtually every available avenue of action. No mention is made below of the option currently being exercised by the vast majority of research libraries, and by this nation as a whole, as inaction and minimal stop-gap efforts will not answer the questions raised herein. Librarians who can comfort themselves with the thought that the problem is too big, too expensive, or too far off to be mitigated by any action on their parts, may need stronger proofs than any words can offer. However, for those librarians, in whatever department, who feel the urgent need to take part in some solution to this problem, the following recommendations should prove fruitful, in some degree, on an individual, regional, national, and even international level.

Microform

The first of four recommendations commonly found in library literature is to turn to microforms as the solution of the future for all preservation problems. The attractions and drawbacks of this option fall into three general areas: archival quality, costs, and reader reaction. Of course one given of the concept is acceptance of the material's content as more important than the actual artifact. An objective examination of all aspects of microform as a preservation medium must be tempered with the understanding that the technology in this field changes rapidly enough to make improved quality at lower cost a realistic possibility within this decade.[170]

Archival Quality

The archival quality of microform is its equivalent to paper's durability—i.e., archival quality refers to how well a microform withstands normal use without showing nitrate spots, scratches, cracks, or other signs of damage. "For normal practical long term storage purposes one always recommends the use of silver halide film...."[171] This is "now considered the only type acceptable for archival purposes and the only one for which national testing standards have been established...."[172] Generally speaking, microfilm master copies meant as the permanent record of a valuable item are kept on silver halide film, "long the primary composition in all types of photography because of its capability to record detail with minimum distortion."[173] The established quality of this medium is inconsequential however, if it is not treated correctly by the library. Obviously, "microfilm that is used by patrons cannot, by definition, be archival."[174] As Adelstein

pointed out in 1978, "archival permanence = archival film + archival processing + archival storage conditions....It is...important to recognize that different organizations have the responsibility for and control of each factor."[175] As the cost of silver rises the

> use of nonsilver film for service copies seems acceptable (and inevitable) providing there is some assurance that whoever is responsible for master negatives produces, processes and stores them for permanence....Many librarians have urged a central repository of preservation master negatives that would ensure archival storage conditions and continued availability.[176]

The cooperative effort required for such a venture should not prove insurmountable.

Even on an individual basis, libraries must be willing to maintain a protected, high-quality, archival master copy of any microform for which the original document is no longer available. These masters will be easily copied as either negatives or positives due to the reverse polarity of silver halide film. Careful storage in boxes which meet the ANSI standards for microform storage is as vital as the original choice of silver halide film. Ideally these one-of-a-kind masters would be kept in a special building, safe from fire and other natural disasters. A national depository of such unique masters may well prove worth the investment needed to create it.

While the characteristics of silver halide film are well established, "the quality of diazo and vesicular films remains in great doubt."[177] On the one hand, flat statements such as Peter Ashby's in 1979 appear: "Diazo and vesicular film...cannot be considered archivally permanent."[178] On the other hand, Adelstein reported in 1978 that "with proper processing and storage conditions, it is estimated that satisfactory keeping may be obtained, even after 100 years, for those diazo films which meet the A.N.S.I. specifications."[179] Few would argue with the following assessment by Gabriel of the two films most commonly used for everyday, patron perusal:

> [Diazo film] is much more resistant than silver film to damage from heat and scratching....Vesicular film is highly durable, resists scratching and tearing and fingerprints can be easily removed....Since the film is processed with a plastic rather than a gelatin layer, there is nothing to support bacterial or fungal growths and it is highly resistant to fading and discoloration in storage.[180]

Obviously the dramatically lower cost of diazo and vesicular film is a strong inducement to buy the cheaper film in these financially difficult times. Nevertheless, Allen Veaner of the *Microform Review*, John Teague, and the ALA, among others, strongly recommend to librarians that until

"national standards" are established for diazo and vesicular films, libraries only accept silver halide film for archival purposes.[181]

Cost

After choosing what type of film will be used for what purpose, the various cost factors must be considered.[182] Each "library must invest in reading machines and reader-printers; train staff and patrons; and pay for continued maintenance and repair."[183] As with books, special storage conditions must be met, such as "temperature not to exceed 70 [degrees] with relative humidity in ex ess of 40 percent...."[184] Even disaster recuperation costs are different for microform; "remember that fire or water damage that leaves a book copyable often destroys a microfilm."[185] Compared to traditional libraries, it must also be remembered that microform libraries are more "labor-intensive" and that "microform cataloging takes more time...."[186]

A few cost factors may prove to be lower for microforms than paper. In 1978, for example, a new method "of simple, inexpensive film protection [was created]....Vesicular film, diazo film, polyester and acetate bases ...have proven to be totally fungus resistant after one year in a supersaturated fungal growth environment."[187] The following persuasive arguments, as cited by Pamela Darling, all involve a cost factor to some degree: "[it] precludes the mutilating and tearing out of pages, takes up 90 percent less space to store, can be duplicated easily without damage to the original, and is less likely to be stolen."[188] Of course, the special expenses for any individual library of changing all or part of their retrospective journal and/or current collection from paper to microform will also involve unique problems with the individual facility, budget organization, and staff flexibility.

The reports of partial changes from paper to microform generally conclude that the latter is less expensive to house and use. The New York Public Library, for example, filmed a certain newspaper in-house at a cost of $200 to $350 a year. They then bought a service copy for $40 a year when binding would have been $30 to $75 a year with the pages crumbling away.[189] In 1978 a special library reported the results of their experiment which indicated that "substantial space savings, potential savings in search and photocopy time, and intermediate to long-range cost savings can be realized by converting *Chemical Abstracts* from hard copy to microfilm."[190] Of course certain items become so brittle that their only hope of preservation is by careful microfilming.

The method of converting any paper copy to microform is itself a cost factor. In general the choices include buying the microform copy from a professional publisher, making it in-house, sending the library's original paper copy out to be copied, and a cooperative arrangement whereby the library obtains a free copy in exchange for loan of the original. Darling's assessment of the overall costs remains essentially accurate. It is "generally true that: 1) commercially-produced film is cheaper than binding; 2) in-house filming costs are higher than binding but considerably cheaper than full restoration...."[191]

One final characteristic of microform strongly affects any long-range cost estimates, and that is the fact that "films can be re-generated."[192] Any material committed to microform and correctly stored can be inspected regularly for signs of deterioration, accidental damage, or vandalism. If nitrate spots, for example, begin to appear then the entire film can be regenerated at a comparatively reasonable cost, something which is obviously impractical with paper. The value of this option, however, depends on two assumptions: that the library can maintain some effective inspection system at a reasonable cost and that the library has access to originals should the copies prove too badly damaged to copy.

Readers' Problems

One other aspect of microforms, apart from archival quality and cost, affects their usefulness as a solution to the paper preservation problem—i.e., readers' difficulties. The equipment remains bulky, awkward, and unique to each format. Actual studies of reader reactions to the introduction of microform show a wide range of responses from acceptance to indifference to total rejection. While "most librarians are resigned to the coexistence of several different formats...," readers tend to find them something of a barrier.[193] In any case, as mentioned earlier, librarians must be prepared to "train patrons."[194] Case studies indicate that when approached with the readers' problems in mind, a positive reaction to microfilm is definitely attainable.[195]

Microforms: Summary and Conclusion

If librarians remain unwilling to admit that no single library can continue to collect every item which might be needed by its patrons while also preserving them (and this is the crux of the matter)—i.e., a complete in-house preservation/conservation/restoration system—then microform remains the closest thing to a possible solution for such an outlook. The drawbacks to such an effort on an individual basis, however, are legion. It

requires a huge capital budget for the creation of a complete, in-house microform processing lab with skilled camera people, trained processing technicians, and an efficient staff of catalogers. Adjustments would have to be made for items with incomplete pagination and missing issues—a time-consuming task. The entire library would have to be reoriented around the need for reader/printers, storage facilities for microfilm and microfiche, and laboratory facilities. A new clerical staff would be required simply to obtain copyright permission to film each individual item, an obviously labor-intensive process.[196] There are other problems so vast that the mere mention of them provides some hint of their disruptive influence. What will be copied first, the most fragile or the least used or the most used? How will patrons' needs be satisfied during the months that an item is in process? What will be kept in paper after it has been copied? Will the silver halide masters be available for sale to other libraries? Will the material be registered with any national microform union catalog? What is the dividing line between an item that is thrown out as not worth copying and one worth the money spent to copy it? What effort, if any, will be made to insure that all significant records will be copied? How will patrons pay for copies of books which used to be available for circulation but are now only available as microform?

Obviously a wholesale microform preservation project will be virtually impossible for any single research library to adopt as a long-range solution to the paper deterioration problem. The decision to purchase commercially-produced serials on microform might prove a practical, stopgap measure on a local level. It would save some space and preservation costs in the single area most commonly cited as increasingly burdensome. Efforts to coordinate other individual projects will receive a boost in the fall of 1985 when the final report of the project "Coordinating Preservation Microfilming through the Association of Research Libraries Microform Project" will be available. This survey of over 200 institutions revealed that "among libraries that have significant preservation activities, there is surprisingly little consistency of operations....The survey shows that output could be increased dramatically, with 70% of respondents showing a willingness to participate in one or more cooperative preservation projects (though many with the qualification that outside funding would be essential to their participation)...."[197] However, even such coordinated efforts leave too many questions unanswered by such a solution. A foremost example is the fact that such a method completely fails to provide access to every significant work for the rest of the scholarly community. Retrospective conversion costs could rapidly sink any effort. The sheer size of the undertaking, even without plans for outside access or objectives of

comprehensiveness, is too large for a single library or the piecemeal efforts of various libraries in small, coordinated groups.

Librarians as a Profession

If microform proves too complex and too large a project for a single library to use as a preservation tool then the call for librarians as a profession to deal with the problem may prove slightly more fruitful. "The American library profession has, perhaps slowly but surely, responded to the mushrooming crisis."[198] Four themes appear repeatedly in the library literature encouraging professional library organizations to address this issue: urge printers and publishers to use Permalife; train librarians in conservation; accept responsibility for the maintenance of the human record by supporting research and appealing to Congress; and join international efforts in this field. All four of these proposals have merit on their own, in varying degrees, but it is again doubtful that any single one of them will solve the present paper crisis.

Permanent Paper

Urging publishers and printers to use Permalife, or some variation of it, may prove a solution—at least for several centuries—to the problem of future volumes deteriorating, although it obviously does nothing to restore old volumes. While perennially popular among various members of the profession, this goal is not quite so well known to the paper industry. It is encouraging to note that the Library of Congress recently found "that about 25 percent of the American books and about 50 percent of the European books are made of alkaline paper. Five years ago less than one percent of the books tested were made with alkaline paper."[199] As Haas noted in 1979:

> [the] interest of libraries concerning paper characteristics are not well known to most publishers and are almost unknown to paper manufacturers. Some publishers now add the notation "alk. paper" to the ISBN's. Library concerns need to be carefully stated and brought effectively to the attention of publishers and more of the smaller or specialized paper manufacturers.[200]

CLR pointed out one obvious target in this area. "The U.S. Government is the largest publisher in the United States, and nearly all of its productions are on highly acidic papers. We encourage libraries to make their voice heard to the Joint Committee on Printing...."[201] For any effort in this direction to be effective, the "probability is that many individuals from paper manufacturing, publishing, and libraries will have to make them-

selves accountable if further progress is to be made."[202] In 1978 the ALA took tentative steps in this direction when it began gathering data on "ways to get publishers to use acid-free paper." President Moon warned members that "the real target is the papermakers....don't go after the publishers...work with them on this."[203] A few years later CLR's Committee on Production Guidelines for Book Longevity underscored this concept when noting that their aims "would be largely realized if publishers would be more aware of the need for 'permanence' and would make thoughtful decisions about the paper used to print their books....Acid-free paper *need not be more expensive* than acidic paper of the quality normally used in hardbound books."[204] Publishers must understand that they will not actually lose money in reprints when the reprints are no longer needed due to stronger paper. The available money will simply be spent on new books rather than reprints of old ones. Libraries might even have more money to spend since part of their budgets will not be spent on locating worn out items and filming or restoring them.

One persistent suggestion in this area requires separate discussion and that is the cry that librarians "have been remiss in not demanding that the publishers provide library editions on Permalife paper of all significant books as they appear or prove their worth."[205] The elevated cost of special editions and reprints of certain books is prohibitive in itself. The added implication that publishers choose what will and will not be kept for all time out of this nation's literature and research poses another set of problems. That may prove to be rather like allowing a druggist to approve what medications will be marketed and what will not.

Specifications on Permanent Paper

If librarians insist on permanent/durable book papers, from publishers and papermakers, then "specifications for stable paper are needed. Manufacturers and consumers, with specifications, can communicate in quatitative language."[206] Since standards "are the language for the dialogue between buyer and seller...." it remains for publishers to "insist that paper makers provide long-life papers...."[207] Of course it must be remembered that the "presence of standards does not automatically ensure that publishers will choose permanent and durable paper; without standards, however, publishers do not even have the option."[208] Certain standards for "permanent/durable" paper have been established in the past decade but these remain known to relatively few librarians and members of the paper industry.[209] Among the best known of these are CLR's guides for paper and the Library Binding Institute's (LBI's) guides for binding. CLR notes that: "We offer guidelines that we think are desirable and economically reasonable, and we encourage publishers who follow the guidelines to make an

appropriate statement to appear just below the copyright lines."[210] These guidelines include: "[a] minimum pH of 7.5...minimum average machine direction tear resistance of 70 grams...minimum cross-direction folding endurance of 30 double folds at 1 kg. tension...minimum alkaline reserve...of 2% based on oven dry weight...."[211] LBI proclaims that only: "Certified Binders can display the Library Binding Institute seal. It's your assurance that you have selected a binder who produces bindings of superior quality in accordance with the Library Binding Institute Standard... for a longer life and lowest cost per circulation."[212] A standard, universally recognized symbol of permanent paper would be ideal. The NISO Subcommittee S, chaired by Gay Walker, has just provided such a symbol. This ANSI standard states minimum requirements for acidity, folding endurance, tear resistance, alkaline reserve, and stock for a paper that will last "several hundred years...." The infinity sign inside a circle is the symbol used to express compliance with these standards.[213] As Verner Clapp pointed out, it "would be useful if book-papers achieving a certain level of permanence/durability showed an identifying watermark....Lacking this, a number of publications printed on stable papers have taken pains to announce the fact."[214] Some books do carry explanatory phrases on the verso of the title page, such as the following: "This book has been printed on permanent/durable paper with a neutral pH to insure a life expectancy of at least one hundred years."[215] The *National Union Catalog* is even more explicit; the paper's properties are fully listed on the first page.[216] After materials have paper standards plainly indicated, the National Institute for the Conservation of Cultural Property's (NICCP's) study on the development of standards for storing library and archival materials" will be of even greater value. Although its completion has been delayed, the NICCP's conservation bibliography should be available soon.[217]

The four reasons listed by Verner Clapp in 1971 as to why stable paper is not in common use remain valid today. Permanent paper is not visibly different from poor paper. Studies to prove the stability of variations on Permalife are too expensive for papermakers to undertake themselves. And, as mentioned earlier, librarians have not proclaimed an unequivocal need for the material and no nationally recognized standards have been set up by a reputable body to define the characteristics of such paper.[218]

Cost of Permanent Paper

Claims that permanent paper costs too much to produce still counter many approaches made to papermakers on the issue. However, these claims are gradually being proven false even in the heart of the paper industry. "Recently both economic forces and the anti-pollution laws have increased interest in acid-free paper production."[219] Some papermakers recognize

that the "calcium carbonate-alkaline size papermaking process offers overwhelming benefits as compared with the traditional alum-rosin size process. It requires less energy, is significantly cheaper, produces a much better product, is easier to control and creates a great deal less waste."[220] As Stuhrke states, by its very nature an "alkaline papermaking environment is noncorrosive, extends life, and reduces maintenance costs."[221] Papermakers are starting to research the problems in this area, as evidenced by at least one paper at a 1984 TAPPI (Technical Association of the Pulp and Paper Industry) conference, "Relative Effects of Wet End Chemistry Variables on the Strength of Acid and Alkaline Papers."[222] Of course work would have to be done to determine the permanent/durable value of such paper, but such modifications should not destroy the value of the paper for the papermaker. "A 1979 TAPPI Papermakers' report listed almost a score of advantages to the papermaker of making alkaline rather than acid paper. Among these are a savings of around $20 per ton...."[223] A new large paper mill by S.D. Warren is to be on stream some time in 1983 producing alkaline paper. This single mill should prove significant competition for the older, slower mills.[224] "It has been predicted that by 1986, 25% of all U.S. printing and writing grades will be produced using alkaline size and by 1991, 55% of this production will involve alkaline size. This compares to only 4% in 1981."[225] Remaining barriers between the book paper industry and durable books must be torn down if any progress is to be made.

Permanent Paper: Summary

Keeping in mind the strict limitation of its value—i.e., the lack of protection for retrospective materials—the use of permanent paper may help individual libraries maintain their autonomy so far as the issue of paper preservation is involved. It creates, however, the potential for an enormous overflow of material as buildings rapidly become too small to contain the thousands of new books which never need be culled or reduced in number. Weeding collections would become a major labor-intensive task with increasing costs as the exponential rise in the literature growth rate continues. This solution, as with microforms, offers no assurance that any systematic effort would preserve at least one copy of every significant work. These three formidable drawbacks weigh heavily against this concept as a complete solution.

EDUCATION

The second approach, within the arena of professional librarianship, centers on various proposals to train librarians and novices in the new art of conservation.

> Practising archivists of necessity will continue to be the main teacher pool and contributors to the literature until regular faculty in library schools and history departments have been adequately trained, but first a basic reorientation must occur that recognizes that records and papers of contemporary society are the central problem.[226]

The next decade may see a shift to well-trained professionals as graduates increase exponentially. For example:

> a graduate program in preservation administration and book conservation and restoration started at the Columbia University School of Library Service in the fall of 1981. Graduate programs in the conservation of art on paper and art works on paper exist at the University of Delaware, Winterthur, the State University of New York at Cooperstown, and at New York University. Internships in conservation are available at the Library of Congress, the Newberry Library, the Northeast Documentation Conservation Center, [and the Humanities Research Center in Austin. The Smithsonian Institution is also planning a conservation training program].[227]

The Resources and Technical Services Division (RTSD) of ALA with the cooperation of the Library of Congress National Preservation Program sponsored a five-day hands-on conference entitled "Library Preservation: Fundamental Techniques" from 26-30 August 1985.[228] As useful as such workshops are, the field is too large and too important to be covered by a few rare book librarians passing precious knowledge down to waiting assistants. Robert Patterson rightly insists that "librarians must take the responsibility for educating themselves about conservation....At this time, conservation does not have a generally accepted curriculum....the new technology adds a complex and challenging factor to preservation."[229] Darling notes that:

> Because of the relative novelty of preservation as a serious library activity, there is not yet a substantial body of resources...for use in developing preservation programs. By comparison with areas such as cataloging or reference work, the field of preservation appears primitive indeed....Resources do exist, and their number and value are growing rapidly; but they are only beginning to reach the mainstream of professional consciousness.[230]

A broader concept of education involves regional conservatories where "conservation methods [would be] taught and new techniques developed."[231] The Newberry Library, for example, has undertaken "projects aimed at developing more effective stabilization and repair procedures. These programs also have been, and continue to serve as, a model for other libraries and archives wishing to initiate or expand their own preservation activities."[232]

In 1973 the New England Document Conservation Center was founded to assist libraries in that region with little background in preservation.[233] The

New York State Library's Clearinghouse for Paper Preservation and Restoration in Albany will answer inquiries and provide advisory services for free. Specific libraries also provide assistance to practicing librarians whenever possible, in workshops or as an example of a functioning in-house preservation system. Two examples of this latter model are the $500,000 conservation laboratory of the Humanities Research Center at the University of Texas at Austin and the Conservation Department of the Boston Anthenaeum.[234]

Another proposal intends making the most of available labor by judicious education of staff. "A simple training program can make a peripatetic book mender of a book shelver" by means of a well filled cart pushed along the aisles.[235] It is certainly true that for most libraries an "informed staff is worth infinitely more than all the information compiled in a report."[236] Sally Buchanan's *User's Guide to the Conservation of Library Materials*, for example, provides basic information for all staff who photocopy, shelve, or handle books in any way.[237] Cunha suggests that the profession require graduate courses in conservation, as well as hold workshops and management seminars to train professional staff.[238] Peterson holds that "for library schools not to offer...at least some exposure to the student of the problem, is not to really prepare students." Charles Davis noted that: "Because schools don't have courses labeled preservation does not mean that they don't have offerings."[239]

In the absence of such courses, a substantive number of quality manuals provide the basic background in repair and restoration on an in-house basis. *Paper and Leather Conservation: A Manual*, for example, details the equipment, techniques, and methods of most preservation jobs.[240] As of April 1983, *American Libraries* includes a section entitled "Preservation" in the news column "The Source" with Susan Brandehoff as editor.[241]

Education: Summary

Outside of single, independent efforts (such as replacing book shelvers with book menders) and temporary, ad hoc efforts (such as workshops), a cohesive national effort in this area may require a graduate course in conservation as a prerequisite for an accredited library science degree. Paul Banks offered one of the most in-depth analyses of the problems involved in training members of our profession when he delineated six characteristics of the field in 1979:

> [The] field of library conservation...is highly technical,...the ethical and philosophical framework within which conservation decisions must be made is not well developed,...the problems...are highly diverse,...the

> need for conservation...is both massive and urgent,...conservation is expensive by any standard, by any approach....[and] the field of library conservation is...a developing field.[242]

In evolving any such training program, several questions require consideration in a field too new to have accepted parameters. Should the focus be on management of an across-the-board preservation program on an individual basis or on the practical application of known techniques? Should this be taught on the graduate or undergraduate level? Pearl Berger, in her article on how to set up an in-house repair shop, notes that the profession still needs some place to train the nonprofessionals for semiskilled and unskilled positions which preservation projects will create.[243] These questions, when answered locally, help the plans for educating members of the profession in paper preservation issues as a useful aspect of a full-scale solution.

Research Support

Another useful aspect of a solution—and a third in the options within the profession—involves accepting the responsibility for this situation by supporting research and applying for funding. Funding should be available from both the government and the private sector. In applying for this all-important money, attitude or vision may have a significant impact.

> Would we not do better, at least whenever nonlibrarians may be listening, to speak of preservation as a byproduct of accessibility and continued dissemination? A successful heart transplantation is not acclaimed because it keeps alive a heart that would otherwise have died....One approach is to ask the Congress for appropriations to protect property that has been amassed by the major research libraries; the other is to demand that Congress meet the cost of opening up this national resource to all the country's scholars and making sure that it will be kept open.[244]

Barrow's admonition of 1959 is still true today; "more research is needed, and the cooperation of the scientist, papermaker, printer, publisher, and librarian will be required to assure permanent books for the future."[245] Cunha's exhortation, however, is more to the point today. Librarians must, as a profession, accept the "responsibility for conservation as [they] have accepted the many other responsibilities important to [their] work, and through [their] local, regional, and national associations applying the collective clout [they] can muster to do what has to be done."[246] While no cohesive national program currently moves toward an effective resolution of the paper crisis, many major library organizations maintain an avid interest in the field. The American Library Association, for example, established the Preservation of Library Materials Section of the RTSD in

1980.[247] In April of 1983 the ALA produced a 13-page "Preservation Bibliography" listing bibliographies; dictionaries and directories; general works; environment and treatment manuals; nonbook material, disaster preparedness guides and serials.[248] Of course the Library of Congress' Preservation Office trains professionals, publishes, disseminates and serves, somewhat, as a model. The National Preservation Program of this office "is beginning to define its role in the cooperative area."[249] If Congress is to be persuaded to fund any large-scale research projects, much less a national preservation program, then librarians might find it beneficial to present a united front in their requests for money.

Even if librarians are reluctant to unite in their funding appeals to Congress, they might consider uniting in an effort to effectively disseminate their hard-earned research results. A single, organized group focusing on funding, or research, or both might concentrate efforts more effectively than the various organizations currently functioning in the conservation, restoration, preservation, library, and archive fields. If only as a central repository for information on research projects, funding, and results, such an organization could prove most useful.

> Foremost in the field of restoration is the requirement to establish an even more expedient and more reliable interaction and exchange of experience within related professions. Only through this kind of cooperation is it possible not to lose touch with the most recent research results in the rapidly advancing sciences...and to remain flexible and open to new trends in the field.[250]

Currently a variety of conservation research facilities throughout the nation work on various facets of this problem. The Preservation Research and Testing Laboratory of the Library of Congress assumed "responsibility for testing and evaluating materials, equipment, and methods used in preservation [and]...intended...[these methods to] be national in scope."[251] The New England Document Conservation Center (NEDCC) was founded in 1973 with start-up funds from CRL. Anne Russell, of the NEDCC, explained that: "Helping libraries to select materials for conservation...is one of the most important services we provide. In general, we recommend that an institution invest first in improving environmental conditions and storing materials in acid-free folders and boxes."[252] The NHFRC and the NEH are two important funding organizations.[253] The Research Libraries of the NYPL spent $1.2 million—about 7% of the general operating budget—on preservation last year. This conservation division coordinates fiscal support, reviews policies and procedures as they bear on the issue, and inspects and monitors environmental conditions, among other responsibilities.[254] These institutions, as well as other smaller undertakings around the country, provide ongoing research into practical methods

of long-term preservation, as well as emergency measures. No single publication however, provides an assured forum for the results and updates on all research in this field.[255] No single annual meeting provides a podium for reports of the year's major findings in conservation, preservation, and restoration of books, archives, manuscripts, and other forms of written material. No efficient network prevents duplication of efforts or ineffective use of the minimal funds available. (One effort in this area is the first edition of the RLG *Preservation Union List*, published in 1984, which is a set of fiche listing 25,000 works for which member libraries hold master microfilm negatives.)[256] No organization utilizes the knowledge of the few experts in preservation to advise and support local or regional preservation efforts. Some measure of unity in the profession's appeals to Congress and exchange of information would certainly bolster any more complete preservation plans. Without suggesting that "all" research librarians agree to any single dogma, various avenues could be opened and fundamental principles established by interested organizations.

International Preservation Help

Communication is equally important in the fourth and final aspect of professional response—i.e., international cooperation. Weider urged that the "most important international tasks include those of coordinating existing diverse activities, of preventing duplication of effort, of providing for a multilateral exchange of information...."[257] When the National Library of Australia used Israeli plastic bags to help vacuum pack low-use materials, for example, the basic information on this successful process was reported in *Library Administrator's Digest*.[258] Perhaps surprisingly, preservation work on an international level began as early as 1898 when the Keeper of the Vatican Library, Cardinal Franz Ehrle, appealed to the International Conference of Libraries held in Saint Gall to reappraise existing restoration methods.[259] Since that time various organizations have worked diligently to promote the exchange of information on a truly international basis. Perhaps the most familiar of these groups is Unesco which produces such valuable material as the *Unesco Journal of Information Science, Librarianship and Archives Administration*. One of Unesco's most recent publications is Kathpalia's *A Model Curriculum for the Training of Specialists in Document Preservation and Restoration*.[260] In 1967 Cunha reviewed America's current role in the international preservation effort most disfavorably and little has changed in that estimate to date.

> In Europe and in other parts of the world, restoration centres, usually with government support, are making organized and coordinated efforts to further conservation of library materials. In the United States, what little is being done is privately financed. The United States, for some

> inexplicable reason, does not support the International Centre for the Study of the Preservation and the Restoration of Cultural Property (the Rome Centre).[261]

The International Federation of Library Associations (IFLA) offers improved hope for international cooperation in research with the organization of its Conservation Section.[262]

Two international organizations have been able to help various countries work on preserving their national archives: the International Council on Archives (ICA) and Unesco. "Both ICA and UNESCO have published studies on the requirements of modern archival buildings." "Countries that have constructed new buildings in the recent past are Australia. India (Uttar Pradesh, Gujaral, Andhra Pradesh), Indonesia, Japan and the United Kingdom. Countries that are planning new buildings are Belgium, India, Iran, Iraq, Kenya, Malaysia, and Singapore, to name but a few."[263] F.W. Ratcliffe's *Preservation Policies and Conservation in British Libraries: Report of the Cambridge University Library Conservation Project* offers a current overview of the state of the field in England. American libraries are not alone in noting that:

> Whilst preservation awareness is growing in libraries of all kinds, few libraries have preservation policies and, of those, only the largest can afford to pursue them in any realistic sense....The report makes recommendations for action in two areas, first within individual libraries involving little or no additional expenditure and immediately applicable, secondly at a national level.[264]

While the paper preservation problem is too enormous to contemplate a worldwide solution, the gains to be derived from the international exchange of information and research should prove well worth the relatively small expenditures of personnel, time, and money.

Librarians as a Profession: Summary

While internationally slow, the other first efforts toward the profession's acceptance of its responsibility for paper preservation have proved fruitful enough to warrant continued outlays along the same lines. As Robert Patterson states:

> We must not only attempt to develop preservation programs, but we must also develop stronger critical faculties about what we intend to save, and how we intend to go about it. We have more choices today than we had five years ago, and the number of choices will increase as we move toward the next century.[265]

The ongoing lack of federal support for both research and actual conservation continues to severely limit the active participation of librarians in this

field. The Library of Congress continues to serve as a valuable resource but its Preservation Department has not developed into the working model and national leader that it might once have been. Research at the Barrow Laboratory remains the basis of virtually all work in the field. The few training grounds for library conservationists produce highly skilled workers. Various local, regional, and even national organizations and programs continue to provide worthwhile information and education. The ALA and the AIC (American Institute for Conservation of Historic and Artistic Works) continue to bring the issue before practicing librarians and conservators. Of course ARL's continued support in several facets of this field is most encouraging. Publishers who use permanent paper for significant works must simply get more library business than those who do not. Each of these areas adds something to the overall solution of this problem although no single item stands alone as a sufficient answer.

LOCAL PLANS

"Conservation must soon join Cataloging, Acquisitions, Circulation and other departments as basic components of the library's organization."[266] This concept of preservation as an integral component of a library's operation forms the third recommendation for future action—i.e., after the use of microfilm and professional response to the issue. Pamela Darling suggested:

> That this apparent conflict between preservation needs and ongoing program commitments is not actually a conflict of priorities but only of perceptions....there is scarcely a library function...that does not affect the potential lifespan of individual items in collections....The first administrative challenge, then, is *not* to pull resources out of some nonexistent hat in order to start a new program, but to identify, analyze, rationalize, and adjust what is already being done in light of what we can now recognize as the effects of historical practice on the preservation of collections.[267]

For the librarian who intends to handle a single institution's preservation problems, various useful plans exist as guides for different levels of involvement. "Obviously the small library cannot afford the luxury of a full-time staff person devoted to the duties of conservation officer; however, all staff can be made aware of conservation basics. The physical plant should be surveyed for potential hazards and a disaster plan developed."[268] These designs are comprised in the third form of recommendation of future action, after the use of microfilm and professional response to the issue. Cunha's *What an Institution Can do to Survey its Conservation Needs* is an excellent, practical, organized manual which can be used when evaluating

the physical plant and environment. The book includes a series of questions, a summary grid, and forms for various special aspects of the collection.[269] Larger libraries might appreciate Darling's *Preservation Planning Program Manual* which "is designed primarily as a guide for libraries undertaking a formal study of preservation needs as a foundation for planning programs to meet those needs....It...presupposes a library staff large enough to permit the assignment of about a dozen people to the job."[270] A large companion volume, *Preservation Planning Program Resource Notebook*, contains "important, often difficult-to-acquire documents" and serves as a vital tool for libraries that are seriously following the *Manual*.[271] Essentially two basic types of recommendations appear repeatedly in the literature: single unit, in-house workshops and repair sections which focus as much on restoration as preservation and the multidimensional, interdepartmental, all-inclusive plan. Particularly when public and smaller college libraries are considered, it is certainly true that "we have had almost a professional lifetime during which the need for conservation measures have been recognized, and yet few libraries in this country...yet have anything resembling a conservation programme or a conservation unit of significance.[272]

Basic Mending

The first of these options is an essentially simple setup based on the expertise of a few individuals. As Ready urged in 1978, few "libraries have even the most elementary of mending services, but those should be an essential part of the library economy."[273] Virtually any interested research librarian can easily locate some specific, useful manuals and articles which assist in limited in-house preservation and conservation efforts. Pearl Berger, for example, provides detailed guidelines for the establishment of an in-house repair shop in the *Library Journal* "Series on Preservation." Her practical program includes advice on everything from training staff to ultimate size or program.[274] Jane Greenfield's *Books: Their Care and Repair* is "not a book to be read through but one that should lie open on the workbench...."[275] It includes a list of expendable materials and a list of suppliers. Hedi Kyle's *Library Materials Preservation Manual* describes reversible procedures designed for use by the novice.[276] Barrow, in *Manuscripts and Documents: Their Deterioration and Restoration*, described the standard restoration procedures and chose the one he found most effective. While the material is slightly outdated (originally published in 1955, second edition in 1972), the background remains quite useful for the novice.[277] For the librarian who finds even these efforts too much, advice is also available. Richard Smith advises that even if:

> a library does not want to make any preservation effort, the library should rebind its books before they are on average fifty-five years old. Once books are rebound, they can be used for a substantial additional period with no further expense for preservation....Libraries should not spend money restoring books unless they also protect the books from acid attack by deacidifying them.[278]

National organizations also provide materials. For example, "the Preservation Planning Project of the Association of Research Libraries' Office of Management Studies (ARLOMS)...is a one-time project aimed at putting 'self-help' tools into the hands of people responsible for developing preservation programs."[279] Dan Hazen offers a useful article which "first delineates the types of decisions implied by preservation activity and then suggests structures and criteria for each."[280]

A variety of tools and services is available to librarians interested in small-scale, in-house preservation work.[281] The Library Binding Institute, a trade association, will "examine free of charge volumes for libraries to determine compliance with contract specifications...."[282] Laboratories are now available to have any of dozens of tests conducted on paper. One such laboratory is the Chicago Paper Testing Laboratory in Northbrook, Illinois, which will test, among other factors, fiber, tensile strength, printability, resistance to grease, and folding endurance according to TAPPI and ASIM procedures. "A paper-testing kit developed by the W.J. Barrow Laboratory is available from Applied Science Laboratories Inc., 2216 Hull St., Richmond, VA."[283] The Gaylord catalog offers bottles of Wei T'o deacidification solutions as well as a pH Pencil Detector. Available upon request from Wei T'o are technical notes—TN-102, TN-101—to give "general information" and "application techniques" on the company's products. From the same source, upon request, "Use of Magnesium Bicarbonate Prepared with Magnesium Hydroxide and Club Soda to Protect Paper against Aging" is available. This is a useful, fairly simple version of a sophisticated procedure to be performed by essentially untrained personnel with readily available materials.[284] *Boxes for the Protection of Rare Books* is also useful. "It is hoped that these instructions will enable anyone with some degree of manual dexterity to fabricate these boxes without difficulty."[285] Howard Lowell's "Planning for Library Conservation" and Robert Schnare's "How to Handle Your Deteriorating Book Collections" each offer a list of suppliers and a basic bibliography.[286] Mary Lynn Ritzenthaler's *Archives and Manuscripts: Conservation* covers philosophy, the nature of archival materials, causes of deterioration, environment, storage, administration, a conservation survey, various treatments and includes a glossary, 12 basic procedures, a bibliography, audiovisual sources, 40 suppliers, 7 regional conservation centers, 15 con-

servation organizations, and 7 funding sources.[287] John Feulner's 1980 guide, "Selected Information Resources on Pulp and Paper," lists 27 organizations of various kinds which do work in this field. Information on each includes—as available—address, phone, areas of interest, holdings, publications, and information services.[288] Between this advice for the minimally involved and the numerous articles for the genuinely interested, the establishment of a small in-house effort should not prove too difficlut to plan.

All Inclusive Local Plans

The second option—i.e., an elaborate, all-inclusive design—is more difficult to plan but also a great deal more useful to implement. Several institutions, for example, have ongoing programs to preserve, or film titles from certain time periods, on certain subjects, or in certain collections. None are inclusive or coordinated but they do exist.[289] Other libraries have written plans to handle preservation on various levels. Cornell, for example, recently published *Conservation, Safety, Security, and Disaster Considerations in Designing New or Renovated Library Facilities at Cornell University Libraries*. It covers building sites and overall physical plans, interior environment, fire detection, alarm and extinguishing systems, and security and emergency equipment.[290] With Cunha's exhortation in mind, however, at least two sound designs have emerged.[291] The first step is to make "prevention of damage the immediate goal in all libraries and widely advertise the steps that can be taken 'in-house' to accomplish that."[292] In 1979 two well-written, detailed schemes for these first steps were created by Robert Patterson ("Organizing for Conservation")[293] and the Standing Committee of the IFLA Section on Conservation ("Principles of Conservation and Restoration in Libraries").[294] The former acts as a realistic detailed guide while the latter serves well for the broad principles of the issues involved.

Patterson Plan

Robert Patterson's *Library Journal* article sets out a well-defined program which allows for individual flexibility while encompassing all the aspects of paper preservation that a single library can reasonably examine. "The following is presented as a model for the library where the need for establishing a conservation program has been recognized, but where...the librarian may feel unprepared to embark upon such a venture without guidance."[295] Rather than establishing a separate department, Patterson advises forming a committee composed of all library functions which could be of use or potential use. His "charges to the committee" include:

> Examine the library's physical environment and make recommendations for enhancement of environmental factors, including an effective monitoring system,...prepare a disaster plan for the library,...examine current handling, bindery, and processing practices and bring them into conformity with accepted conservation principles,...explore avenues which will provide the library with access to professional conservation expertise and facilities,...recommend what in-house physical treatment can be undertaken for minor cleaning and/or repair of materials,...develop an integrated systems approach in responding to materials identified as usable,...identify possible sources of funding for conservation programs,...establish a clearinghouse of information for in-house and external use,...explore the feasibility of joining cooperative conservation efforts at local, regional, and national levels.[298]

Patterson's specifics for each separate charge supplement these brief statements, making implementation of this plan eminently feasible. The emphasis required on the various sections probably changes from institution to institution but the plan is too flexible to hinge on any specific priority of objectives. Perhaps the greatest virtue of this design is its completeness. The other partial solutions examined earlier all ignored some vital aspect of paper preservation. Microfilm demands too much of any single library; this plan aims at only what can be realistically accomplished in any institution. Urging publishers and printers to adopt Permalife paper failed to provide for retrospective preservation; this plan calls for "an integrated systems approach" to that material most in need of attention. Educating librarians and novices in the issues and solutions—while a worthwhile undertaking—failed to actively handle any of the problems taught; this plan provides for ongoing information exchanges as well as concrete action. Accepting the responsibility for these materials as a profession—also a valuable undertaking—is incorporated in Patterson's objectives concerning possible funding sources, access to "professional conservation expertise" and use of "cooperative conservation efforts." International exchanges of information are generally too large to be the focus of a single library but Patterson's plan indirectly encourages utilization of any information from such a source. These practical specifications are most useful in their flexibility, as they allow for individual management structures and the implementation of cooperative arrangements. His final objective may well prove the most important as this alone opens the door to a truly large, national solution to the preservation problem. The encouragement of resource sharing ultimately encourages the potential salvation of at least one copy of a most significant record—i.e., the preservation of paper records in a systematic national program. Whatever emphasis the individual library places on each of Patterson's objectives, the overall plan incorporates virtually every useful, potential, and partial solution to the issue.

IFLA Plan

While not as broad in outline as Patterson's plan, the IFLA document, "Principles of Conservation and Restoration in Libraries," gives specific guidelines for in-house preservation. "The purpose of the 'Principles' is to establish a responsible attitude to conservation and restoration in libraries and to encourage those entrusted with the care of libraries and archive collections, old and new, to formulate a positive policy on the future of those collections."[297] These principles include details on such factors as humidity and temperature.

Poole's comments on management, when utilized in conjunction with the IFLA document and Patterson's plan, help to round out the background needed to handle the paper preservation problem on a local level.

> Remember that conservation is an across-the-board function that affects nearly all aspects of library and archival operations. Submerging book conservation...in an administratively obscure section of the processing department is a certain guarantee of the failure of your conservation program....a good program requires centralized responsibility for binding, for collections maintenance, and for restoration. In most cases, a centralized budget for preservation would be essential as well.[298]

With the information and advice above, a great deal can be accomplished on a local level, particularly when part of that involvement includes cooperative arrangements on a larger scale.

PLANS ON THE NATIONAL LEVEL

The "responsibility for preserving those items held by more than one library can be shared. By dividing the work, at least one copy of many more titles can be saved, and scarce human and financial resources will not be squandered on duplicate efforts. The principle is sound, but the challenge of implementing it is yet to be met."[299] This final recommendation for action—cooperative organization on a national level—consists of more theory than fact. "Unfortunately, development of a national approach has been painfully slow, due to the complex technical nature of the problem and the necessary preoccupation of the profession with severe financial problems, dramatic changes in bibliographic control, and the advent of networking."[300] In 1982 the National Conservation Advisory Council published one broad proposal covering, among other things, library materials. In the proposed charter for a National Institute for Conservation, the purposes of the Institute include:

> To provide for voluntary cooperation and planning among institutions, programs, and individuals in the United States concerned with conserving the nation's publicly and privately owned cultural property; to assist in meeting national conservation needs through information, education and scientific support programs for conservation professionals; to enhance public understanding of conservation principles and problems, provide a center for communicating with public and private conservation efforts in the United States and abroad, and increase the level of conservation capability and its support in the United States.[301]

If funding plans prove successful, this institution might prove valuable to libraries before the end of this decade. Nevertheless, Stipe observes correctly that if "the preservation-conservation fight is an underfunded, unsupported and often lost cause, it is largely because we preservationists have not made our case in terms of today's market."[302]

In 1967 Cunha wrote out the preamble, articles of membership, and legislation necessary for formation of a co-op funded by the federal government. In doing so he noted that a "cooperative approach to conservation of library materials under which libraries in each region pool their efforts and resources might accomplish jointly what most of them are unable to accomplish individually."[303] While more useful plans have been written and applauded by sectors of the profession, no more reasonable and succinct statement of the principle exists. To accomplish jointly what cannot be accomplished separately, some cooperation is vital if the human record of this nation is to survive the paper it is printed on.

Finances

Prior to discussions of any particular plan for the establishment of a national system of conservation and preservation, two problems require some minimal examination—i.e., finances and the selection of material to be included. While these items have been briefly mentioned in other contexts, they are so pivotal to a national project that special emphasis is useful. Edwin Williams, in 1970, stated that when "it comes to sources of financial support...[for a national, preservation/resource sharing system]...there has appeared to be no alternative and there has been no difference of opinion—the problem of deterioration is too large, it is agreed, to be solved unless substantial federal funds are provided."[304] Despite variations on methods of obtaining such funds, this remains the general consensus among professionals interested in the establishment of such a system. Nevertheless, Margaret Child correctly points out that the "case has yet to be made that library preservation is, or should be, a national priority that has a claim on federal dollars....Neither is it an initiative that has received much congressional attention."[305] Whether the funds

obtained from the government should be supplemented by private donations and/or local fees or payments remains debatable, as does the method of approaching Congress. Should all federal funding of academic libraries be replaced with a single fund for this massive, urgent project and if so, how to persuade individual institutions to agree to such a plan? Should this be proposed as a conservation or a resource-sharing plan or both? Should a pilot project be set up before any request is made in order to have a demonstratively working model to show Congress when the request is finally made? Who should head the drive for funds, the ALA or the CLR or the ARL or some yet unformed conglomerate of librarians, scholars, and university presidents?

Such complex questions have no quick, obvious, or simple solution. One of the few guiding principles may be that the broader the base of support for this drive, the more optimistic the outcome. The completely united appeal of librarians may not have the impact of a consortium of notable scholars in all disciplines—i.e., university presidents, historians, scientists, diplomats and politicians (whose best speeches will not be available to their grandchildren), and distinguished faculty. In this age of increased defense spending and cuts to the already slim humanities budgets, an appeal to the practical application of the preservation of vital foreign materials might help. In other words, an appeal from the broadest base of support to the largest number of interests possible may help guide the funding efforts. For a practical view of how to put this theory into practice, see Peter Sparks's article "Marketing for Preservation" which explores possible applications of Philip Kotter's *Marketing for Nonprofit Organizations* to preservation fund raising.[306] As Margaret Child notes: "I'm sure that, especially these days, no one is still waiting hopefully for the federal government to solve the library preservation problem."[307]

Selection

Having disposed of the funding problem in a morass of new questions, the second problem of selection arises. As Darling warned in 1974, taken "together, libraries have enough material that should be filmed to keep all the cameras in the world grinding away from now until 2001, so we'd best order our priorities lest we lose the irreplaceable whilst tending to the dispensable."[308] Librarians must not be intimidated by that choice but, instead, simply remember that "we can choose what will survive and what will perish just as we chose what was added to our collections in the first place. And with that power and ability to choose comes inescapable responsibility."[309]

A 1980 article by Rose Mary Magrill, "Selection for Preservation: A Service Study," examines various methods for choosing which books are to be stored, filmed, or preserved in an individual library. Since a national center must start with selections on an individual basis, these methods prove useful when examined in the context of the proposed system. These decisions can be made in at least three ways: during the circulation process (which tends to garner the most frequently used books), by knowledgeable staff members patrolling the aisles (an expensive use of highly skilled personnel, or by a sample survey of what sections of the collection need the greatest attention. This study concluded that the last solution would prove most fruitful.[310]

In March of 1985, Lisa Williams published "Selecting Rare Books for Physical Conservation: Guidelines for Decision Making." "This article discusses the rationale for, and the possible uses of, guidelines designed to facilitate conservation decisions by systematically evaluating and weighing such factors as monetary, intellectual, and aesthetic values, projected use and usability."[311]

The results of one other study on selection apply to this proposal. A 1965 ARL-sponsored study indicated that the "establishment of a central register of best copies appears to offer no particular problem."[312] "On the basis of this study it was concluded that it is administratively feasible to establish a national preservation collection of materials....This assessment...extends to the identification of brittle...materials...."[313] These results indicate that an attempt to locate the copy of an old, brittle Library of Congress cataloged item which is in better condition than other copies should be manageable.

These and other aspects of the selection process require a general consensus among the involved parties before a plan is fully implemented. Will a cutoff date be established after which all new books and journals will automatically be included in the program? What is the priority system for rare items? Who decides what is worth keeping in each field? Are research libraries alone to be involved or do the public libraries, with their store of popular items, have a right to be included? Are special libraries, such as the Folger and Crerar, to be invited? What newsprint items will be included? While not insurmountable, these and other questions may prove a stumbling block to any work on the project.

After all questions of finance and selection have been settled, at least to what extent is possible, the next problem is which design to follow. While several plans have been created on various levels of practicality, two

continue to stand out as the most promising: Gordon Williams's "Preservation of Deteriorating Books: Parts I and II,"[314] and Warren Haas's "Preparation of Detailed Specifications for a National System for the Preservation of Library Materials."[315] When considered in tandem—as two parts of a complete design—these two projects address almost every aspect of the paper preservation issue.

Williams's Plan

In 1962, Gordon R. Williams published an article in *Library Journal* entitled "Preservation of Deteriorating Books: Parts I and II." This report is the result of a study supported and funded by the 1962 ARL Committee on the Preservation of Research Library Materials. The report is based on three principles. The first is that "our problem is to insure the *continuous availability*...of all significant written records."[316] The second is that "even though copies of books are adequate for many uses, the availability of the original is also necessary to verify the accuracy of the copy."[317] The third is that "every library need not physically preserve its own particular example provided it is assured that: a) another example is being preserved; b) its patrons may have access to the preserved original when only that can satisfy their needs; and c) a usable copy of the text is cheaply and readily available for local use of its patrons whenever required."[318] Williams's plan assumes that a funding source would have to be located, as indeed it will. "Analysis of the factors involved indicates that the most practical solution requires the establishment of a federally supported central agency that will physically preserve, for use when required, at least one example of every written record of significance, and that will insure the ready availability of adequate copies and other records to all libraries."[319] He offers three possible sources of and organizational plans for obtaining federal support. As mentioned earlier, this premise of government support has become almost a given for any national system.[320] After gaining initial capital funding and minimal maintenance support from the government, this plan aims at a certain degree of self-sufficiency. "The income from the sale of positive prints from [the] negatives can be expected, over a period of years, to nearly balance the cost of the negatives. Therefore this program, once established, will probably become largely self-supporting...."[321] While this prediction may well prove overly optimistic, the concept of working toward the highest degree possible of self-sufficiency can only help in the struggle to obtain funding.

When funding creates a working system with some actual duties, four major responsibilities take priority over all else: first, to "undertake the centralized preservation of deteriorating records deposited by libraries";

second, to "coordinate its own preservation program with local programs...to assure that all significant records are preserved while avoiding...duplication"; third, to "assure the ready availability of microform or full-size photocopies of deteriorating materials to all libraries"; fourth, "itself preserve...all microform masters made at its own expense or deposited by...other agencies."[322] Apparently the assumption is that locating and selecting those items to be preserved will, for many years, be of less importance than answering the needs of the supporting libraries. This has a twofold virtue as a working hypothesis. As so much material needs to be preserved, simply handling what is offered will take all the available time and money for many years without attempting to locate the only copies of individual items. Second, for the plan to succeed, supporting libraries must be very pleased with the service it renders or their dissatisfaction, or even withdrawl, will affect participation of the other libraries as well as funding sources. After the system is established and running smoothly, special projects may proceed.

Williams's single source for materials is the research library. The agency must not buy any copies as all funds will be needed elsewhere. As an incentive, the first library "depositing a 'usable' or 'good' example of a record will be allowed to buy a positive microform copy of that book for half the cost of the print," either at the time of the deposit or later.[323] Utilization of copyright laws and various programs will assure the addition of new materials and whatever foreign copies become available.

While selection of the high priority materials is not detailed, Williams does set out a guide of what will ultimately be included in the system. "Fortunately, one selection of books for their intellectual contribution has already been made, and that is the selection by research libraries for addition to their collections."[324] His research determined that "four percent of the collection will have to be discarded as not worth the cost of preservation before it would be more economical to make the examination than to preserve everything in the collection."[325] This is not a perfect base of selection as some books may be missed due to budget problems or an error in judgment, and some may be chosen that are only of temporary value. Yet, despite these drawbacks, this criterion satisfies most of the major requirements of an efficient selection process for such a large-scale project.

These points of the Williams plan fail to include the many details and clear guidelines set out in the proposal. The broad outline of the plan, as explained earlier, covers the main issues of the paper preservation problems. As Edwin Williams said in 1970:

> [Preservation of Deteriorating Books] was unanimously adopted in principle by the [ARL] at its meeting of January 24, 1965; it stands therefore—until changes are approved—as a statement of the association's position, a plan of action that has been approved by librarians of the institutions most vitally concerned with the problem of deteriorating library materials. Hence it can be described as the most significant single document on the subject....[326]

Haas's Plan

Warren J. Haas's master plan, "Preparation of Detailed Specifications for a National System for the Preservation of Library Materials," has yet to be brought up before a professional organization for approval or implementation, but it may very well lay the groundwork for the only plan so acted upon. Haas insists that "the goal of dissemination and extended access is more attractive than that of preservation to the public at large, many library users, and even potential funding sources. In the end, however, the two must be seen as inseparable of the fundamental library obligation to create and maintain resources for research."[327] By acknowledging the fact that preservation fails to stir the enthusiasm and support of extended dissemination, Haas intends to educate and prepare all sectors of society for the concept that the two are both vital to ongoing research.

His premise is that the:

> preservation effort requires [certain]...elements...if it is to succeed: a dedicated group of individuals...; presentation of sound programs of action...that [generate] confidence and respect on the part of those whose financial support is needed; and results that are readily evident....[Various problems include: a small pool for membership in the primary group, any] proposed action must be realistic in both its aspirations and its financial requirements, [and the fact that this is] basically an unattractive topic....[328]

Whereas Williams focused on the requirements of establishing a national agency, Haas focuses on the background requisite for such an implementation.

Haas also supports four basic areas of action and responsibility, but his concentration is on more than the establishment of the national center. First, is the requirement for continual research, a factor which is not explicitly mentioned in Williams's plan. Second, the public, librarians, and the financial powers involved must be educated and trained in the paper problems. Third, individual libraries must establish and continue local preservation and conservation efforts. Finally, after the groundwork has been established, collective action becomes the primary effort.[329]

Financially Haas's plan assumes a great deal of private funding. Different groups pay for their own contributions, such as the Library of Congress supporting a set of traveling exhibitions on papermaking designed to alert the public to the imminent danger. Certain projects require organizational sponsorship which presumably includes minimal funding, such as the Library of Congress sponsorship of a "series of annual seminars to report and review research activity on specific topics."[330] Ultimately, however, "Federal financial support of great magnitude is essential if the individual research libraries of the country are to become in fact as well as in theory a true national asset."[331] Haas's assumption that various professional organizations finance the effectual creation of a demand for preservation may indeed prove necessary in any attempt to capture a sufficient portion of the federal budget. Rather than creating a need where none exists, Haas proposes educating the public and politicians about a need of which they are unaware.

The numerous specifics of this plan cover aspects of the issue from training, to wooing university presidents, to establishing local plans of action. Two major items require separate attention—i.e., establishment of a "preservation consortium" and care for "endangered titles." "A 'preservation consortium' operating independently or under the auspices of the ARL or the [CRL] and investing a modest amount of time and money would be the most direct way to test the validity of the proposition that collective action is essential to further progress...."[332] Such a consortium, howsoever it is established, may well be a convincing argument to Congress and other libraries that such a facility can function effectively. "But given the difficulty of attaining this theoretical goal of a national preservation collection, the principle of setting aside the best copies of 'endangered titles' under conditions that will slow the rate of deterioration and expedite access by reproduction...is still...sensible."[333] While this alternative should prove far less costly than a wholesale preservation project, selection alone will prove costly in staff time. Unfortunately such stopgap measures may prove necessary before a complete system can be established. Almost ten years after the Haas plan, William Welsh commented that people "were enthusiastic, energetic and sincere in 1976, but were all mistaken in believing that the Library of Congress, with the advice and consent of the library community, could inaugurate [a national preservation program] by itself."[334]

CONCLUSION

Examining the problems of paper preservation, no matter how tight the limitations, involves more associated issues than a single article can

include. The causes of paper deterioration, questionable validity of current testing methods, fa. tors which compromise the nature of this issue, and the modern tools to create a solution all help to define the various facets of this problem. Philosophically it must also be remembered that "a conservation program seeks to create a balance between the protection an item receives and its values and uses."[335] So little can be determined, from current studies, concerning the extent of the damage in terms of physical items or cost estimates that only further, in-depth studies on a national basis will pinpoint the number of books lost to fu ure generations. Unfortunately, what little evidence is available indicates that we do not have the time to measure the damage done; steps to protect what remains must be taken quickly. More optimistic, however, is an examination of a few of the possible solutions to this gargantuan problem. Microform technology continues to expand. Librarians as a profession grow steadily more aware of the problem through seminars, articles, and reports at annual meetings. Deacidification methods continue to improve and massive amounts of material can now be treated. Most encouraging of all, perhaps, are the practical detailed specifics of the various plans for effective action on local and national levels. Patterson, Williams, and Haas have designed workable plans and, even more, have provided specific objectives to be met by every alert, involved librarian. "Certainly there are economic and organizational problems in any course of action, but there are social implications in our failure to act, since we are speaking of the preservation of a cultural heritage."[336] This decade, more than any other in our preservation history, has the challenging potential to consummate a true solution. "We are in a stage analogous to trying to decide on a classification scheme or a card format; it's 1876 in the preservation field."[337]

In July 1823, John Murray wrote in *The Gentleman's Magazine*, that "our beautiful Religion, our Literature, our Science, all are threatened."[338] Almost 160 years later Pamela Darling warns that "medieval leather bindings now age more in ten years than they did in their first hundred; the life expectancy of most contemporary record materials--books, photographs, recordings—is shorter than our own."[339] Now is the time to act. Scholar, scientist, historian, student, politician, papermaker, printer, publisher, teacher, archivist, conservator, librarian—all must move forward together today. "To date, there is no evidence that the problem of preserving the human record will some how be solved in the natural course of events."[340] Or, as Warren Haas pointed out in 1976, "scholars, librarians, and archivists do, in fact, have the responsibility to solve this preservation problem. And that responsibility is not conditioned—it does not depend on public perception, or amount of money, or anything else. It is our responsibility, and we can either succeed or fail. The rate at which things are done is a

function of money; whether or not they are done at all is a function of people...."[341]

APPENDIX
Supply Companies

Note: The companies in this appendix are listed merely to represent the various products available. Inclusion is in no circumstance a recommendation of either company or product. Exclusion is not a commentary on availability, quality, or any other aspect of a company.

Archivart. Process Materials Corporation 301 Veterans Boulevard Rutherford, NJ 07070 (201) 935-2900; Robert Stiff. Catalog and price list received upon request. Samples offered. "Process Materials Corporation fully guarantees all materials shipped to be in accordance with specifications given in our catalogue." Includes an application index, an alphabetical list of all products, and a basic division of products into six categories. Each section includes general guidelines, specifications, and instructions on what to look for in any brand of the product and how to use it. The pH values are specified on all relevant items. Coverage includes bookbinding, framing, prints and fine arts, photography, textile conversion, and conservation equipment.

Conservation Resources International. 1111 N. Royal St., Alexandria, VA 22314, (703) 549-6610; William Hollinger, Jr., President. Samples and catalog provided upon request. (See also Hollinger Corporation below.) Catalog contains an interesting 12-page article on the atomic makeup of paper and the chemical reactions involved in acidic deterioration and other types of degradation. Included are "specifications for archival papers" and explanations of when to use each product. Wei Two products are included.

P.H. Glatfelter Company. Spring Grove, PA 17362-0500, (717) 255-4711; Clinton Clough, Jr., Market Research Manager. This paper company produces "coated and uncoated papers [which] are alkaline-sized, *Acid-free*, and have a pH above seven." They ship to paper merchants and publishers all over the country. Their "Ageless Text is a permanent-durable paper which meets specifications of paper quality for historical publications sponsored by the National Historical Publications and Records Commission." Further specifications and prices are available upon request.

Hollinger Corporation. 3810 South Four Mile Run Drive, P.O. Box 6185, Arlington, VA 22206, (703) 671-6600; Mary Hollinger, President. Catalog and price list upon request. Product index with cross reference index available in back of catalog. Upon request will send the Library of Congress' "Pulp Method of pH Measurement and Calcium Carbonate Determination." When relevant, products are marked to indicate which standards they meet, such as the American National Standards PH1.53-1978 Photographic Activity Test. The products are primarily for storing materials and include: boxes, envelopes, folders, document cases, microform storage, mylar products, and paper, among others.

Jerome Business Forms, Inc. 20 Millpark Court, Maryland Heights, MO 63043, (314) 428-7799; Dan Ottenlips, CFC. Samples sent on request. This company now produces W.J. Barrow's Permalife paper. "In 1976, when the Standard Paper Company went out of business, Howard Paper Mills, Inc. of Dayton, Ohio, bought all rights to Standard's grade structure, trade names and paper making devices. Included was Standard's acid free paper, Permalife....If any reader wants to know

more about the chemistry of Permalife, which has been considerably improved since the Standard Paper Company first made the grade, you may contact our technical staff at Howard Paper Mills, Inc., 115 Columbia St., P.O. Box 982, Dayton, Ohio 45401...." "400 year guarantee under normal conditions and over a 100 year guarantee under archival conditions. If product fails to last 400 years return to JBF Inc....Paper will be replaced....Our acid free paper equals or exceeds the specifications for a permanent/durable book paper established by W.J. Barrow...." The other unique point about this company, aside from its connection with Barrow and its interesting guarantee, is that the watermarked bond paper is provided in a format useful for formfeed computers, complete with tear-away edges.

University Products Inc. P.O. Box 101 South Canal St., Holyoke, MA 01041, (800)628-1912. Catalog sent upon request. "This catalog contains the largest selection of Archival Materials available anywhere." Some products are both acid free and lignon free. Various storage containers are "metal edged for...vermin free enclosure." A sample swatchbook of acid-free papers is available for purchase. Mylar and Wei T'o products are sold.

See also supply sources listed by Carolyn Horton in her revised second edition of *Cleaning and Preserving Bindings and Related Materials*. Chicago: ALA, 1969, pp. 56-61. Each of these items was tested and approved in independent tests by Walter McCrone and Associates at the request of the ALA's Library Technology Program.

CHRONOLOGY OF PAPER

c. AD 105 Ts'ai Lun of China creates paper

264 Date found on what is probably the world's oldest surviving paper as discovered by the Swedish geographer and explorer Dr. Sven Hedin (1865 to 1952)

793 Paper is made in Baghdad

900 Paper is made in Egypt

1035 Waste paper is repulped and recycled in Asia

c. 1158 Moors introduce paper in Spain

1300s Paper mills exist in Spain, Italy, Germany, and other European countries

1348 First French mill starts at Troyes

1450s Johannes Gutenberg's invention of printing creates a higher demand for paper in Europe

1575 Paper is first made in the new world at Cuhuacan, Mexico

1690 William Rittenhouse starts making paper near Philadelphia

1719 René A.F. de Reaumur offers the French Academy his idea that paper could be made from wood

1774 The German Karl William Scheele discovers chlorine bleach which is soon used to whiten paper

1798 Nicholas-Louis Robert, a Frenchman, patents the first machine for making paper mechanically

1800 Matthias Koops, in London, sets up the first commercial mill using wood to make paper

1817 The first successful creation of paper by mechanical means in the U.S.

1830s Moritz Friedrich Illig's invention of alum rosin sizing is in wide use in Germany

1840 Friedrich G. Keller, a German, patents a machine for grinding wood into fibers to use in making paper

1866 Albrecht Pagenstecher sets up the first groundwood pulp paper mill in the U.S.

1907 The English Librarian Cyril James Davenport (1848-1941) warns that books being made will not last 100 years

1929 The American chemist Edwin Sutermeister (1876-1958) first tests book paper for acid content

1959 William J. Barrow's research indicates that 97% of the U.S. books printed in the 20th century have a life expectancy of less than fifty years

11 Dec. 1959 Standard Paper Manufactuing Company of Richmond Virginia produces the first commercially viable, acid-free paper, i.e., Permalife

1960s William J. Barrow's work confirms that of Sutermeister and adds a great deal of information which still serves as the basis for much of the work in the field

1960 The Association of Research Libraries establishes its Preservation Committee

1963-74 William J. Barrow's wor· is published in seven volumes

1970 The Library of Congress' *Information Bulletin* begins to carry preservation news on a regular basis. The Library of Congress establishes its Preservation Office

1976 The Library of Congress publishes its *National Preservation Program for Libraries* as one result of the nation's first planning conference on a national preservation program

1980 First Annual Preservation of Library Materials Conference is held

Dec. 1981 Richard Smith's mass deacidification process, Wei T'o, becomes operational in Canada

1983 The Library of Congress spends 5% of its budget on preservation

Dec. 1981 The U.S. government agrees to spend $11.5 million to build the Library of Congress a mass deacidification plant

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18. Cunha, and Cunha, *Conservation of Library Materials*, pp. 13, 89, 377.

19. "The W.J. Barrow Research Laboratory, Inc....ceased its active operations in July 1977 when funding from the Council on Libra. / Resources ended after nearly 20 years. The W.J. Barrow Restoration Shop, Inc., a closely related but separate organization, continues to provide document restoration services on a commercial basis." Juli T. Henley to Westbrook, personal comm' nication, 17 June 1983.

20. McCarthy, Paul. "Vapor Phase Deacidification: A New Preservation Method." *American Archivist* 32(Oct. 1969):33. As quoted from Smith, Richard. "Paper Deacidification." *Library Quarterly* 36(Oct. 1966):273.

21. W.J. Barrow Research Laboratory. *Physical and Chemical Properties of Book Papers, 1507-1949* (Permanence/Durability of the Book series, vol. 7). Richmond, Va.: W.J. Barrow Research Laboratory, 1974, p. 21.

22. Barrow, "Permanence in Book Papers," pp. 1075-76.

23. Nelson, Clark W. "Technical Notes." *American Archivist* 34(Jan. 1971):75.

24. Hudson, Lyth. "Permanence of Paper." In *The Fundamental Properties of Paper Related to its Uses*, vol. 2 (Transactions of the Symposium held at Cambridge, Sept. 1973), edited by Francis Bolam, p. 716. London: Ernest Benn, 1976.

25. "'P' Stands for Permanent." *Laboratory* 32(1964):99.

26. Hollinger to Westbrook, personal communication, 8 Nov. 1984. (Hollinger is the president of Conservation Resources International, a company in Alexandria, Va. which markets a wide array of conservation/preservation supplies.)

27. Feller, Robert. "Thermochemically Activated Oxidation: Mother Nature's Book Burning." *P.L.A. Bulletin* 28(Nov. 1973):238.

28. Ibid., p. 239.

29. Ritzenthaler, Mary Lynn. *Archives and Manuscripts: Conservation; A Manual on Physical Care and Management*. Chicago: Society of American Archivists, 1983, p. 26.

30. Hudson, "Permanence of Paper," p. 714.

31. Banks, Paul. "Environmental Standards for Storage of Books and Manuscripts." *Library Journal* 99(1 Feb. 1974):339.

32. Ibid.

33. "'P' Stands for Permanent," p. 101.

34. "Detailed information about the effects of the environment on library materials will be found in *Preservation Planning Program Resource Notebook*." See, Darling, Pamela. *Preservation Planning Program Manual*. Washington, D.C.: ARL—for environmental specifications (pp. 40-42); environmental examination checklist (pp. 53-55); and environment monitoring equipment supply sources (p. 56). Darling, *Preservation Planning Program*, p. 40.

35. For a basic background in this area, see chap. 3, "The Enemies of Library Material," and appendix A, "Some Causes of Damage to Library Materials." In Cunha and Cunha's *Conservation of Library Materials*. For another useful resource see Kathpalia, Yash Pal. "Conservation and Preservation of Archives." *Unesco Journal of Information Science, Librarianship and Archives Administration* 4(April/June 1982):94-100. "The use of modern techniques and chemicals has resulted in the development of a new science: preventative conservation which is cheaper than the only alternative, restoration." The article covers storage, environment (biological pests, light, temperature, humidity, pollution, and dust), fire, deacidification, restoration, and staff.

36. "'P' Stands for Permanent," p. 100.

37. Feller, "Thermochemically Activated Oxidation," p. 240.

38. Banks, "Environmental Standards," p. 341.

39. Ritzenthaler, *Archives and Manuscripts*, p. 25.

40. For information on a recent fungal outbreak in the Virginia State Library, see, Chamberlain, William. "Fungus in the Library." *Library and Archival Security* 4(1982):35-55.

41. Banks, "Environmental Standards," pp. 340-41.

42. Morrison, Robert C. "Environmental Protection." *Library Security Newsletter* 2(Spring 1976):8-9. (This excellent article succinctly covers the dangers of ultraviolet light,

humidity, and excess heat. Morrison follows these warnings with practical, low-cost methods of minimizing existing problems.)

43. See Bernard Faye's article "The Design of Archives Buildings." *Unesco Journal of Information Science, Librarianship and Archives Administration*, vol. 4, pp. 88-93 for commentary on the preservation aspects of designing new buildings.

44. Cunha, and Cunha, *Conservation of Library Materials*, pp. 12-13.

45. "Folding endurance. Performed by using the Massachusetts Institute of Technology Fold Endurance Tester, this test simulates the stresses placed on a book leaf by flexing it to and fro by page turning. It is perhaps the most important physical test in evaluating permanence and durability of book papers."W.J. Barrow Research Laboratory, *Physical and Chemical Properties*, p. 9.

46. For a history of papermaking, including discussions of these and other testing procedures, see the W.J. Barrow Research Laboratory series *Permanence/Durability of the Book I through VII*. This series discusses a variety of subjects as researched at this laboratory, from medieval paper to bookbinding adhesives. The series was sponsored by the Council on Library Resources.

Vol. I. 1963 *A Two Year Research Program.*
Vol. II. 1964 *Test Data of Naturally Aged Papers.*
Vol. III. 1964 *Spray Deacidification.*
Vol. IV. 1965 *PVA Adhesives for Use in Library Bookbindings.*
Vol. V. 1967 *Strength and Other Characteristics of Book Papers, 1800-1899.*
Vol. VI. 1969 *Spot Testing for Unstable Modern Book and Record Papers.*
Vol. VII. 1974 *Physical and Chemical Properties of Book Papers, 1507-1949.*

'If paper is heated at 100 [degrees] C for 72 hours, it is artificially aged to a condition comparable with that of about 25 years under normal storage. It is now generally accepted that extending artificial aging to 48 days equals 400 years natural aging." Stuhrke, Richard A. "Development of Permanent Paper." In *Preservation of Paper and Textiles of Historic and Artistic Value* (A Symposium sponsored by the Cellulose, Paper and Textile Division at the 172d Meeting of the American Chemical Society, 30-31 Aug. 1976), edited by John C. Williams, p. 25. Washington, D.C.: American Chemical Society, 1977.

47. Hudson, "Permanence of Paper," p. 714.

48. Lunar, P., and Cardwell, R.D. "Thermochemical Stability of Pulp and Paper." In *The Fundamental Properties*, p. 731.

49. Graminski, E.L., et al. "The Effects of Temperature and Moisture on the Accelerated Aging of Paper." *Restaurator* 2(1978):175, 177.

50. Wilson, William, and Parks, E.J. "Comparison of Accelerated Aging of Book Papers in 1937 with Thirty-six Years of Natural Aging." *Restaurator* 4(1980):51.

"Central to [William J. Barrow's] research was the assumption that a prediction of stability could be extrapolated from accelerated aging tests using heat (72 hours at 100 [degrees] C = 25 years)." Morrow, *Preservation Challenge*, p. 27.

51. Hudson, "Permanence of Paper," p. 716.

52. Banks, *Environmental Standards*, p. 340.

53. Shaffer, Norman. "Library of Congress Pilot Preservation Project." *College & Research Libraries* 30(Jan. 1969):8-9.

54. Williams, Gordon. *The Preservation of Deteriorating Books: An Examination of the Problem with Recommendations for a Solution*. Washington, D.C.: Council on Library Resources, 1964.

55. Smith, *A Comparison of Paper*, p. 3.

56. Shatzkin, Leonard. "Publishing on Permanent Papers." *Library Quarterly* 40(Jan. 1970):117.

57. Committee on Production Guidelines for Book Longevity. Council on Library Resources. *Interim Report on Book Paper*. S.l.: CLR, 1981, p. 15.

58. Morrow, *Preservation Challenge*, p. 28.

59. Haas, Warren. "Preparation of Detailed Specifications for a National System for the Preservation of Library Materials." In *Library Conservation: Preservation in Perspective*, edited by John P. Baker and M.C. Soroka. p. 419. Stroudsberg, Pa.: Dowden, Hutchinson and Ross, 1978.

60. Schnare, Robert. "How to Handle Your Deteriorating Book Collection from an Administrative Point of View " In *Conservation Survey Manual*. Ballston Lake, N.Y.: Section on the Management of Information Resources and Technology [SMART] of the New York Library Assn., 1982.

61. Darling, Pamela. "Developing a Preservation Microfilming Program." *Library Journal* 99(1 Nov. 1974):2804.

62 Johnson, Carolyn M. "Priorities in Preservation " *New Library Scene* 1(Sept./Oct. 1982):1-2.

63. Smith, R.D. "The Nonaqueous Deacidification of Paper and Books." Ph.D. diss., University of Chicago, 1970, p. 3.

64 Williams, Gordon. "Preservation of Deteriorating Books: Pt. 1. An Examination of the Problem " *Library Journal* 91(1 Jan. 1966):52.

65. Patterson, Robert. "Conservation: What We Should Do Until the Conservator and the st Century Arrive." In *Conserving and Preserving Library Materials* (Allerton Park Institute No. 27), edited by Kathryn Luther Henderson and William T Henderson, p. 13. Urbana-Champaign: University of Illinois, Graduate School of Library and Information Science, 1983.

66. Darling, "Developing a Preservation Microfilming Program," p. 2803.

67. Waters, Peter. "Archival Methods of Treatment for Library Documents." In *Preservation of Paper and Textiles of Historic and Artistic Value, II* (Based on a symposium sponsored by the Cellulose, Paper and Textile Division at the 178th meeting of the American Chemical Society, 10-12 Sept. 1979), edited by John C. Williams, p. 15. Washington, D.C.: American Chemical Society, 1981.

68. Williams, "Preservation of Deteriorating Books," p. 55.

69. Patterson, "Conservation," p.16.

70. Banks, Paul. "Columbia-New York University Program in Library and Archives Conservation." In *History and Future Directions of Conservation Training in North America*. Washington D.C.: National Institute for the Conservation of Cultural Property, 1984, p. 48.

71. Weider, Joachim. "The Restoration and Conservation of Library and Archive Materials as an International Task." *IFLA Journal* 1(1975):24.

72. Shaffer, "Library of Congress Pilot," p. 5; *Library of Congress Information Bulletin* 29(4 June 1970):A-41-43; and *Library of Congress Information Bulletin* 29(5 Feb. 1970):56-57.

73 *Abbey Newsletter* 8(Oct. 1984):78.

74 National Conservation Advisory Council. *Conservation Treatment Facilities in the U.S* Washington, D.C.: NCAC, 1980, p. 15.

75. Byrnes, Margaret. "Preservation of Library Materials: 1982." *Library Resources & Technical Services* 27(July/Sept. 1983):30-31.

76. *College & Research Libraries News* 46(May 1985):264.

77. Brandehoff, Susan. "Preserv/Conserv/ation." *American Libraries* 14(March 1983):165; American Institute for Conservation of Historic and Artistic Works. "AIC Code of Ethics and Standards of Practice." 1 May 1979 (available from the organization); and Byrnes, "Preservation of Library Materials," p. 301.

78. *Abbey Newsletter* 8(Oct. 1984).*id.*

79. Waters, "Archival Methods of Treatment," p. 15.

80. Poole, Frazer. "Thoughts on the Conservation of Library Materials." In *Library and Archives Conservation* (Boston Athenaeum's 1971 Seminar on the Application of Chemical and Physical Methods to the Conservation of Libraries and Archival Material, 17-21 May 1971), edited by G.M. Cunha and N.P. Tucker, p. 16. Boston: Library of the Boston Athenaeum, 1972.

LC has, however, established model programs of preservation and restoration which, as they are funded and staffed by unique methods, cannot be copied exactly. Nevertheless, after the 1976 Preservation Conference, "the Library expects to develop a specific proposal for funds to support a cost-and-feasibility study. This will be followed by a proposal for a full-scale program."

81. Haas, "Preparation of Detailed Specifications," p. 419.

82. Nelson, "Technical Notes," p. 77. (Both American plastic papers "have superior dimensional stability, strength, and durability; resist grease and water.")

83. Byrnes, Margaret. "Preservation of Library Materials: 1981." *Library Resources & Technical Services* 26(July/Sept. 1982):226.

84. "Preservation News: LC Trading in Preservation Futures." *Conservation Administration News* 11(Oct. 1982):19.

85. Morrow, *Preservation Challenge*, p. 174.

86. Plotnick, Arthur. "Can Bill Welsh Conquer Time and Space for Libraries?" *American Libraries* 15(Dec. 1984):768.

87. "Preservation News: Non-Destructive Photocopier Device Sought." *Conservation Administration News* 14(July 1983):17.

88. Wolpert, V.M. "Synthetic and Plastic Papers." In *The Fundamental Properties of Paper*, p. 372.

89. Bansa, "Conservation of Modern Books," p. 112.

90. Swartzburg, Susan G., and White, Susan B., eds. *Preservation Education Directory: Educational Opportunities in the Preservation of Library Materials 1981*. Chicago: ALA, Preservation of Library Materials Section, Education Committee, RTSD, 1981, p. 22.

91. Cunha, George. "The Management of Library Conservation." In *Louisiana State University Library Lectures* (Nos. 29-35, Sept. 1974-April 1976), edited by Caroline Wire, p. 13. Baton Rouge: Louisiana State University Library, 1978.

92. Thompson, Enid. "Teaching a Basic Course in the Conservation of Documentary Materials." *Library and Archival Security* 4(1982):1-8

93. Banks, Paul. "Education for Conservators: A Proposal for Training Conservators of Library and Archival Materials." *Library Journal* 104(1 May 1979):1014.

94. Nyren, Karl. "Library Journal News Report." *Bowker Annual of Library and Book Trade Information*, 27th ed., edited by J. O'Hare and B. Suns, p. 420. New York: R.R. Bowker, 1982.

95. Swartzburg, and White, *Preservation Education Directory*, p. 22.

96. Haas, "Preparation of Detailed Specifications," p. 420.

97 Greer, Allen. "Discussion of Alkaline Printing Papers." *Library Quarterly* 40(Jan. 1970):109.

98. Poden, J. Keith. "Alkaline Sizing Conversion." *1983 Papermakers Conference* (Portland Marriott, Portland, Oreg., 25-27 April). Atlanta, Ga.: TAPPI, 1983, pp. 159-61.

99. It is also important to recognize that some paper mills are quite aware of the issue and even provide informational brochures on their wares such as the Mohawk Paper Mills of Cohoes, New York. They offer a large pamphlet on their "Mohawk Superfine" which gives the paper's pH (above 7.5) and the results of accelerated aging tests ("in excess of 300 years"). Council on Library Resources Committee. "Production Guidelines for Book Longevity" (1981). Reprinted from CLR. "Making Books that Last." *Publishers Weekly* 219(29 May 1981):19; and _____. "Binding Books to Last." *Publishers Weekly* 222(2 July 1982):37.

100. Darling, Pamela. "Expanding Preservation Resources." In *Conserving and Preserving Library Materials*, pp. 19, 33.

101. "Meeting Reports: Administrative Challenge of Preservation: A Conference at the Library of Congress." *Conservation Administration News* 14(July 1983):9.

102. Wellborn, Stan. 'America's Self-Destructing Libraries." *U.S. News and World Report* 86(12 Feb. 1979):42.

103. Byrnes, "Preservation of Library Materials: 1981," p. 224.

104. Clapp, Verner. "The Story of Permanent/Durable Book Paper, 1115-1970." *Scholarly Publishing* 2(July 1971):361.

105. "'P' Stands for Permanent," p. 101.

106. Ibid., p. 100.

107. Lundeen, Gerald W. "Preservation of Paper Based Materials: Present and Future Research Developments in the Paper Industry." In *Conserving and Preserving Library Materials*, p. 82.

108. Smith, "The Nonaqueous Deacidification of Paper and Books," p. 59.

109. For a useful overview of microforms in libraries, see *Drexel Library Quarterly* 11(Oct. 1975). While slightly outdated, the excellent articles by Allen Veaner and Charles

Meadow, among others, make the entire issue well worth reading. For more complete coverage of this area, see: Veaner, Allen B., ed. *Studies in Micropublishing: 1853-1976, Documentary Sources*. Westport, Conn.: Microform Review, 1976.

110. Walker, "Preserving the Intellectual Content," p. 174.

111. Teague, John S., ed. *Microfilm Points the Way to Harnessing the Information Explosion* (Proceedings for a Seminar held by the Microfilm Assn. of Great Britain in London, 5 Dec. 1974). Surrey, England: Microfilm Assn. of Great Britain, 1975, p. 62.

112. Darling, Pamela. "Microforms in Libraries; Preservation and Storage." *Microform Review* 5(April 1976):94.

113. For a worthwhile exploration of these and similar problems, see Walsh, Patricia, ed. *Serials Management and Microforms: A Reader*. Westport, Conn.: Microform Review, 1979.

114. Darling, "Developing a Preservation Microfilming Program," p. 2803.

115. Smith, Richard D. "Mass Deacidification: The Wei T'o Way." *College & Research Libraries News* 45(Dec. 1984):589 (see footnote no. 3 on the same page of this article for a listing of Smith's major works).

116. Walker, "Preserving the Intellectual Content," p. 12

117. Smith, "Mass Deacidification," p. 592.

118. *Abbey Newsletter* 8(Oct. 1984):71. See also: Raloff, "Halting Untimely Book Ends," pp. 154-56; and Garelick, Glenn. "Saving Books with Science." *Discover* 4(March 1983):66-67 for more information on the background of the new LC plant.

119. Smith, "Mass Deacidification," p. 592.

120. Plotnick, "Can Bill Welsh Conquer Time," p. 109.

121. Williams, Gordon. "Objectives of a National Preservation Program." In *A National Preservation Program: Proceedings of the Planning Conference*. Washington, D.C.: LC, 1980, p. 31

122. Smith, "Mass Deacidification," p. 592.

123. Harris, Carolyn. "Preservation of Paper Based Materials: Mass Deacidification Methods and Projects." In *Conserving and Preserving Library Materials*, p. 57.

124. Smith, "Mass Deacidification," p. 592.

125. Darragh, David. "Deacidification of Brittle Manuscripts and Documents." *Restaurator* 2(1978):183. "Paper loses folding endurance very rapidly at first and then more and more slowly as time goes on. This suggests that the best time to treat books for preservation is when they are new and strong." Smith, "The Nonaqueous Deacidification of Paper and Books." p. 30.

126. Library of Congress. *A National Preservation Program for Libraries*. Washington, D.C.: LC, 1978, p. 2.

127. Barrow, William J. *Deterioration of Book Stock, Causes and Remedies: Two Studies on the Permanence of Book Papers*, edited by Randolph Church, p. 54. Richmond: Virginia State Library, 1959.

128. Occasionally the mass deacidification methods have also proved too potentially lethal for extended use. "Even when the VPD process [developed by W.H. Langwell for use with the chemical CHC] was independently demonstrated to be effective in deacidifying paper, doubts about its safety to humans discouraged use of it.. A.D. Baynes-Cope [proposed use of another method; but since] both the deacidifying agent and the solvent are highly toxic, use of [his] method has been primarily limited to the laboratory." "Vapor Phase Process for Mass Deacidification of Paper and Books Developed." *Paper Conservation News* 1(Nov. 1973):2-3.

129. Harris, "Preservation of Paper Based Materials," pp. 59-68.

130. Smith, "Mass Deacidification," p. 589

131. _____, "New Approaches to Preservation," p. 163.

132. _____, "Mass Deacidification," p. 589

133. "'P' Stands for Permanent," p. 99.

134. Smith, "New Approaches to Preservation," p. 140.

135. _____, *The Nonaqueous Deacidification of Paper and Books*, p. 37.

136. "This Paper has 50 Years to Self Destruct." *Feliciter* 21(March 1975):13.

137. Darragh, "Deacidification of Brittle Manuscripts," p. 183.

138. Williams, Edwin. "Deterioration of Library Collections Today." *Library Quarterly* 40(Jan. 1970):5.

139. Ready, William. "Deterioration is Winning the Library Stakes." *Canadian Library Journal* 35(June 1978):205.

140. Poole, "Thoughts on the Conservation of Library Materials," p. 14.

141. Weider, "Restoration and Conservation," p. 25.

142. "Short Life for Older Books." *Library Association Record* 79(Dec. 1977):671.

143 Byrnes, "Preservation of Library Materials: 1981," p. 225.

144. Walker, Gay, et al. "Yale Survey: A Large-Scale Study of Book Deterioration in the Yale University Library." *College & Research Libraries* 46(March 1985):111, 122. ("The survey design, the questions, and the implementation procedures described here may be particularly useful working tools adaptable to different situations and needs at other libraries." Ibid., p. 126.)

145. Waters, Peter. "The Conservation-Restoration Program." In *A National Preservation Program*, p. 25.

146. Williams, John C. "Method of Deacidifying Paper." (U.S. Patent No. 3969549, col. 1, 13 July 1976).

147. Preservation of Library Materials Committee. *Statement on the Conservation of Library Materials*. Madison: University of Wisconsin, 1976, p. 1.

In yet another view, "At the Library of Congress current estimates indicate that for materials presently identified as rare, with permanent research value, complete conservation will require about twelve thousand five hundred man years of work. Other parts of the collections are in equally serious condition." Waters, "Archival Methods of Treatment for Library Documents," In *Preservation of Paper and Textiles II*, p. 14.

148. Walker, "Preserving the Intellectual Content," pp. 178-79.

149. Darling, *Preservation Planning Program*.

150. Poole, Frazer. "Objectives of the Conference." In *A National Preservation Program*, p. 14.

151. Walker. "Preserving the Intellectual Content," p. 112.

152. Zamora, Gloria, and Adamson, Martha. "Looking Back at the Microfilm Decision: Expectations and Experiences." *Special Libraries* 70(April 1979):180.

153. Sparks, Peter. "Library of Congress Preservation Program." In *Library Preservation Program*, p. 69.

154. Weber, David. "Preservation Programs: The Fiscal Support at Stanford and Other North American Libraries." In *Library Preservation Program*, pp. 89-92.

155. Smith, "Mass Deacidification," p. 590.

156. Ibid., pp. 590-91.

157. Smith, Richard. "Mass Deacidification Cost Comparisons." *College & Research Libraries News* 46(March 1985):122.

158. Parliament, Robert. "Construction and Start-up of the Deacidification Unit at Princeton University Library." In *Book and Paper Group Annual 2*. Washington, D.C.: American Institute for Conservation, 1983, p. 85.

159. *Interim Report on Book Paper*, p. 15.

160. Haas, Warren. "Report of a Meeting: Conference on Book Preservation." *Restaurator* 3(14 May 1979):124.

161. *Permanent/Durable Book Paper* (Summary of a Conference Held in Washington, D.C. 16 Sept. 1960). Richmond: Virginia State Library and ALA, 1960, p. 27.

162 Hagermeyer, R.W. "Impact of Increasing Paper Consumption and Resource Limitations on Alkaline Papermaking." In *Preservation of Paper and Textiles II*, pp. 241, 246, 248.

163. Committee on Production Guidelines for Book Longevity. Council on Library Resources, *Book Longevity*. Washington, D.C.: CLR, 1982, p. 6.

164. Williams. John C. "A Review of Paper Quality and Paper Chemistry." *Library Trends* 30(Fall 1981):211.

165. Committee on Production Guidelines for Book Longevity. CLR, *Book Longevity*, p. 6.

166. Greer, "Discussion of Alkaline Printing Papers," p. 111.

167. Ibid., p. 109.

168. Shatzkin, "Publishing on Permanent Papers," p. 121.

169. Belew, David. "Paper—What's Going to Happen." *Inland Printer-American Lithographer* 173(Sept. 1974):80.

170. The National Micrographic Association "is in the midst of a busy period in standards activity. We expect four new technical reports, seven new revised or withdrawn A.N.S.I. Standards; and six new N.M.A. (industry) standards." Neale, William. "Standards Report." *Journal of Micrographics* 14(Sept. 1981):17.

171. Teague, ed., *Microfilm Points the Way*, p. 62.

172. Dranov, Paula. *Microfilm: The Librarian's View, 1976-77*. White Plains, N.Y: Knowledge Industry, 1976, p. 6.

173. Gabriel, Michael, and Ladd, Dorothy. *The Microform Revolution in Libraries*. Greenwich, Conn.: JAI Press, 1980, pp. 13-14.

174. Morrow, *Preservation Challenge*, p. 46.

175. Adelstein, Peter Z. "Preservation of Microfilm." *Journal of Micrographics* 11(June 1978):34.

176. Morrow, *Preservation Challenge*, pp. 47, 49.

177. "A word about archival. Currently, the only film that can be considered archival is wet processed, silver-gelatin film. There is a standard on the stability of diazo film which classifies it as long term (suitable for preservation of records for a minimum of 100 years) and medium term (suitable for preservation of records for a minimum of ten years)." Glotfelty, Robert A. "Technical Corner." *Micrographics Today* 14(April 1980):4.

178. Ashby, Peter, and Campbell, Robert. *Microform Publishing*. London: Butterworths, 1979, p. 83; and Eastman Kodak. "Storage and Preservation of Microfilms" (Pamphlet 0-31), 1981, p. 2.

"To comply with A.N.S.I. specifications, archival-record films must have a gelatin-silver halide emulsion ...The A.N.S.I. standard...on diazo films specifies that such images are not approved as archival-record films... "

179. Adelstein, "Preservation of Microfilm," p. 334.

180. Gabriel, and Ladd, *Microform Revolution in Libraries*, pp. 15-16.

181. Teague, [illegible]y J. *Microform Librarianship*. London: Butterworths, 1977, p. 94; and Dranov, *Microfilm*, p. 6.

182. To help answer questions about type of film, cost factors, and other problems, "a new Library Committee under the leadership of Carl M. Spaulding...was formed...." Spence, A N. "Standards Report." *Micrographics Today* 15(Jan. 1979):10-11.

183. Darling, "Developing a Preservation Microfilming Program," p. 2803.

184. As quoted in *ANSI Practice for Storage of Processed Safety Photographic Film*, ANSI pH 1.43-1976: the "important storage elements...are the level of humidity and temperature of the air and cycling of these factors, as well as the hazards of fire, water, fungal growth, contact with certain chemicals in solid, liquid, or gaseous form, and physical damage." Raikes, Deborah A. "Microform Storage in Libraries." *Library Technology Reports* 15(July/Aug. 1979):446.

185. Banks, "Environmental Standards for Storage of Books and Manuscripts," p. 342.

186. Spreitzer, Francis. "Microforms and the Library: A Review Article." *Library Quarterly* 49(July 1979):318.

187. Dorfman, Harold. "The Effect of Fungus on Silver Gelatin, Diazo and Vesicular Film." *Journal of Micrographics* 11(4 March 1978):257.

188. Darling, "Developing a Preservation Microfilming Program," p. 2803.

189. Ibid., p. 2804.

190. Kirsch, Kenneth, and Rubenstein, Albert H. "Converting from Hard Copy to Microfilm: An Administrative Experiment." *Collection Management* 2(Winter 1978):279.

191. Darling, "Developing a Preservation Microfilming Program," p. 2804.

192. Teague, ed., *Microfilm Points the Way*, p. 62.

193. Dranov, *Microfilm*, p. 2.

194. Darling, "Developing a Preservation Microfilming Program," p. 2803.

195. Kirtsch, and Rubenstein, "Converting from Hard Copy to Microfilm," p. 279. ("Utilization rates for the microfilm...were not statistically different from the hard copy.")

196 Robinson, Lawrence "The Preservation Microfilming Program." In *A National Preservation Program*, p. 19

197. *Association of Research Libraries Newsletter*, no. 125, 9 May 1985, p. 8.

198. Morrow, *Preservation Challenge*, p. 3.

199. Lundeen, "Preservation of Paper Based Materials," p 80; and *Interim Report on Book Paper*, pp. 10-11.

In 1981 CLR was able to list five companies "who make neutral or alkaline grade as part of a regular product line."

200. Haas, "Report of a Meeting," p. 125.

201. *Interim Report on Book Paper*, p. 6.

202. Haas, "Report of a Meeting," p. 123.

203. Nyren, Karl. "News." *Library Journal* 103(15 June 1978):1214.

204. *Interim Report on Book Paper*, p. 4.

205. Ready, "Deterioration is Winning the Library Stakes," p. 201.

"A better solution to the problem is separate reprinting of certain titles on acid-free paper. ..If organized properly, this undertaking may even be started with the help of government grants until it is self-supporting. These organizations would have to establish a central office, which would collect all orders of certain titles desired for printing on acid-free paper. If there are more than 150-250 such requests for a particular title, then a reprint using modern reproduction techniques or working directly off the original printing plates can be economically justified....If successful, this service may be expanded to out-of-print titles or to those severely deteriorated. Best of all, a "Preservation Subscription Service" would give librarians a chance to demonstrate their seriousness about wanting acid-free materials for their collections." Rebsamen, Werner. "Must all Printed Library Material be Acid-Free?" *Library Scene* 10(March 1981):14.

206. Wilson, William. "Discussion." *Library Quarterly* 40(Jan. 1970):173.

207. Shatzkin, "Publishing on Permanent Papers," pp. 126-27.

208. Morrow, *Preservation Challenge*, p. 28.

209. "Preservation News." *Conservation Administration News* 14(July 1985):16-17. (A new ANSI standard is intended to be "reviewed, revised and made available by the end of 1985." The draft requirements include, among other specifications, 7.5 pH and no unbleached pulp of groundwood.)

210. *Interim Report on Book Paper*, p. 5.

211. Ibid., p. 8.

212. Library Binding Institute. *Standard for Library Binding*. Boston: LBI, 1981 (inside front cover).

213. *College & Research Libraries News* 46(March 1985):129.

214. Clapp, Verner. *Story of Permanent/Durable Book-Paper, 1115-1970* (suppl. 2). Copenhagen: Restaurator Press, 1972, p. 50.

215. Cunha, and Cunha, *Conservation of Library Materials*, verso of title page.

ABBE Publishers Association of Washington, D.C. included the following statement on the verso of Dr. John Bartone's *Intelligence Tests*. "ABBE BOOKS now contain new technology for preservation as archive books. The methodology was developed in Great Britain and gives our books indefinite life and stability. Many American books and library volumes suffer ACIDOSIS, have poor archival properties and will eventually deteriorate. This is a serious problem which threatens all information sources throughout the world. Abbe books are reference, resource and research guide books and serve unlimited requirements for professions and mankind. Reference books never die or lose their place in history. Reference books always maintain their rank and status in all generations of civilization and thus archive preservation became a necessity as a mark in the time and progress of mankind and society."

216. Williams, John C. "A Review of Paper Quality" p. 212.

217. Jane Sennett Long to Westbrook, personal communication, 15 May 1985.

218. Clapp, *The Story of Permanent/Durable Book-Paper, 1115-1970*, p. 366.

219. *Interim Report on Book Paper*, p. 2.

220. Penniman, John. "Calcium Carbonate-Alkaline Size Process Offers Benefits in Paper Manufacturing." *Paper Trade Journal* 164(15 Aug. 1980):34-35.

Penniman also mentions the following benefits: improved strength (it "need not discolor nor degrade with time"), printability "is often reported to be improved,...it inhibits deposits, improves process stability and runability and virtually eliminates corrosion," and reduced energy use. It is usually in the range of 6.8 to 7.2 pH.

221. Stuhrke, "Development of Permanent Paper." In *Preservation of Paper and Textiles of Historic and Artistic Value II*, p. 30.

The following four papers support the proponents of alkaline papermaking and were published in *1983 Alkaline Papermaking* (Portland Marriott. Portland, Oreg., 27-29 April). Atlanta, Ga.: TAPPI, 1983. Brink, Henry, and Gaspar, Lawrence. "Alkenylsuccinic Anhydride Sizing in Alkaline Papermaking." pp. 15-25. ("Alkaline papermaking is a tremendous opportunity for the paper industry. This process offers broad and well-documented benefits in terms of improved productivity and efficiency in raw material use.") Pitt, Richard. "Fillers and Fabric Life in Alkaline Papermaking," pp. 69-72. ("The change from acidic to alkaline papermaking has many economic advantages which generally outweigh the disadvantages.") Beach, Elwood. "Alkaline Papermaking—Wet End Operation," pp. 75-78. ("The alkaline sizings of paper present some significant cost savings to the papermaker.") Sanford, Thomas. "Conversion of Alkaline Papermaking: One Mill's History," pp. 81-82. ("An All...ne Papermaking Task Force was assembled to investigate the procedures for a conversion to alum-free papermaking....Both advantages and disadvantages exist, but the savings in raw materials costs and the reduced paper machine corrosion prove alkaline papermaking is cost effective.")

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225. Goldstein, S.D. "Slime and Deposit Control in Alkaline Papermaking Systems." In *1983 Papermakers Conference*, p. 55.

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227. Greenfield, Jane, and Walker, Gay, eds. *Preservation: Your Responsibility* (Prepared at the Yale University Library under a grant from the National Endowment for the Humanities, May 1981). New Haven, Conn.: Yale University Library, 1982, p. 5.

228. Information is based on brochure.

229. Patterson, "Conservation: What We Should Do," pp. 11-12.

230. Darling, Pamela, with Webster, Duane. *Preservation Planning Program: An Assisted Self-Study Manual for Libraries*. Washington, D.C.: ARL, 1982, p. 98.

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The NEDCC will charge for services to institutions outside their region on an at-cost basis. Two pamphlets available from the NEDCC are "Services" and "Photoduplication Services."

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