Assessing the Condition of the United States National Collection

Fenella G. France PhD MBA FAIC

Chief, Preservation Research and Testing Division,

Library of Congress (LC)

Overview

- *Andrew W. Mellon Foundation Grant (Scholarly Communications)*
- $540,000 for 40 months Jan 2019 – Apr 2022
- The research project will provide data to objectively assess the condition of the books held in the United States by performing an in-depth scientific analysis on a representative sample from the time period 1840-1940
- The physical, chemical and optical data will help ensure that large-scale withdrawal of materials does not compromise the overall robustness of cultural heritage collections, informing the shared print, preservation and digitization communities

https://nationalbookcollection.org/overview

Acknowledgements

- Mellon Project Researchers:
  - Andrew Forsberg, Robyn Hodgkins
- Ian Bogus (CoPI)
- Jake Nadal
- Advisory Board
- Institution Partners
- PRTD Staff (Andrew Davis, Chris Bolser, Amanda Satorius, Jamie Shetzline, Kelli Stoneburner, Emin Voloder)
- Multiple amazing interns…

Everything Not Saved Will Be Lost: Preservation in the Age of Shared Print and Withdrawal Projects

Zachary Maiorana, Ian Bogus, Mary Miller, Jacob Nadal, Katie Risseeuw, and Jennifer Hain Teper

This paper's review of current issues in shared print retention and preservation identifies such shared issues as the cataloging and validation, retention and withdrawal of holdings, loss rates, current condition of holdings, recommendations for the number of copies to retain, and storage environments. Library institutions require a community-wide dialogue assessing practical retention concerns. We hope that our recommendations and discussion will serve as a call to action for further study and greater interest in strong cooperation at both institutional and repository levels, including collaborative action for multiple levels of collection assessments.

Introduction

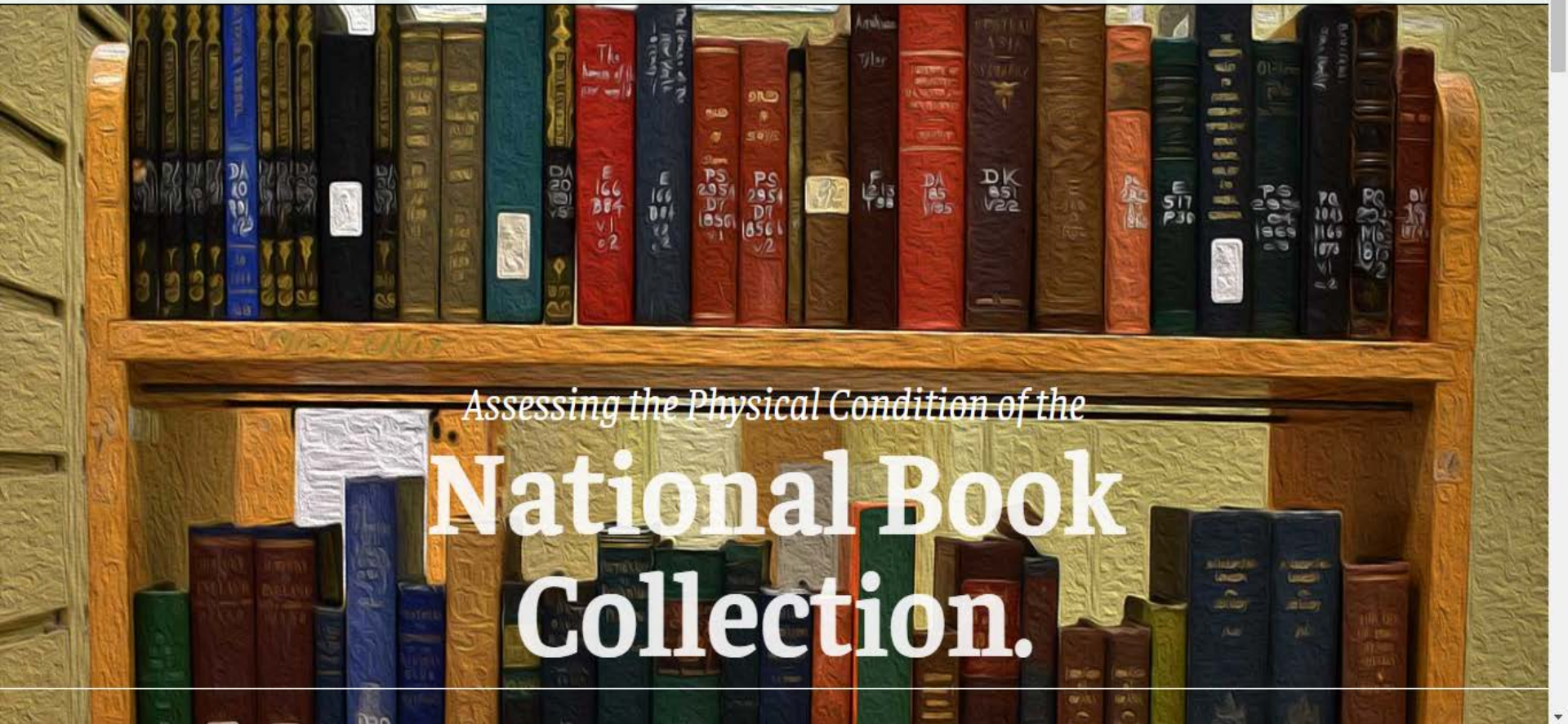
Large-scale collaboration has been central to academic and research library preservation since the 1980s. Working in concert to microfilm brittle books and serials, librarians developed prescient collaborative strategies to distribute the microfilm across the country to be shared between institutions through interlibrary loan. Since then, libraries' collection sharing networks have matured and diversified so that today's library collectives now share their collections and collection development strategies in a more structured and integrated manner. The development of shared print programs (SPPs) to provide expanded access has occurred in parallel with projects to reduce overall print holdings and shift usage to shared copies and digital surrogates. The

Research Library Partner Institutions

- Cornell University
- University of Miami
- University of Washington
- Arizona State University
- University of Colorado at Boulder

Analyze the same 500 volumes from all partners

nationalbookcollection.org/overview



Assessing the Physical Condition of the

National Book Collection.

Preservation of Large Physical Collections

Impact of:

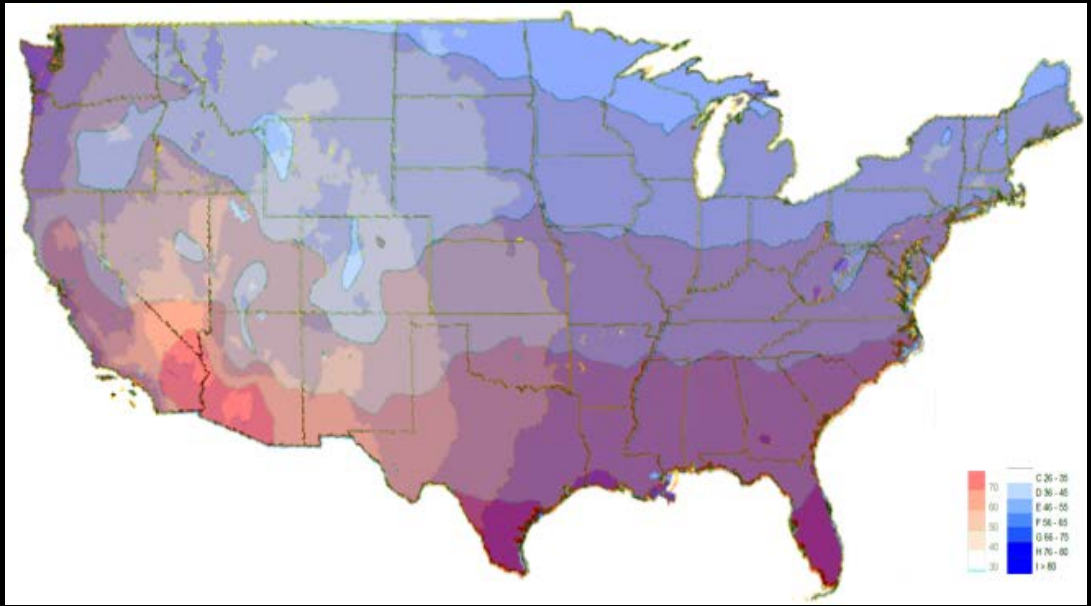
- Use (handling)
- Environment
- Material

Data Analytics and Possible Trends

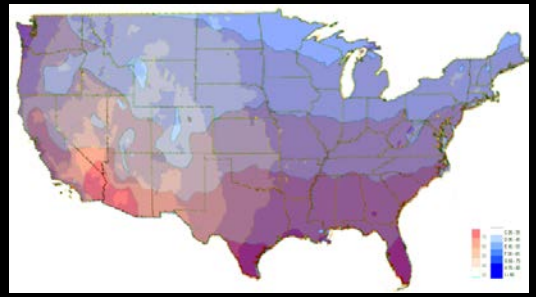
Assessing impact of:

- Text block of each volume – the material (inherent properties)
- Environment
- Usage

Partners are providing environment and circulation data that is available



What can we find out from Data Analytics?



What factor(s) contribute most or have a greater influence on the current state of the text block?

- The inherent properties of the paper and paper composition?
- Impact of Environment
- Usage

*Data suggests a 5% loss in condition from collection use (twenty additional checkouts)**

Using molecular weight data to measure reduction in strength can provide information about when a collection item is no longer fit for purpose

**EAST (Boston Consortium)*

Assessing the Physical Condition of the National Book Collection:

500+ books...

The five hundred (plus) books selected for the project:

Title or Author (filter)

City, Publisher, or Bib No.s (filter)

Decade (filter)

1840s '50s '60s '70s '80s '90s 1900s '10s '20s '30s '40s

Language (filter)

English Mid. Engl. French German Italian Latin Mult. Portuguese Spanish

Sort by

Date, Title Title Author City Publisher Language OCLC # Call # Asc

Visual Assessment

- How are we determining the condition of our collections in a standard / consistent way that allows us to know how our collection compares to another?
- Are we effectively using our knowledge to make retention decisions?
- Do we know what is the "*same*" volume?
- Can we trust our catalog information?

admin.prtd.app/anc/book/10012

PRTD Admin

FENELLA LOGOUT

View an ANC Book

EDIT | SAMPLES | ANALYSES | GO BACK

Assessing the National Collection Project Details

Book ID: book:10012 (Read only)

Catalog ID: catalog:10016 (Read only)

Institution ID: institution:00002 (Read only)

Batch as Received *: 1 From Partner (Require

Catalog Book *: 10016: Trelawny papers (1853)

Syntax: `Catalog ID: Title (abbrev.) (Date)` (Required)

Institution *: ASUL: Arizona Sta (Required)

Received On: 2019-06-20

Returned On: 2019-12-05

Created: Bernardo_D, Jun 20, 2019.
Last Modified: Forsberg_A, Mar 10, 2020.
Assessed: Hodgkins_R, Jun 20, 2019.

Catalog Details

Title *: Trelawny papers

Author

Catalog Details

Title *: Trelawny papers (Required)

Author

Volume

Edition

Published Date (year): 1853

Publisher: Printed for the Camde

Location: London

Height (mm): 219

Width (mm): 165

Thickness (mm): 21

Number of Pages: 23

☑ Rebound collection of catalog books in one library volume?

Create separate book records for **each** ANC catalog entry in a (re)bound collection. Check this box for each record, assess, sample, and analyze each se
ANC book is bound with non-ANC books then describe the volume in the catalog notes field below.

Use the select field below to indicate which ANC catalog books have been bound together with this one:

Collection Includes

catalog:10015, catalog:10017, cat...

1853: Account of the expenses of John of Brabant and Thomas and Henry of Lancaster, A.D. 1292-3
1853: Household expenses of the Princess Elizabeth during her residence at Hatfield, October 1, 1551, to September 30, 1552
1853: Trelawny papers

Enclosures (describe)

e.g., box or tape. Leave blank for none.

Description

admin.prtd.app/anc/book/10012

Visual Assessment: Description

Description > Binding

Leaf Attachment	Material	Format	Overall Color	Other
○ Sewn	◉ Cloth	◉ Hardcover	◉ Black	☑ Obvious Rebinding
◉ Adhesive	○ Leather	○ Softcover	○ White	☐ Edge Decoration
○ Metal Fittings	○ Paper	○ None	○ Gray	☑ Collection of Volumes
		○ Missing	○ Brown	
			○ Multi	
			○ Red	
			○ Orange	

Binding Notes

bound with 10011, 10013

Library rebinding, with new blank endpapers. Perfect binding replaces stitching. Retrimmed.

Sticker, bottom p iii:

37
01/00
---
36 ASU
XL3

30-010-00

2240
GBC

ICI
INFORMATION
CONSERVATION, INC

Note especially attempted repairs that might have compromised the book's integrity. e.g., the use of adhesive plastic to 'protect' the cover.

admin.prtd.app/anc/book/10012

Description > Textblock

Printing Ink	Textblock Paper	Obvious Multiple Papers	Other
◉ Black	◉ Normal	☐ Normal	☐ Illustrations
○ Color	○ Calendered	☐ Calendered	☑ Letterpress
	○ Glossy	☐ Glossy	☐ Tip-Ins

Textblock Notes

Description > Overall

admin.prtd.app/anc/book/10012

Condition

Visual Assessment: Condition

Condition > Lendable? Deteriorating?

- [x] Yes, the library would lend this book.
- [ ] This book's condition is stable.

Condition > Cover

Damage	Damage (cont.)	Partially Detached	Other
☐ Worn Edges	☐ Damaged Spine	☐ Front	☑ Obvious Repair
☐ Damaged Corners	☐ Broken Spine	☐ Back	☑ Label
☐ Torn	☐ Warping	☐ Spine	☐ Notations
☐ Delaminating	☐ Loss		
☐ Discoloring	☐ Pastedown Lifting		
☐ Staining	☐ Powdering		

Cover Condition Notes

Repair: rebound, see cover description.

admin.prtd.app/anc/book/10012

Condition

Condition > Textblock

Physical

- [ ] Brittle or Crumbling

Corners

- [ ] Damage
- [ ] Loss

Pages

- [ ] Loose (Free)
- [ ] Torn
- [ ] Partial Loss
- [ ] Complete Loss

Structural

- [ ] Textblock Separation
- [ ] Tight Binding
- [ ] Uncut
- [ ] Untrimmed Pages
- [ ] Non-Uniform Textblock Edges

Ink Changes

- [ ] Fading
- [ ] Strike-Throughs
- [ ] Transfer

Visual

- [ ] Staining
- [ ] Foxing
- [x] Paper Edge Discoloring

Paper Color

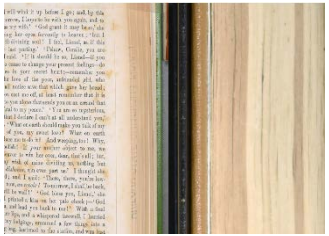
- ( ) White
- ( ) Cream
- (•) Apparent Overall Yellowing

Event Traces

- [x] Obvious Repair
- [ ] Water Damage
- [ ] Insertions
- [ ] Marginalia, Inscription, Ex Libris...

Written Annotations

- (•) None
- ( ) Minor
- ( ) Major



Missing Pages

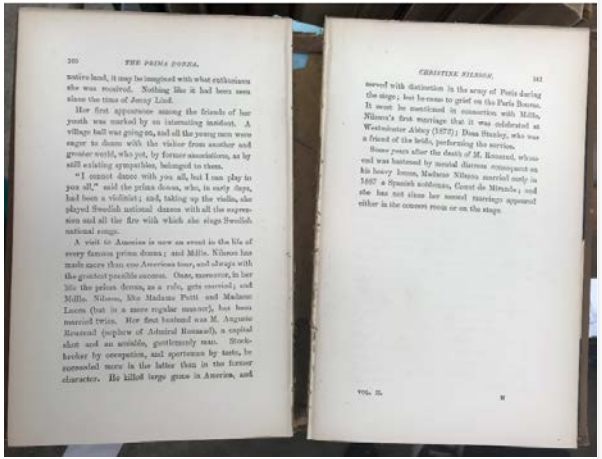
Enter as a space delimited list, e.g.: 12 38 98

Missing Partial Pages

Enter as a space delimited list, e.g.: 6 47 129

Textblock Condition Notes

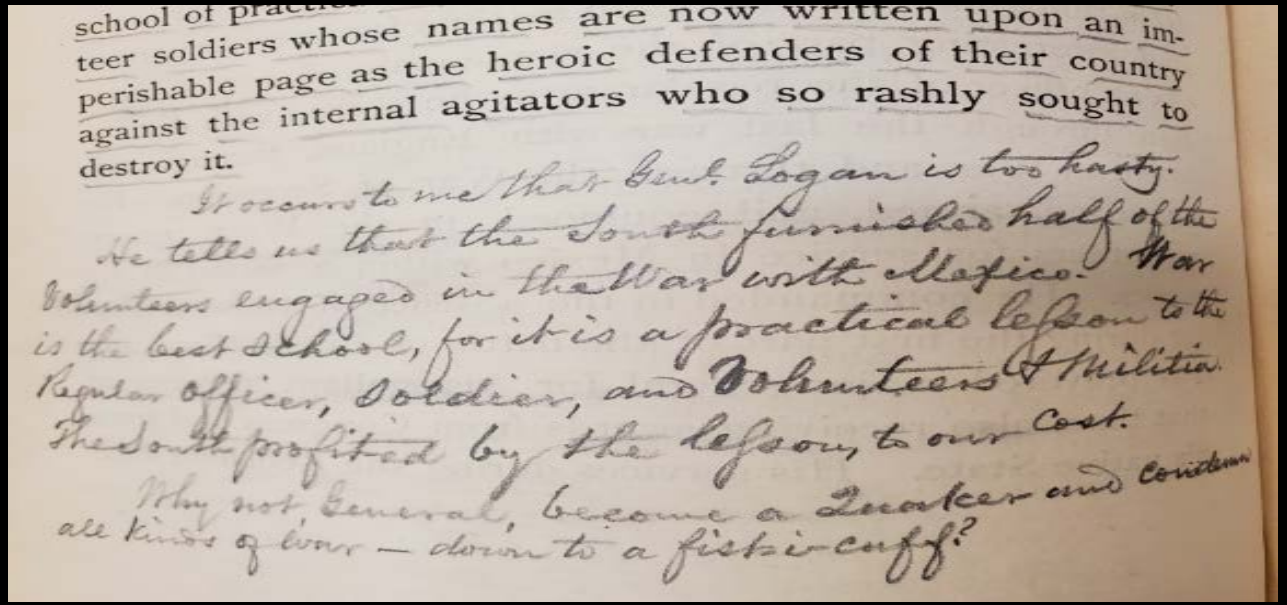
Repair: textblock backing replaced with perfect binding, re-trimmed.



What does “identical” look like?

What is the best volume to keep if we can't keep every one?

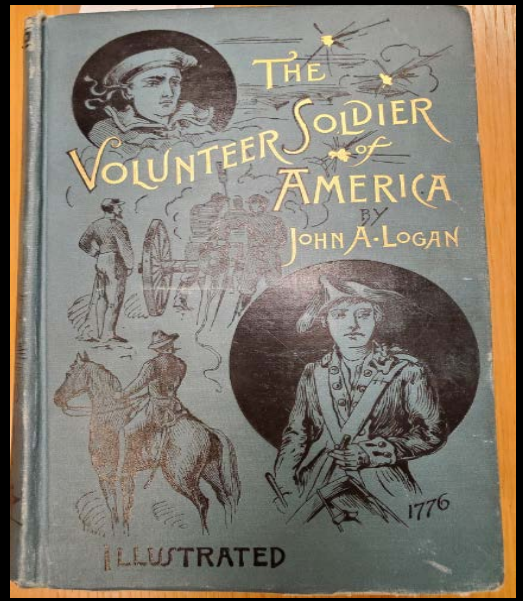
- How to make a well-informed decision?
- Annotations –add value to the volume??



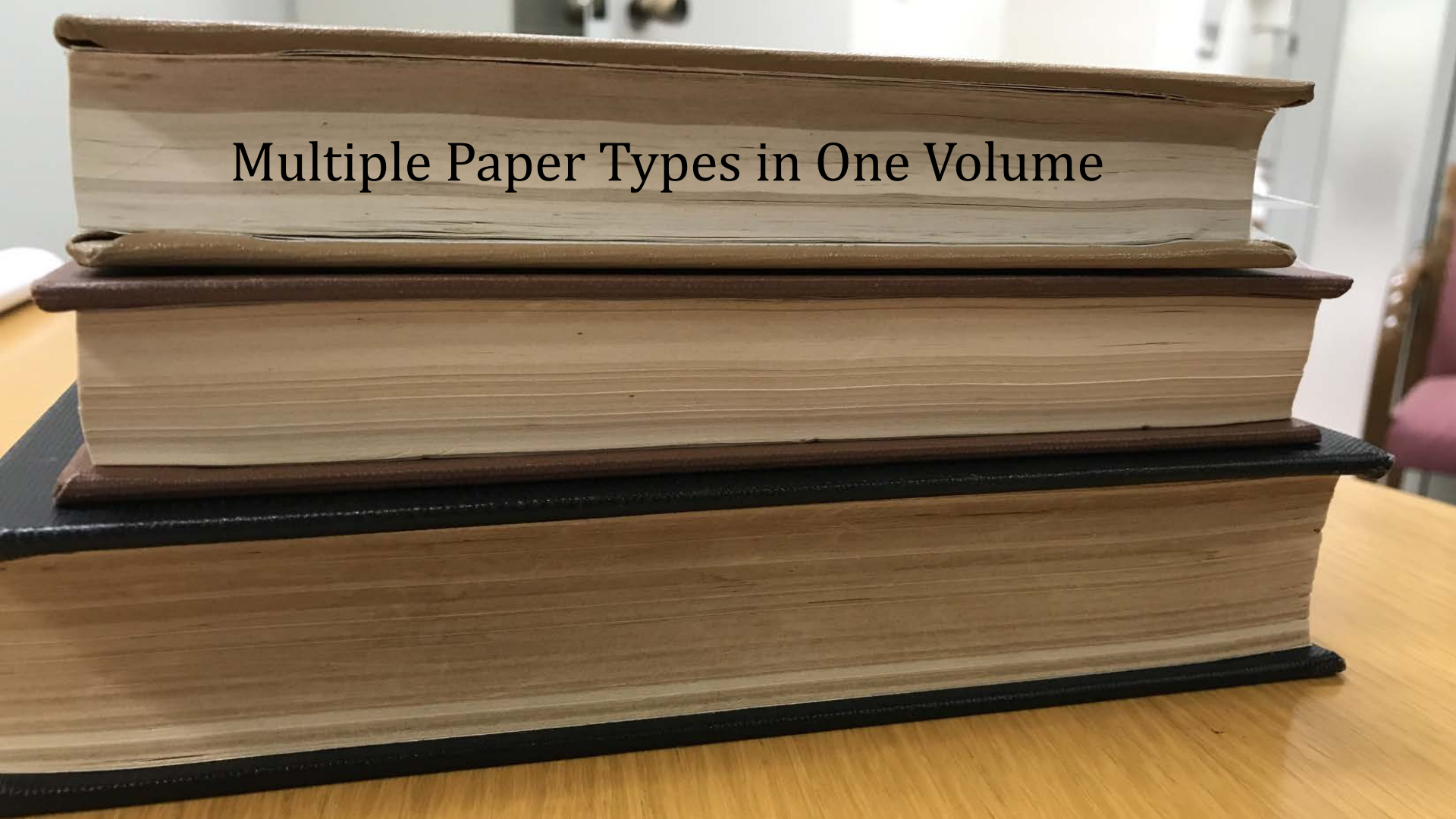
school of practi

teer soldiers whose names are now written upon an im-
perishable page as the heroic defenders of their country
against the internal agitators who so rashly sought to
destroy it.

It occurs to me that Genl. Logan is too hasty.
He tells us that the South furnished half of the
Volunteers engaged in the War with Mexico. War
is the best School, for it is a practical lesson to the
Regular officer, Soldier, and Volunteers & Militia.
The South profited by the lesson, to our cost.
Why not General, become a Quaker and condemn
all kinds of war — down to a fist in cuff?

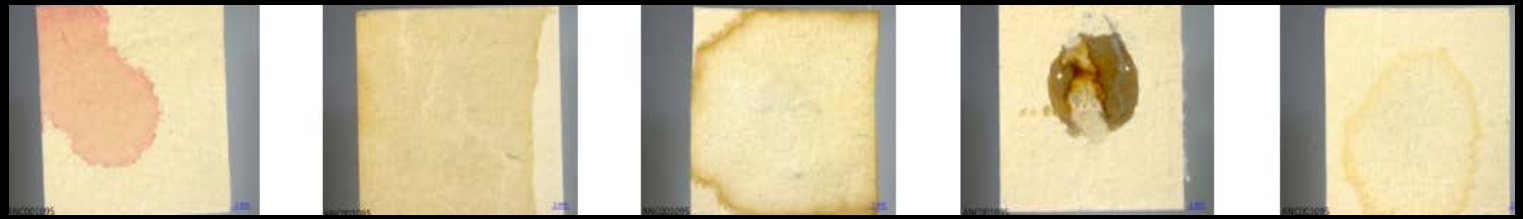


Multiple Paper Types in One Volume



Visual/Subjective Tests

- Double fold
- Spot tests to determine sizing *(starch, rosin, protein, alum)*



  - *Correlate with infrared (non-invasive) data to assess accuracy of subjective tests*
- "Volatiles profile" *(book sniffing)*
  - Can we determine collection health from the "*breath*"?

10001	ASUL	The chronicle of William de Rishanger, of the barons' war, the miracles of Simon de Montfort.	William Rishang

Linking Visual (subjective) Assessment with Lab Testing

Visual Assessment

ANC Book ID	10001
Published	London: The Camden Society, 1840. (180 years old.)
Double Fold (<=10)	10
General Book Notes	matches catalog record, rebound collection of books
Cover Description	hardcover, cloth, sewn leaf attachment, green overall color
Textblock Description	black ink, normal paper, letterpress
Overall Condition	lendable
Cover Condition	label
Cover Damage	damaged corners
Textblock Structural	non-uniform edges
Textblock Visual	paper color: yellowing, edge discoloring
Textblock Event Traces	marginalia

Analytical Tests *(miniaturized)*

- Smallest sample required – a strip (10mm* x 100mm) taken from the replicate volumes for all the destructive (invasive) and |non-invasive tests

- **Mini tensile test**
  - The strength of the paper
- **Acidity - pH**
  - Mini-pH test requires 3 hole punches of sample compared to usual 2.5 g (1-2pgs)
- **Size exclusion chromatography (SEC)**
  - The chain lengths of cellulose in paper can indicate loss of physical integrity - molecular weight (1mg sample size)

**10mm ~3/8”*

pH

SPECIMENS & STATS | AVERAGES & S.D. | AVERAGES ONLY

Barcode	Page	Specimen	Probe	Mass (g)	Cal. Slope	pH
ANC001095	47	1	1	0.0102	97.6	5.02
ANC001095	47	2	1	0.0097	97.6	4.64
ANC001095 Avg.	47					4.830
ANC001095 S.D.	47					0.2687

pH Deltas

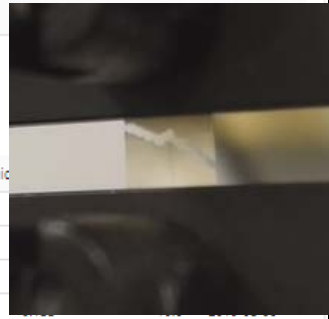
Sample	ANC001095:1	ANC001095:2	ANC001095 Avg.
ANC001095:1	-	0.3800	0.1900
ANC001095:2	0.3800	-	0.1900
ANC001095 Avg.	0.1900	0.1900	-

Sample

Tensile

SPECIMENS & STATS | AVERAGES & S.D. | AVERAGES ONLY

Sample	Pg.	Spec.	Orient.	Max Load (N)	Stress @ Max Load (MPa)	Strain @ Max Load (mm/mm)	Energy Absorpt. (N/mm)	Young's Mod. (MPa)	Thic		
ANC001095:h:1	47	1	horiz.	12.90343	9.35031	0.01810	0.01310	1154.21267			
ANC001095:h:2	47	2	horiz.	14.37038	11.49631	0.03014	0.02711	1796.50136			
ANC001095:h:3	47	3	horiz.	10.76705	8.54527	0.01877	0.01113	922.47181			
ANC001095:h:4	47	4	horiz.	12.55204	9.43762	0.02326	0.01805	1461.74099			
ANC001095:h:5	47	5	horiz.	12.95558	9.81483	0.02015	0.01583	1746.24315	0.132	10.0	2019-08-06



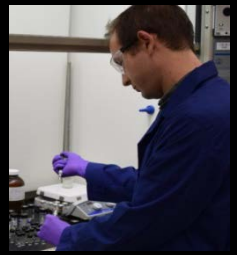
Size Exclusion Chromatography – *Size of Molecule*

Analytical Tests *(miniaturized)*

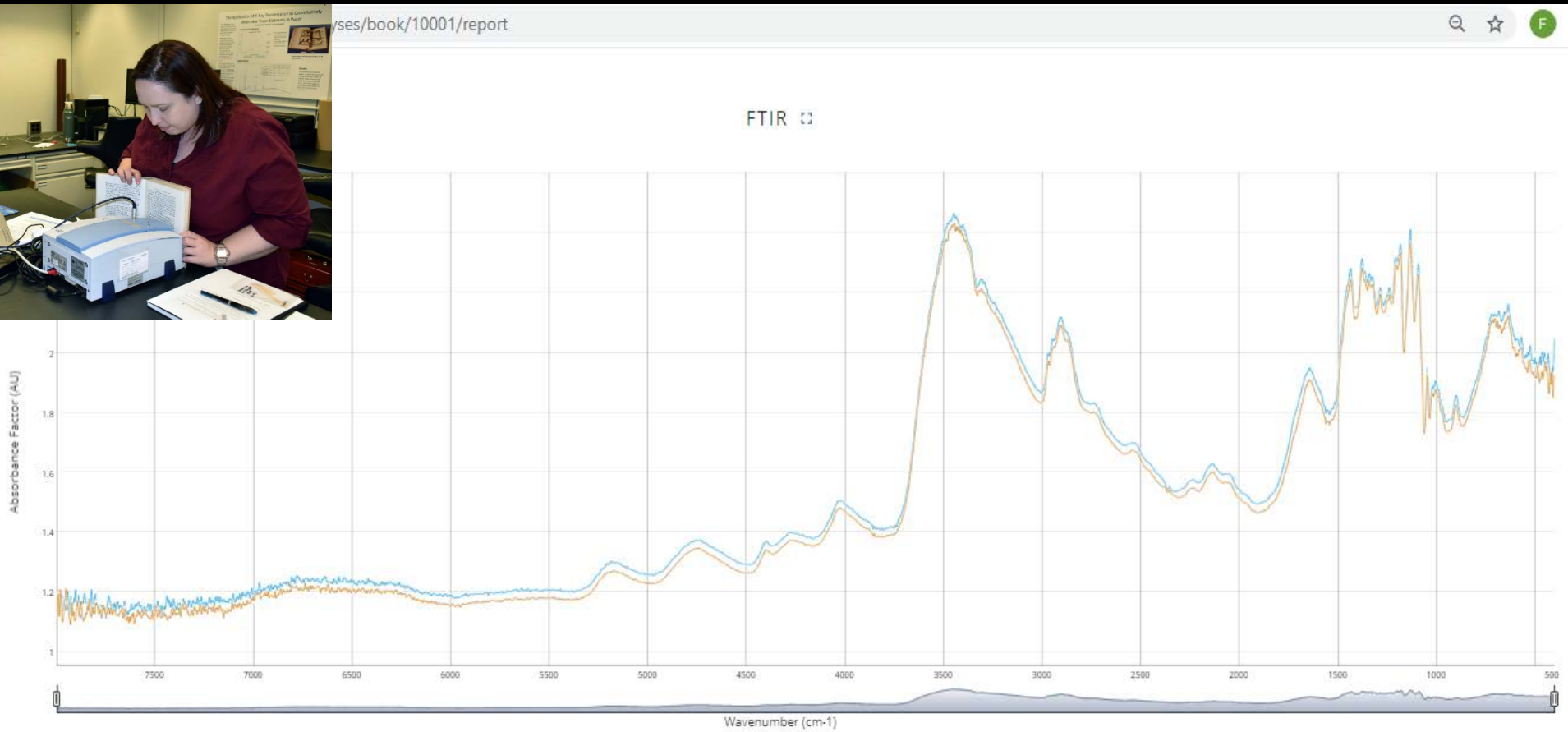
Non-invasive

- Infrared Spectroscopy (IR)
  - Looking at IR data to see how it can be linked, integrated and correlated with the collective physical, chemical and optical measurements

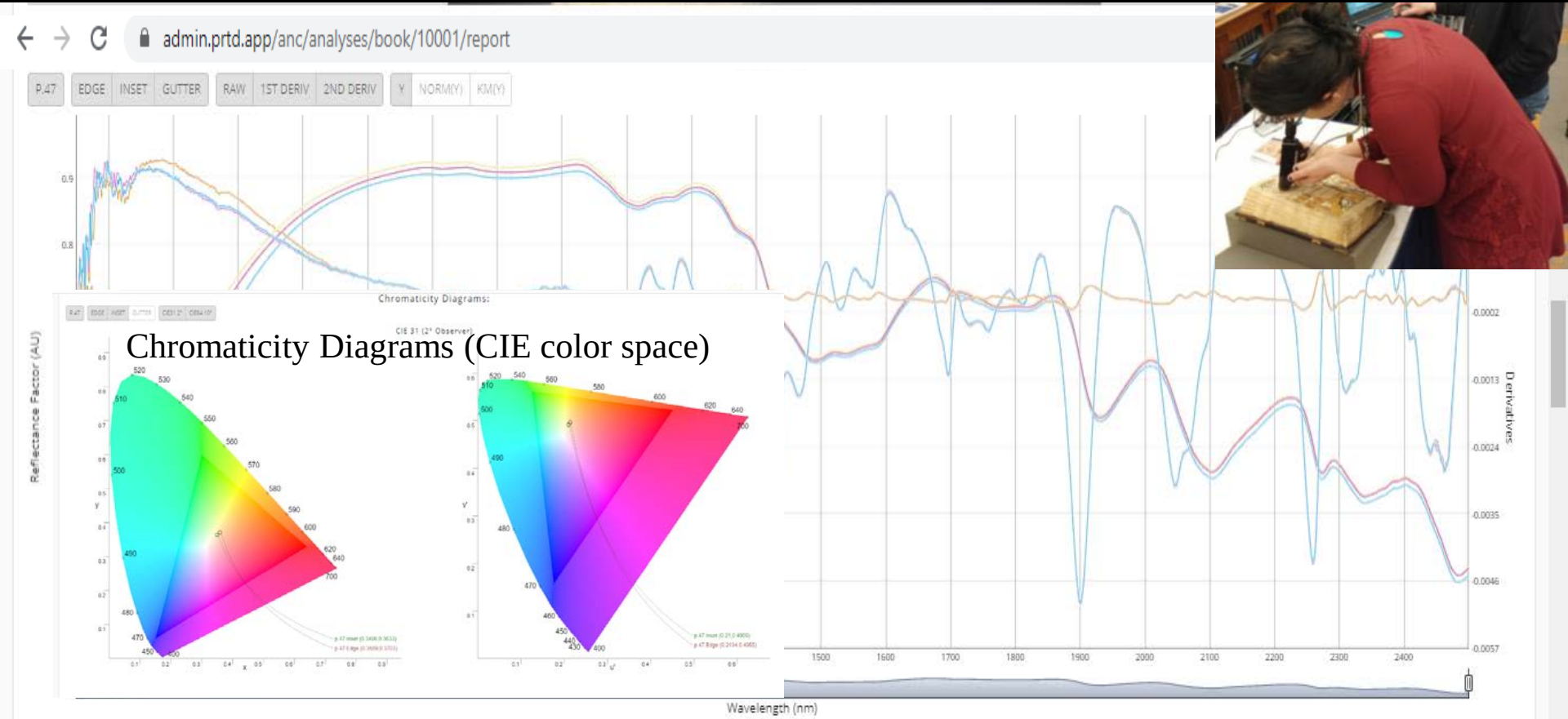
- Ultraviolet / Visible spectroscopy (UV/VIS)
  - Optical measure of the difference between volumes held in different locations, (potential for moving towards completely non-invasive)



Fourier Transform Infrared Spectroscopy(FTIR)



Fiber Optic Reflectance Spectroscopy (FORS)



How do we know if the papers are the same or not?

PRTD Admin

FENELLA LOGOUT

Compare Books

GO BACK

VIS. ASSESS. | PHOTO DOC. | PH | TENSILE | SEC | SPOT | XRF | FORS | FTIR | CHROMATICITY | COLORIMETRY | SAMPLE NOTES

Reference Paper Notes

Paper:10000
Rag, c.1994, PAP00892c
Composition: Cotton Rag
Aging: Room, natural aging
Source: Unknown

Paper:10001
Rag, c.2007, PAP00891c
Composition: Cotton Rag
Sizing: Starch
Buffer: Buffered
Aging: Room, natural aging
Source: Stonehenge

Paper:10002
Newsprint, c.1979, PAP00880c
Composition: Wood Pulp
Aging: Room, natural aging
Source: Unknown

Paper:10003
Wood Pulp, c.1994, ISR5C0103b
ISR: 1
Composition: 100% Bleached Northern Softwood Kraft
Sizing: Alum/Rosin
Aging: 5°C, natural aging
Source: ASTM

Paper:10004
Wood Pulp, c.1994, ISR5C0302b
ISR: 3
Composition: 100% Softwood Bleached Chemi-thermomechanical Pulp
Sizing: Alum
Aging: 5°C, natural aging
Source: ASTM

Paper:10005
Rag, c.1994, ISR5C0503b
ISR: 5
Composition: 100% Cotton Rag
Sizing: Alum/Rosin
Aging: 5°C, natural aging
Source: ASTM

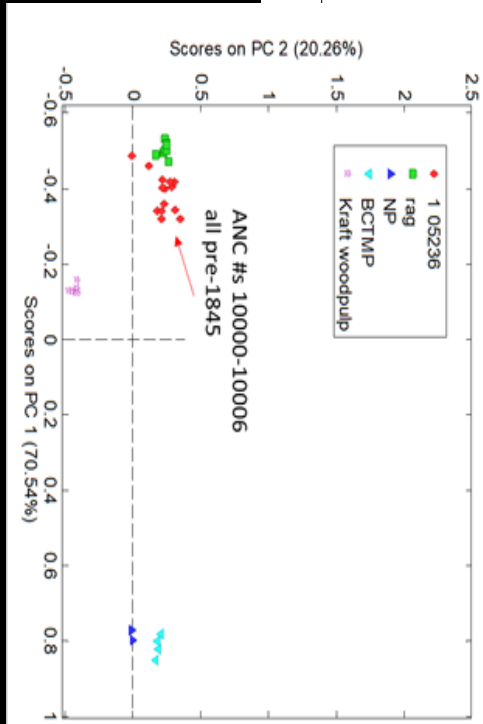
Paper:10006
Wood Pulp, c.1994, ISR5C0702b
ISR: 7
Composition: 20% Bleached Northern Softwood Kraft / 80% Slush-soft Ground Wood
Sizing: Alum
Aging: 5°C, natural aging
Source: ASTM

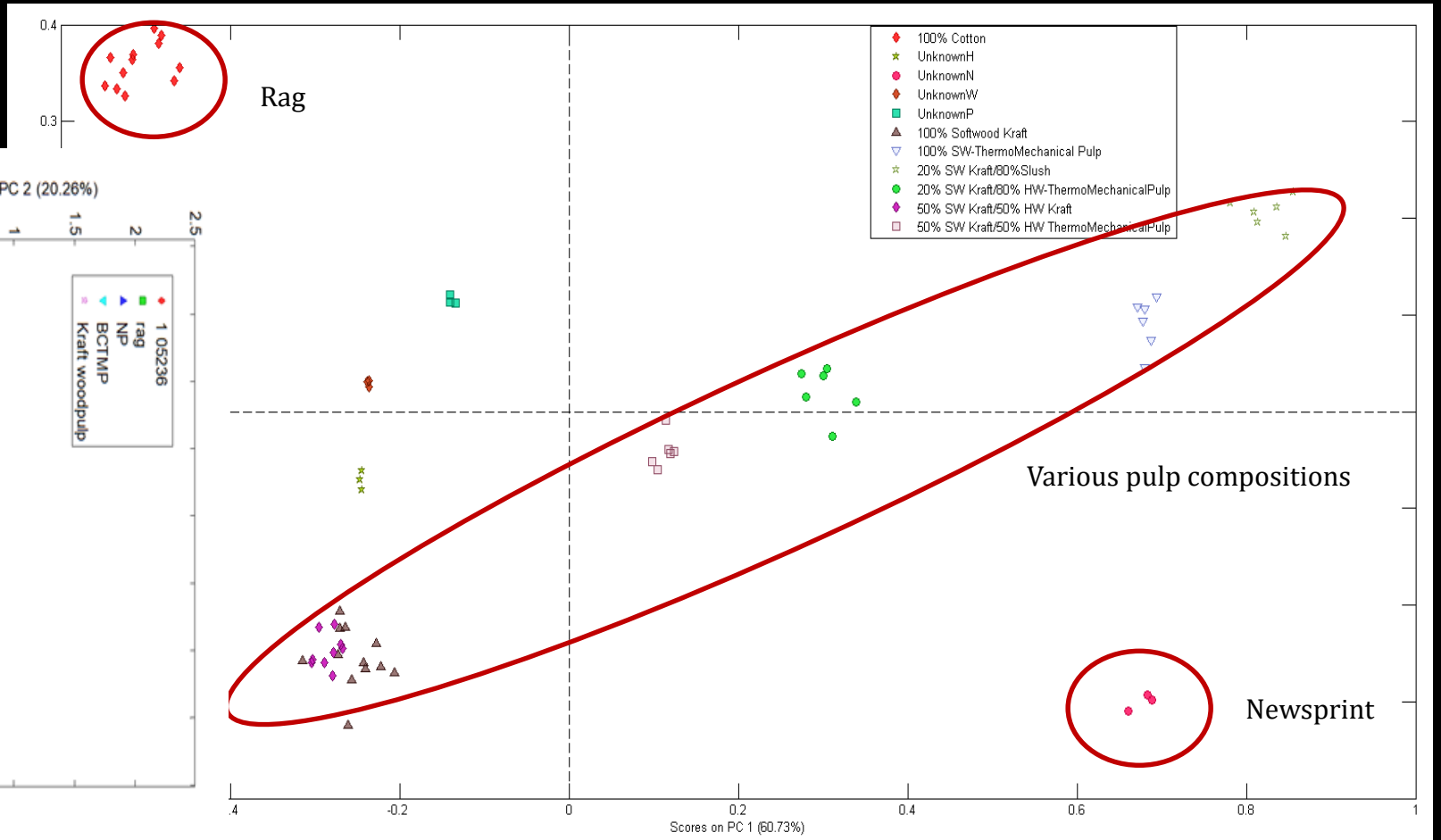
Paper:10007
Wood Pulp, c.1994, ISR5C1102b
ISR: 11
Composition: 50% Bleached Northern Softwood Kraft / 50% Bleached Northern Hardwood Kraft
Buffer: Na2CO3
Aging: 5°C, natural aging
Source: ASTM

Paper:10008
Wood Pulp, c.1994, ISR5c1502b
ISR: 15
Composition: 50% Bleached Northern Softwood Kraft / 50% Bleached Northern Hardwood Kraft
Sizing: Internal and external starch
Buffer: Na2CO3/CaCO3
Aging: 5°C, natural aging
Source: ASTM

Paper:10009
Rag, 2019, PAP00931a
Composition: Cotton Rag
Sizing: Gelatin
Buffer: Unbuffered (Ca might have been used during production)
Aging: Room, natural aging
Source: University of Iowa, Center for the Book

Paper Classification from Pulp Concentration (Chemometrics and FTIR)

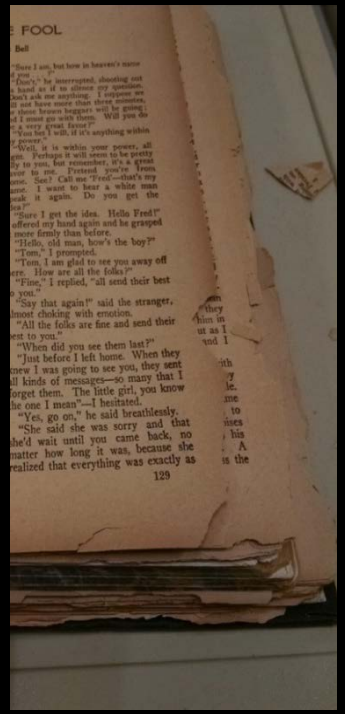




Using results for On-site Evaluations/ “Stack Tests”

- This project is developing field evaluations or “*stack tests*” designed to assess the relative condition of monographs in the stacks, without requiring them to be brought to the laboratory

- Stack tests have three constraining factors:
  - inexpensive, so can be readily available at multiple sites
  - quick, so that results can be useful in decision making, *and*
  - Simple, so they can be performed by available staff



PRTD Admin › ANC Analyses

FENELLA LOGOUT

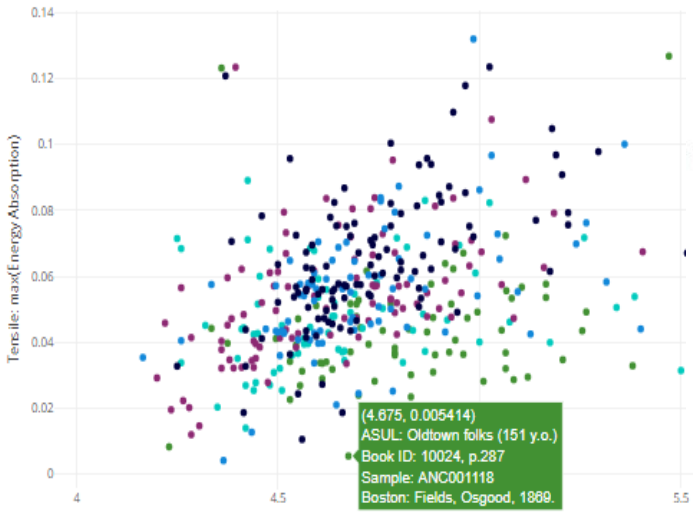
Query Analyses

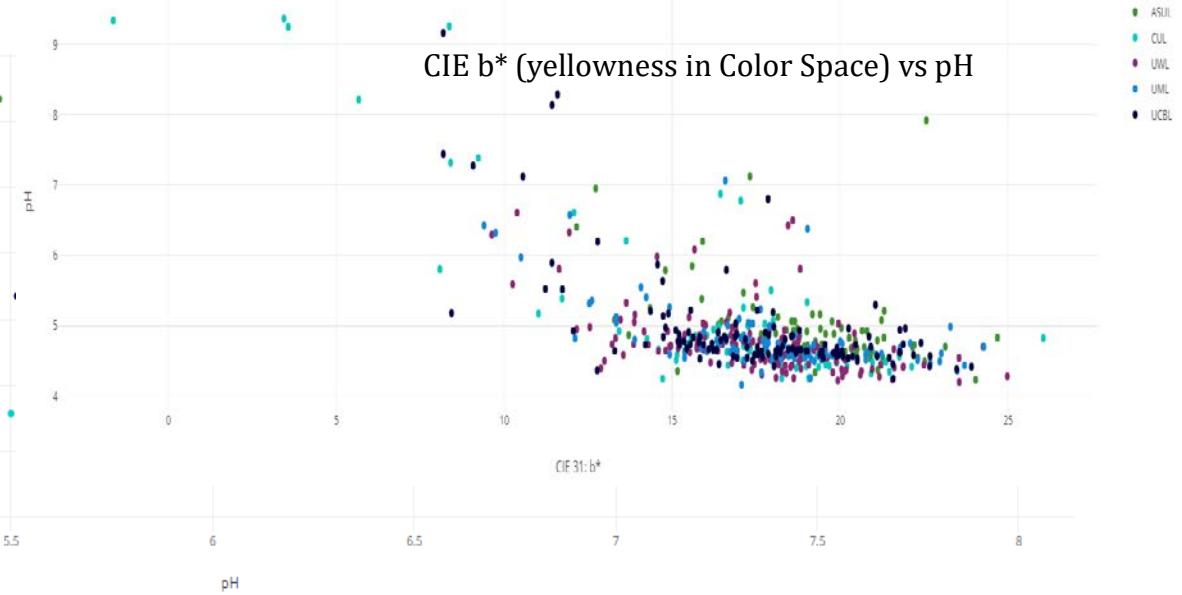
GO BACK

From Decade: 1840 | To Decade: 1890 | NORMAL | CALENDERED | ALUMINUM | LIGNIN | PROTEIN | ROSIN | STARCH | Include Controls

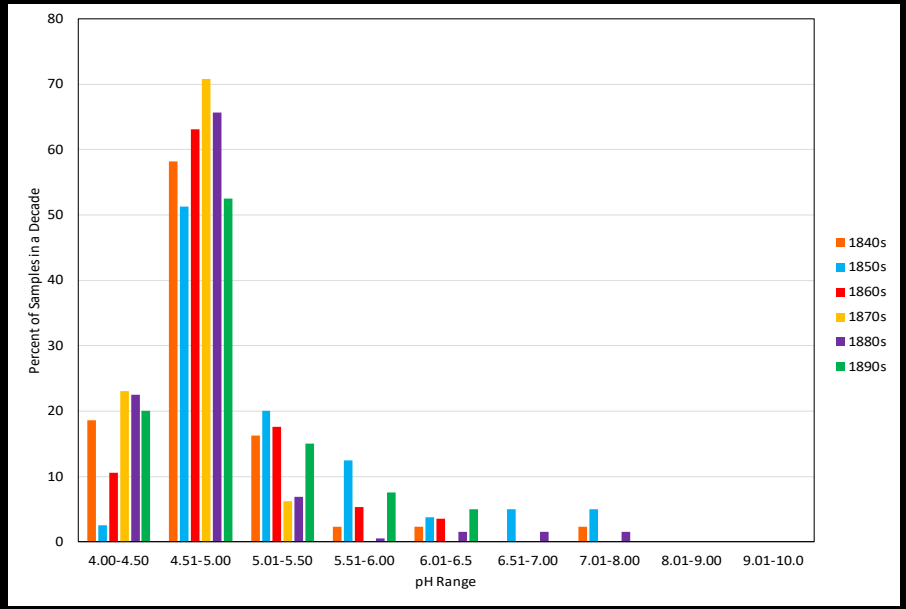
X: pH | CIE Observer: CIE 1931 2° | Colorimetry Loc.: Edge | ΔE* Formula: CIE 2000 | Tensile Orient.: Max()

Y: Tensile: Energy Abs | CIE Observer: CIE 1931 2° | Colorimetry Loc.: Edge | ΔE* Formula: CIE 2000 | Tensile Orient.: Max()



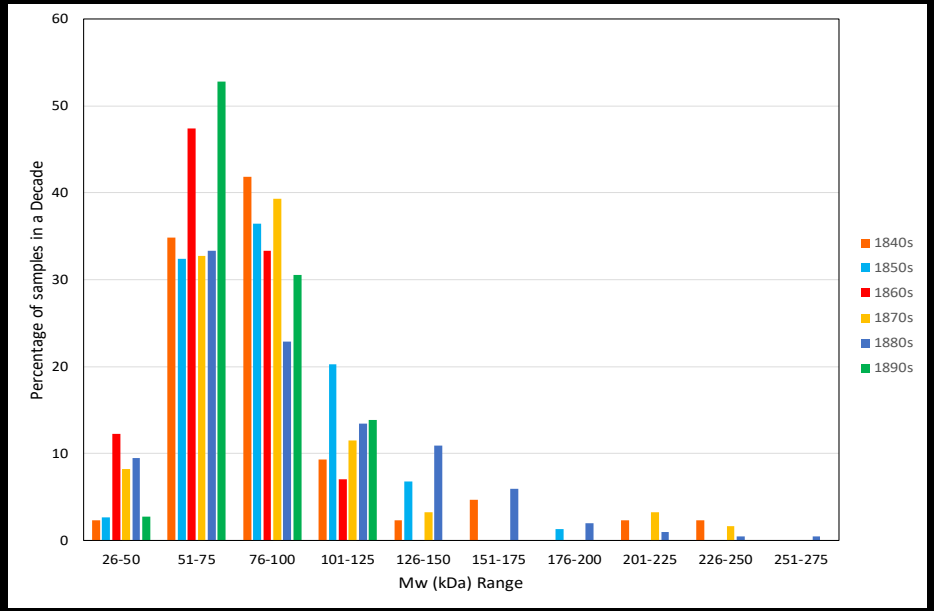


pH by Decade



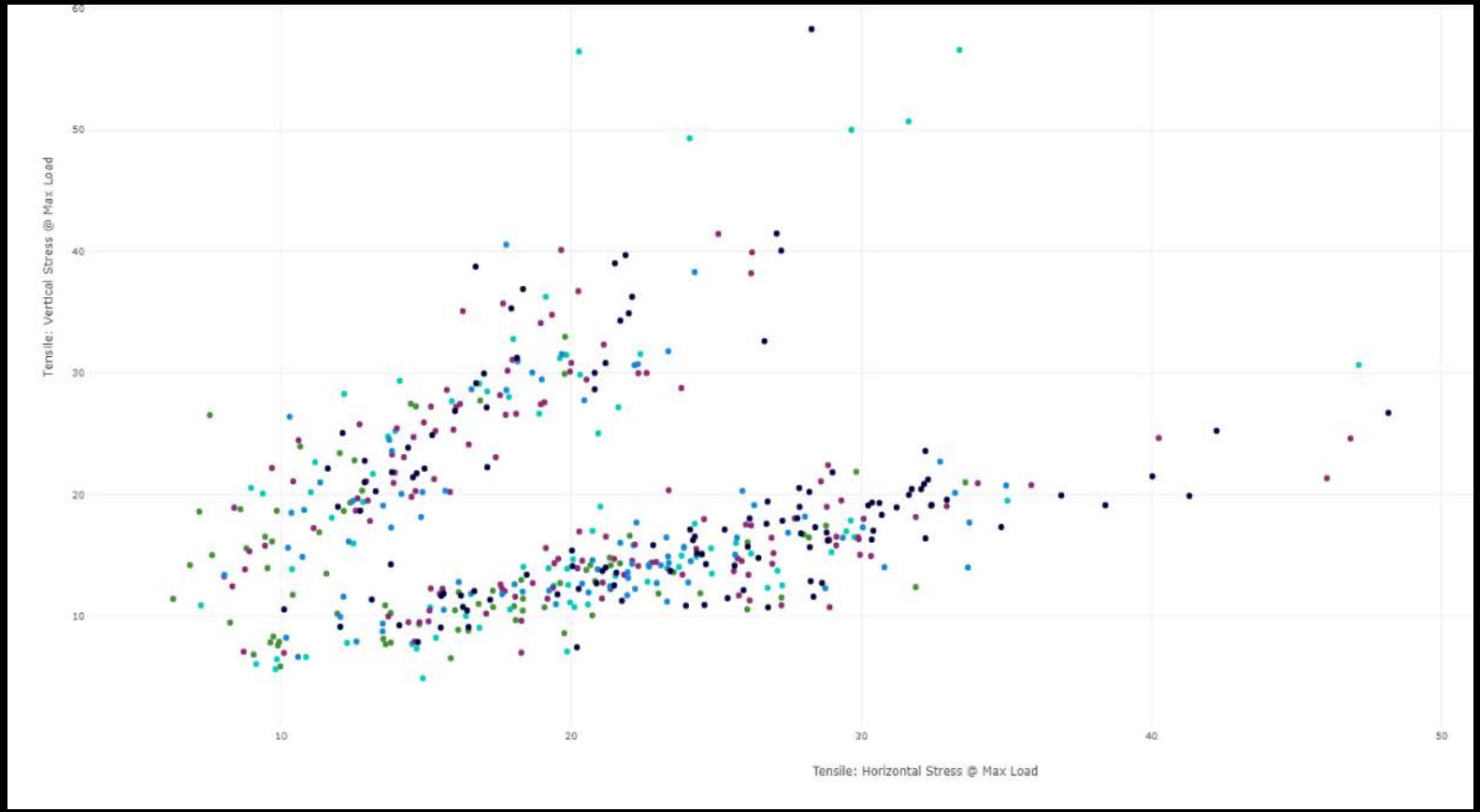
Distribution of pH results for books published **1840-1890** normalized by number of samples in specific decade

Size Exclusion Chromatography (SEC)



SEC Mw results by decade for samples published 1840-1900 normalized by number of samples in a decade

Horizontal vs Vertical Maximum Stress



For the books received to date, it is almost as likely that the paper will be strongest in the vertical direction as it is in the horizontal. i.e., that books in this period are not necessarily bound to make best use of the papers' machine direction

Correlating Double Fold to Other Measurable Parameters

Thanks to Colleagues and Collaborators

A very special thank you to all previous, current and future PRTD staff, interns, and fellows

Questions?

You can ask us preservation questions at any time!

https://www.loc.gov/rr/askalib/ask-preserv.html

Or ampar@loc.gov

Or for this *Mellon funded research* frfr@loc.gov

Assessing the Physical Condition of the National Book Collection:

500+ books...

The five hundred (plus) books selected for the project:

Title or Author (filter)

City, Publisher, or Bib No.s (filter)

Decade (filter)

1840s '50s '60s '70s '80s '90s 1900s '10s '20s '30s '40s

Language (filter)

English Mid. Engl. French German Italian Latin Mult. Portuguese Spanish

Sort by

Date, Title Title Author City Publisher Language OCLC # Call # Asc

LIBRARY LIBRARY OF CONGRESS