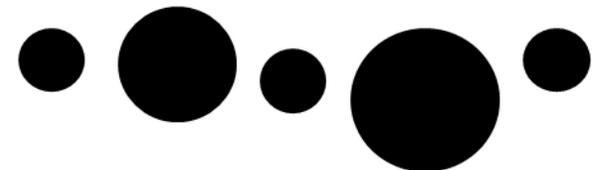
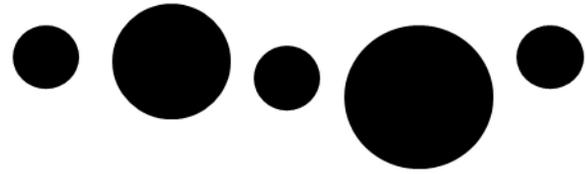




Welcome to Online Office Hours!

We'll get started at 2PM ET





Library of Congress Online Office Hours

Welcome! We're glad you're here! Use the chat box to introduce yourselves. Let us know:

- **Your first name**
- **Where you're joining us from**
- **Grade level(s) and subject(s) you teach**

Preservation Research and Testing Division (PRTD)



Preservation Research and Testing Division (PRTD)

Mission: Ensure long-term access and preservation of the Library's collections

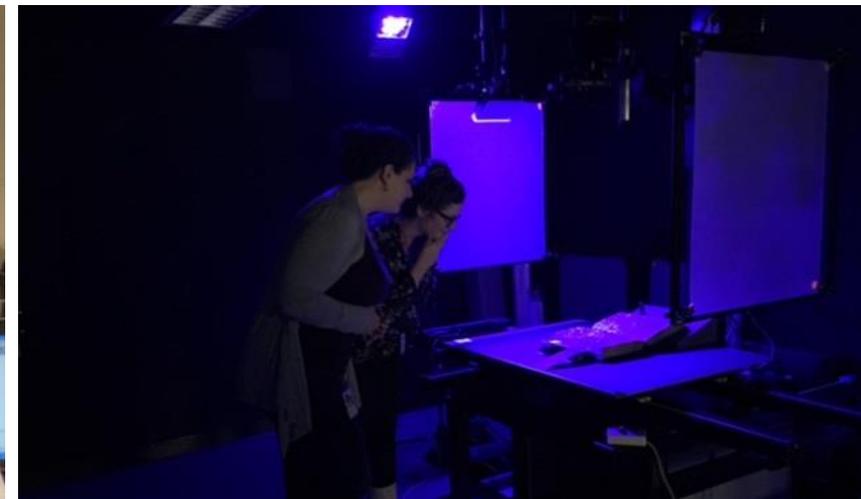
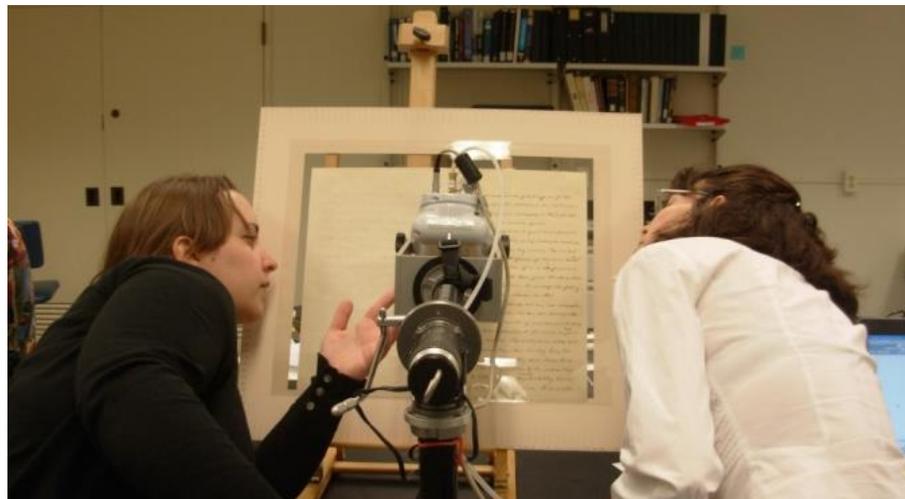
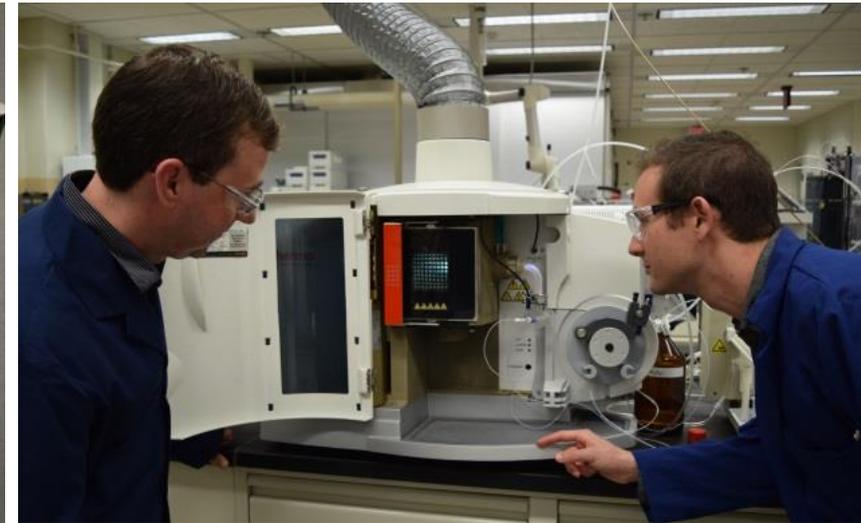
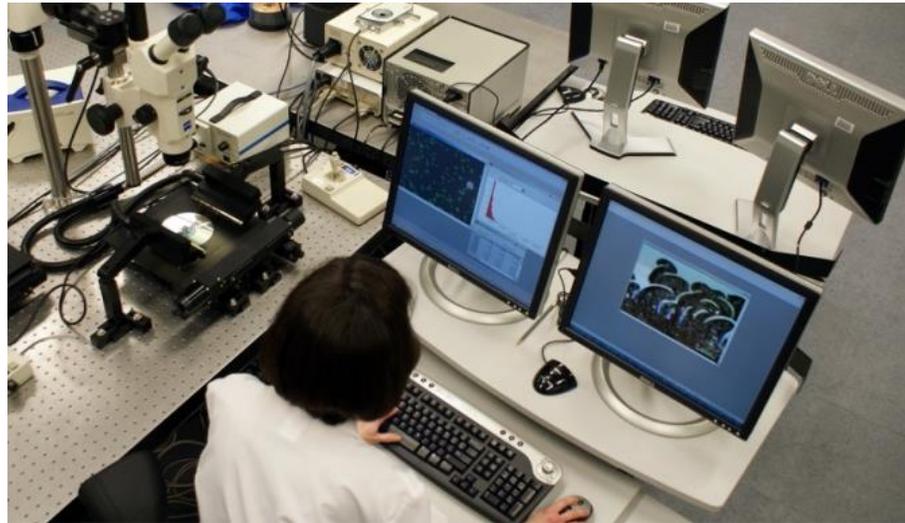
Goals span:

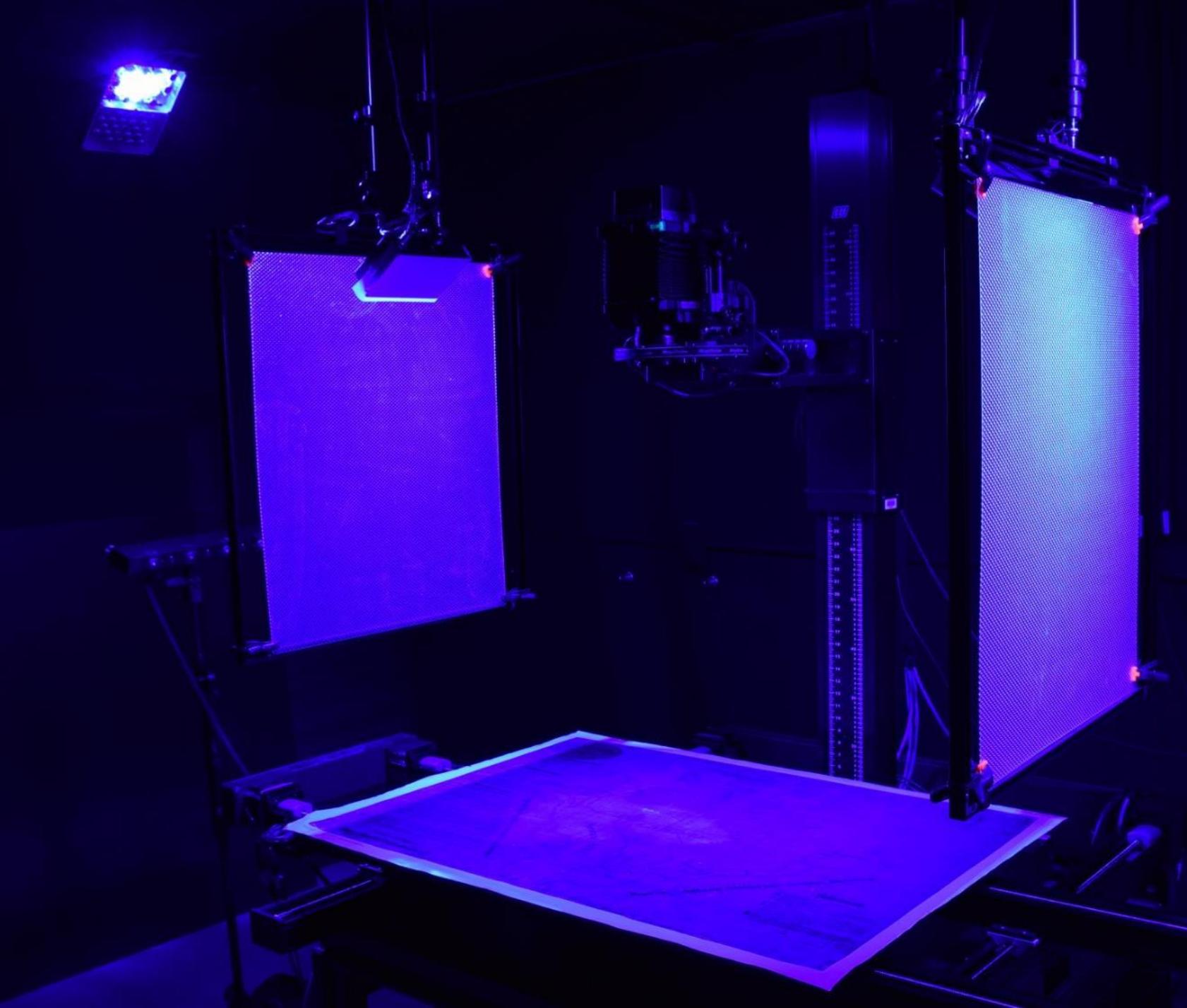
Analytical requests

Quality assurance (object housing, building materials)

Research projects

Full analytical and materials chemistry laboratory





Multispectral Imaging

A non-invasive technique that captures information at specific wavelengths along the electromagnetic spectrum, including those beyond the visible light range.

Equipment

50 MegaPixel Monochrome E7 Camera

Kodak CCD sensor
(8176 × 6132 pixel array with linear dimension of 6.0 microns)
120mm Copal-0 hyperspectral lens
with attached dual filter wheel (UV pass, UV block, R, O, G, B filters)

Light Emitting Diode (LED) Illumination Panels

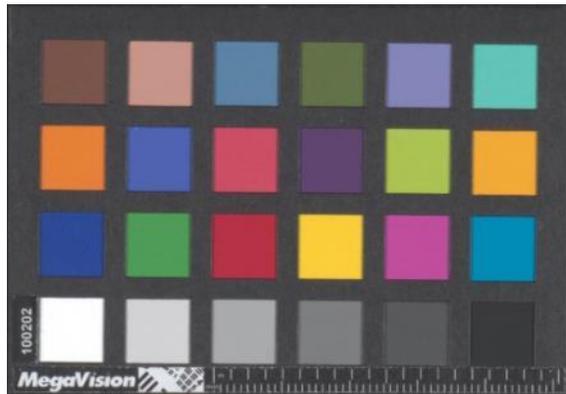
Ultra-Violet: 365nm
Visible: 400, 420, 450, 470, 505, 530, 560, 590, 615, 630, 655nm
Infrared: 700, 735, 780, 870, 940nm
Raking: 470, 910nm
Transmitted: 448, 529, 600, 635, 758, 785, 867, 933nm

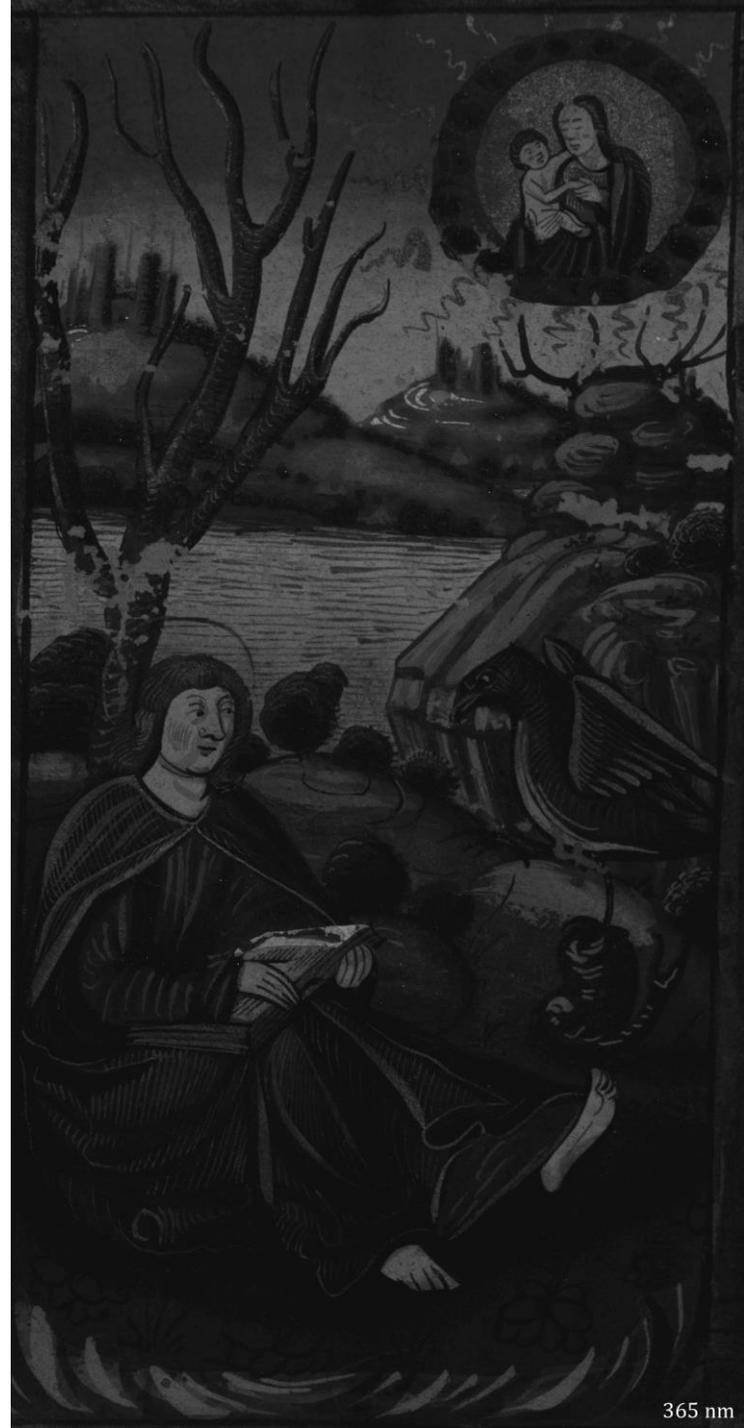


Full Spectrum Color Images

Compilation of 9 visible bands

Software algorithm calibrated specifically to our color target





Thomas Jefferson's handwritten draft of the Declaration of Independence, 1776

A Declaration by the Representatives of the UNITED STATES
OF AMERICA, in General Congress assembled.
When in the course of human events it becomes necessary for one

+ P. Franklin
abolishing our most ^{valuable} ~~important~~ laws
for taking away our charters & altering fundamentally the forms of our governments
for suspending our own legislatures & declaring themselves invested with power to
legislate for us in all cases whatsoever.
he has abdicated government here ^{by declaring us out of his protection & by assuming to}

he has collected ^{at} ~~by~~ excited domestic insurrections amongst us and has
he has endeavored to bring on the inhabitants of our frontiers the merciless Indian
savages, whose known rule of warfare is an undistinguished destruction of
all ages, sexes, & conditions [of existence].

[he has incited treasonable insurrections of our fellow-citizens, with the

allurements of forfeiture & confiscation of our property.
x he has constrained others ^{to} ~~fall~~ ^{to} ~~take up arms~~ ^{to} ~~take up arms~~ on the high seas to bear arms against their country & to
or to fall themselves by their hands, to become the executioners of their friends & brethren
he has waged cruel war against human nature itself, violating it's most sa

-cred rights of life & liberty in the persons of a distant people who never of-
fended him, captivating & carrying them into slavery in another hemis-



a. Difference between ratios of IR and visible wavebands

b. Cropped version of (a)

c. "Otsu" multi threshold technique to enhance different intensity ranges

d. Assigning pseudo color (& remove transition edges from (c))

e. Joining the dots - pseudo color (artistic interpretation)

f. Removed citizen for clarity of viewing

all ages, sexes, & conditions of existence:
[he has incited treasonable insurrections - **our fellow-citizens**, with the
allurements of forfeiture & confiscation of our property,
he has constrained ~~them~~ ^{the high} ~~to~~ ^{to} ~~become~~ ^{to} ~~the~~ ^{to} ~~executors~~ ^{to} ~~of~~ ^{to} ~~their~~ ^{to} ~~friends~~ ^{to} ~~of~~ ^{to} ~~their~~ ^{to} ~~own~~ ^{to} ~~he~~ ^{to} ~~has~~ ^{to} ~~waged~~ ^{to} ~~cruel~~ ^{to} ~~war~~ ^{to} ~~against~~ ^{to} ~~human~~ ^{to} ~~nature~~ ^{to} ~~itself~~ ^{to} ~~,~~ ^{to} ~~violating~~ ^{to} ~~it's~~ ^{to} ~~most~~ ^{to} ~~sa-~~

our fellow-citizens,

our fellow-citizens,

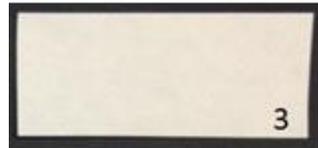
our fellow-citizens,

our fellow-citizens,

our fellow-subjects,

Paper Tests – What are the conditions of these?

(Are they any different? Can we tell?)



Paper Tests – Fold Testing



Paper samples folded back and forth, counting folds until break

Advantages

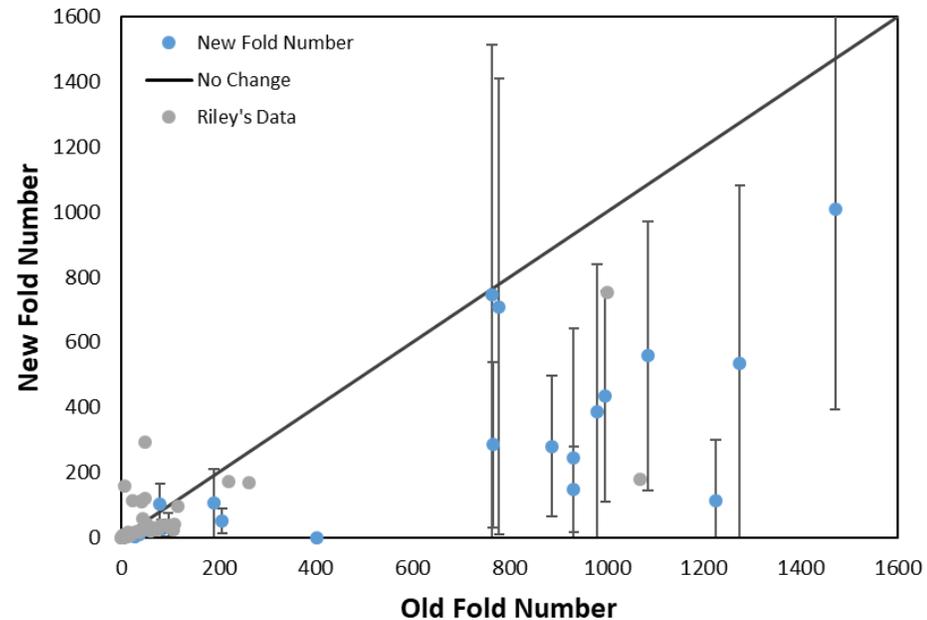
Intuitive!

Long-lived standard in field

Disadvantages

Destructive

Wide variability in data



Paper Tests– Tensile Testing

Paper samples pulled in tension until break, measuring force required to stretch



Advantages

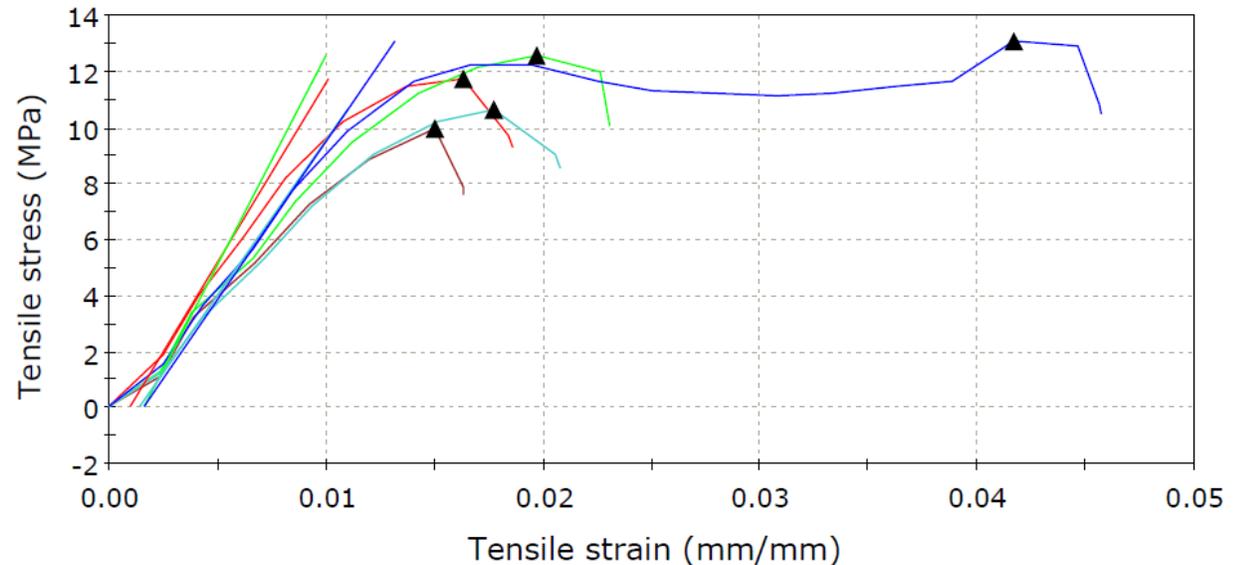
Intuitive(ish)

Large amount of quantitative data

Disadvantages

Destructive (but samples can be miniaturized)

Expensive equipment



Paper Tests – pH and acidity



Paper samples blended and soaked in water, pH of the extract is measured

Alternative: pH pens and strips (less accurate)

Advantages

Intuitive!

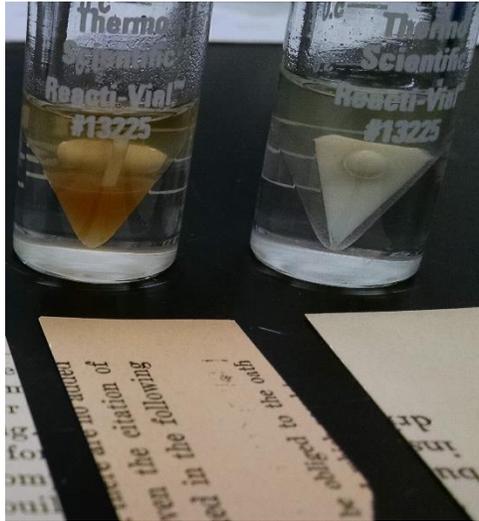
Long-lived standard in field

Disadvantages

Destructive (but can be miniaturized)

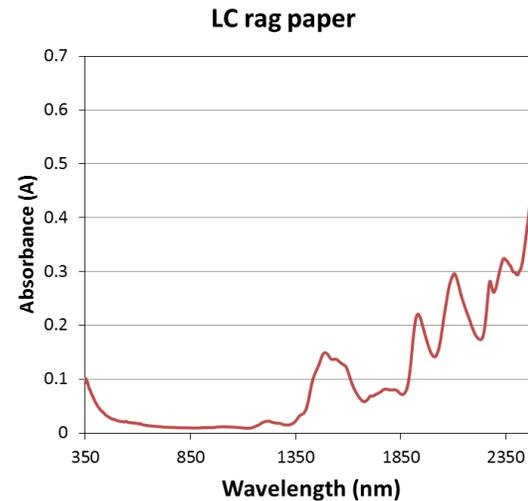
Paper Tests – additional methods

Size Exclusion Chromatography



measures size of cellulose molecules

Infrared and UV-Vis spectroscopy



measures chemical group vibrations

Thermal gravimetric analysis



measures heat-induced breakdown

Frequently trading simplicity for **more complex information**

Also advantageous: **minimally invasive**

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

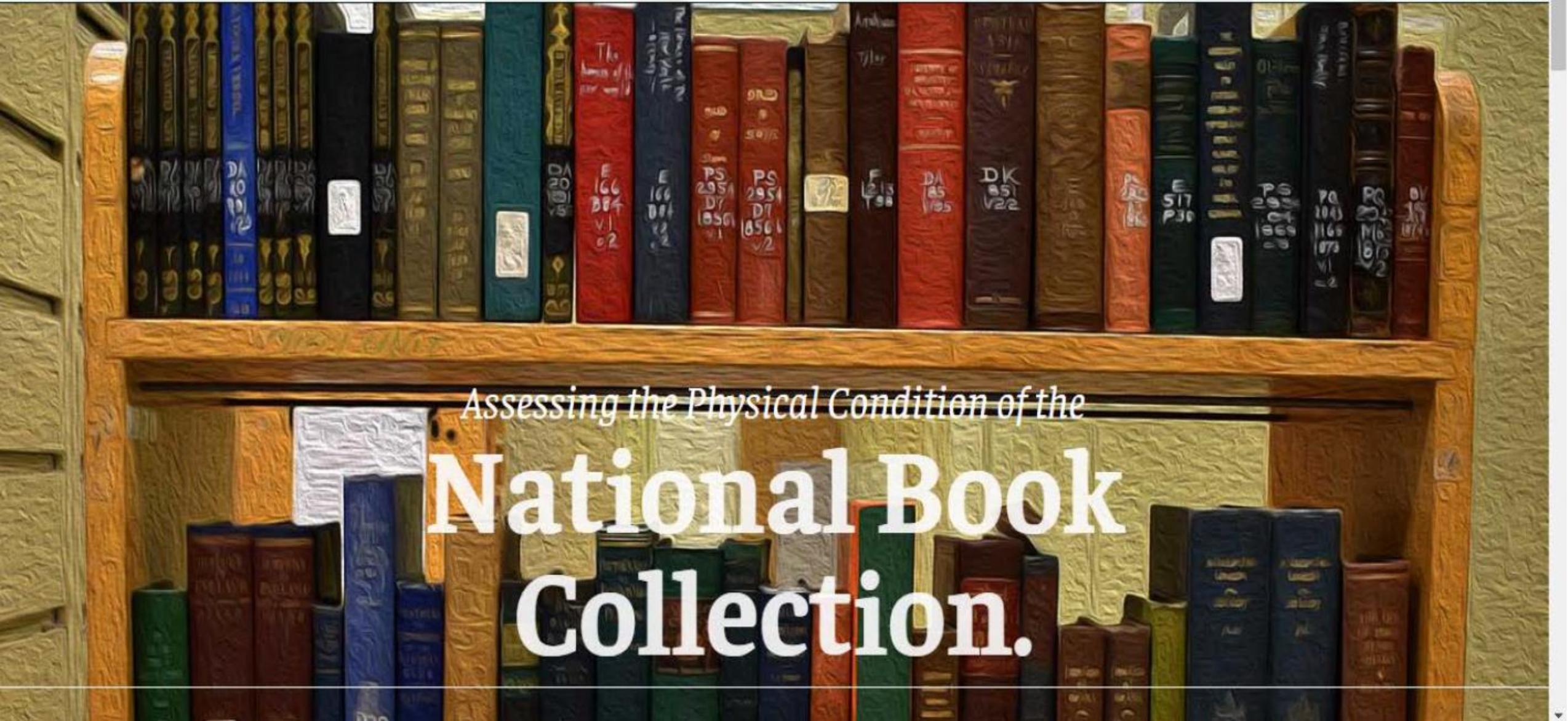
<https://nationalbookcollection.org/overview>

Research Library Partner Institutions

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

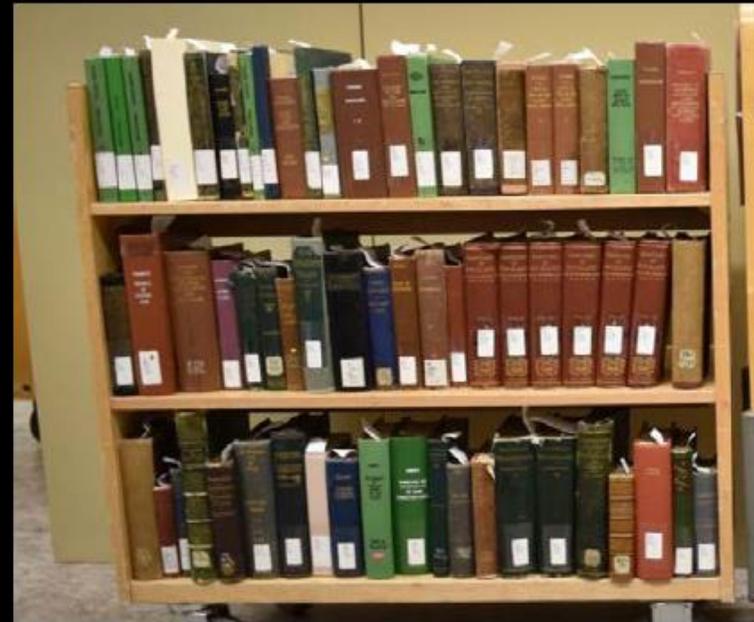
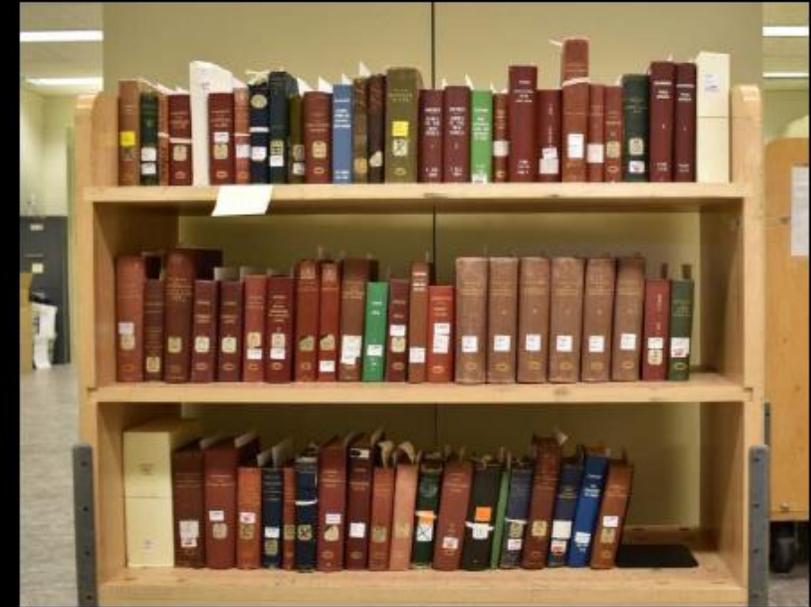
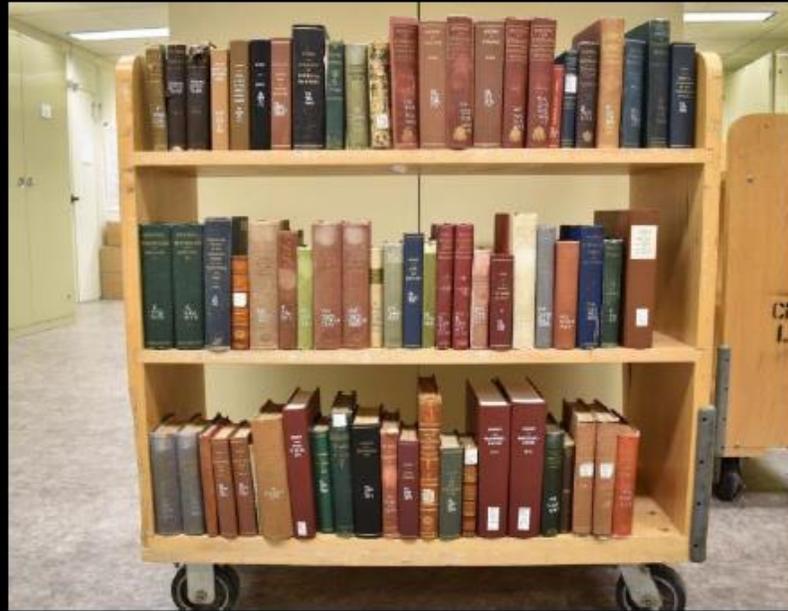
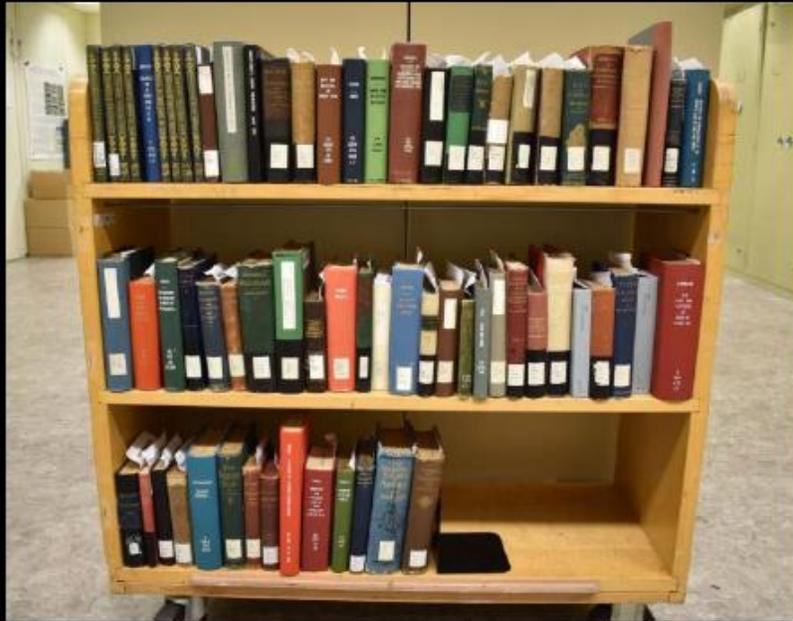


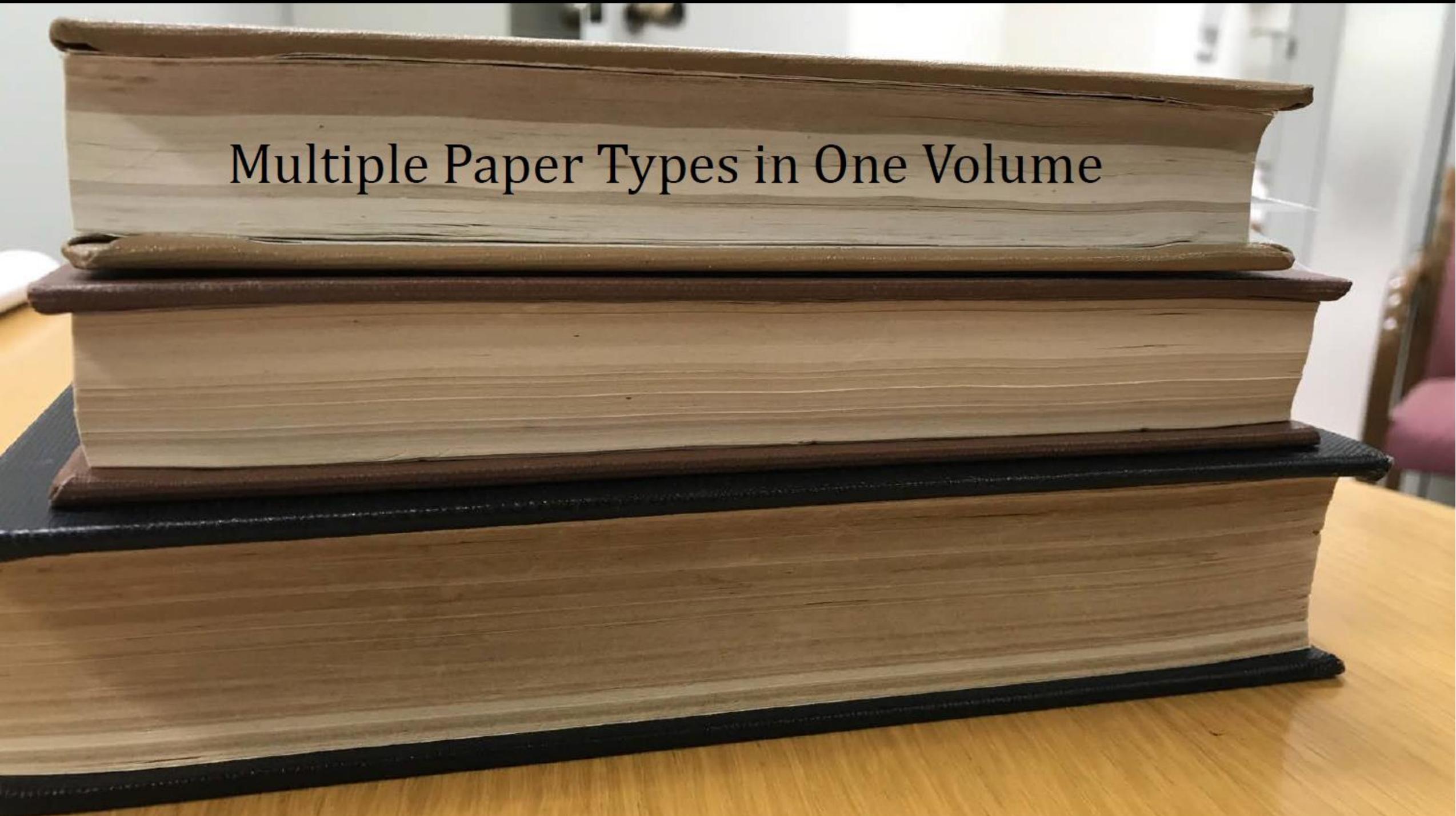
*Analyze the same 500 volumes from all partners:
LC offered the same 500 from our collections*



Assessing the Physical Condition of the
**National Book
Collection.**

What does "identical" look like?



A stack of three old books is shown from a side-on perspective, resting on a light-colored wooden surface. The top book has a light brown cover and its pages are a pale, yellowish-tan color. The middle book has a dark brown cover and its pages are a slightly darker, more uniform tan. The bottom book has a black cover and its pages are a light tan color. The text 'Multiple Paper Types in One Volume' is overlaid in a black serif font across the top book's pages.

Multiple Paper Types in One Volume



Thank you!

Questions? Post them in the chat box!

