



A New Model for Open-Source Development of Institution-Specific Textbooks and Laboratory Manuals

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Outline

- Context
- Models of Open Educational Resources (OER)
- *The Soils Laboratory Manual*
- Future directions
- Considerations

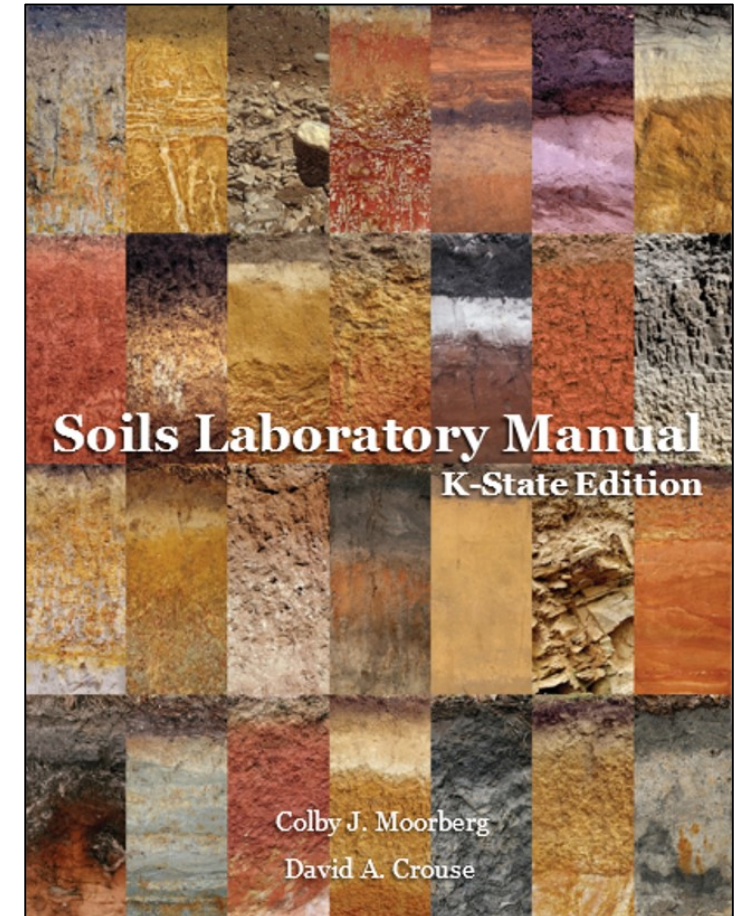


Context & Objectives

- K-State AGRON 305 – Soils
 - 120 students/semester
 - Previous manual: Laboratory Manual for Soil Sciences: Agricultural & Environmental Principles (Thien & Graveel, 2008)
 - Cost in 2015: \$165 (\$112 now)
- Project Objectives:
 - Develop and share an open-source, introductory soil science laboratory manual
 - Summarize student views on textbooks, cost, open textbooks, and the Soils Laboratory Manual

Soils Laboratory Manual, K-State Edition

- Based off of the lab manual used in SSC 201 at NC State
- Each lab designed for four steps:
 - Review concepts
 - Complete pre-lab questions
 - Conducting the laboratory activity
 - Complete lab assignment
- Provided to students for free as a PDF



Open-Source vs Open-Access

- Open-access textbooks
 - Anyone can access it for free
- Open-source
 - Anyone can access it for free
 - Others can contribute
- *Soils Laboratory Manual* as an open-source document
 - CC BY-NC-SA 4.0 international license
 - Made available to adopt and adapt for other institutions
 - New “editions” can be made
 - Contributors are acknowledged for each edition

Contributor Level	Example Contributions
Co-Author	Adaption of the manual for use at a different institution involving major changes to multiple chapters Develop one or more new chapters
Secondary Author	Make significant contributions to one ore more chapters
Contributor	Provide editorial support
Minor Contributor	Identify edits, clarifications, or other contributions leading to the improvement of the manual

Publishing

- Published by New Prairie Press
 - K-State Library's open-textbook publishing company
 - PDF of student version only
- Provided indexing (ISBN)
- 186 downloads since publication
 - 36 countries
 - 69% education, 31% non-education institutions

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Soils Laboratory Manual, K-State Edition

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Description

The *Soils Laboratory Manual, K-State Edition* is designed for students in undergraduate, introductory soil science courses, and highlights the many aspects of soil science, including: soil genesis and classification, soil physical properties, soil-water interaction, soil biology, soil chemistry, and soil fertility. The lab manual includes 15 different laboratories, each one starting with an introduction and pre-lab assignment, followed by in-lab activities, and complimented by post-lab assignment. In-lab activities involve field trips, experiments, observation stations, or problem sets. Post-lab assignments include online quizzes, problem sets, or laboratory summary reports.

The *Soils Laboratory Manual, K-State Edition* is used in Kansas State University's AGRON 305 class, and is based on the *Soils Laboratory Manual, NC State Edition* used in North Carolina State University's SSC 201 class. The *Soils Laboratory Manual, K-State Edition* was originally published as a supplement to 'An Open-Source Laboratory Manual for Introductory Undergraduate Soil Science Courses' in *Natural Sciences Education*, Vol. 46:170013, and is also available for download at <https://dl.sciencesocieties.org/publications/nse/articles/46/1/170013>. Moorberg and

186 DOWNLOADS
Since August 28, 2017

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INCLUDED IN
[Agricultural Science Commons](#),
[Environmental Education Commons](#),
[Geology Commons](#)

Moorberg, C.J., and D.A. Crouse. 2017b. *Soils Laboratory Manual, K-State Edition*. New Prairie Press, Manhattan, KS. ISBN 978-1-944548-09-4.

Publishing

- Included as supplemental information to article in Natural Sciences Education
 - PDF of student version only
 - Article has same CC license as the manual
- 3,300 downloads
- Featured in CSA News Magazine

An Open-Source Laboratory Manual for Introductory, Undergraduate Soil Science Courses

Colby J. Moorberg* and David A. Crouse

Abstract

High textbook cost is a major obstacle to affordable higher education. Open textbooks present one solution, but open laboratory manuals must be developed for lab-based courses to successfully reduce overall textbook costs. Here, we present the *Soils Laboratory Manual*, an open-source lab manual for undergraduate, introductory soil science courses. The manual facilitates the ability for instructors to develop their own editions of the manual customized for their specific course, teaching style, students, or even local soils. The manual was implemented in AGRON 305, an introductory soil science course at Kansas State University. During the fall 2016 and spring 2017 semesters, 213 AGRON 305 students responded to a survey that included questions regarding textbook costs, open textbooks, textbook format, and the *Soils Laboratory Manual*. Of students surveyed, 62% had forgone purchasing required textbooks due to cost, demonstrating a clear need for textbook alternatives. Overall, the *Soils Laboratory Manual* was well received. Based on student preferences, lab manual formatting should be optimized for printed copies, or for PDFs viewed using laptops. Adoption of the *Soils Laboratory Manual* saves AGRON 305 students a cumulative \$12,410 per semester. Similar savings are expected as new editions are developed for other soils courses across the United States and abroad. The *Soils Laboratory Manual* serves as a model for developing open-source resources for natural science courses.

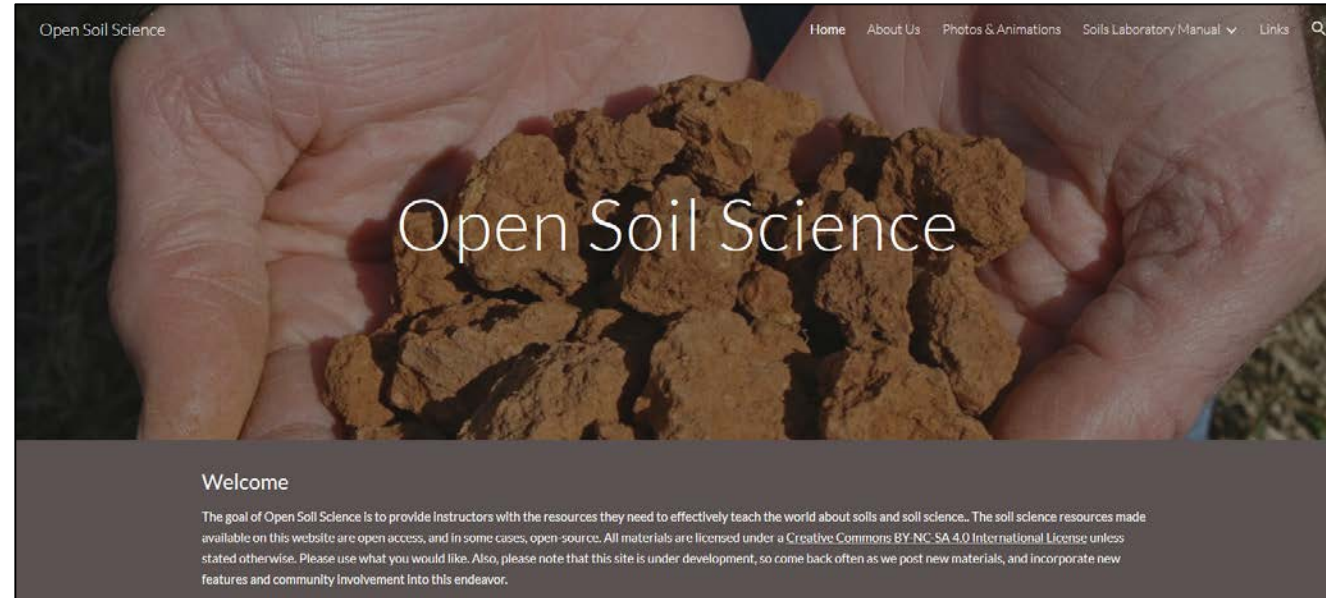
The continued rising cost of textbooks has become a serious limitation to affordable higher education. The College Board reports that students at 4-year, public institutions of higher education spend \$1,250 per year on textbooks (The College Board, 2017). According to a survey conducted by Senack and the Student Public Interest Research Groups, 65% of students surveyed claimed they had forgone purchasing a textbook required for a class due to the high cost of the text, despite 94% of students admitting concern that not buying a textbook may hurt their grade in a course (Senack and The Student Public Interest Research Groups, 2014). Further, 82% of students surveyed said they would perform better in classes if a textbook was freely available online, along with an optional purchase of a hard copy, thus indicating open textbooks as a viable and student-preferred long-term solution to rising textbook costs. It should be noted that this survey included 2039 students from more than 150 universities, providing a general outlook on student views on textbook costs.

In an effort to address these student concerns of textbook cost, some universities have established campus-wide efforts to develop and adopt open/alternative educational resources (OAERs) to reduce the burden of textbook costs on students. One example of such an initiative is the Kansas State University (K-State) open/alternative textbook initiative ("The Open/Alternative Textbook Initiative," Kansas State University, 2016). Lashley et al. (2017) described the initiative in detail, stating that it entails competitively funded awards of up to \$5,000 to facilitate the development and adoption of OAERs in K-State courses. They further state

Moorberg, C.J. and D.A. Crouse. 2017. An open source laboratory manual for introductory undergraduate soil science courses. *Nat. Sci. Educ.* 46:170013. doi:10.4195/nse2017.06.0013.

Ancillary Materials for Instructors


- [Open.SoilScience.info](https://www.opensoilscience.info)
- Google Form for requesting access to ancillary materials
- Ancillary materials shared via Google Drive
- Folders for each college's version and materials
- Includes
 - Instructor version of the manual
 - Assignments and keys
 - Quizzes
 - Problem sets
 - Reports
 - Original Word and RTF files
- 60 current library users



Lab Manual Contents

- Includes 15 laboratories (chapters)
 - Designed for 15 week semester
- Three types of assignments
 - Online quizzes
 - Problem sets
 - Lab summaries/reports
- Includes three field trips

Laboratory	Title	Assignment
1	Safety Training and Orientation	None
2	Chemistry and Math Review	Problem Set
3	Soil Formation	Online Quiz
4	Soil Classification and Mapping	Report
5	Soil Texture and Structure	Online Quiz
6	Soil Pit Field Trips	Problem Set
7	Soil Density	Problem Set
8	Soil and Water Conservation	Online Quiz
9	Soil and Water Relationships	Lab Summary
10	Soil Water Measurement and Movement	Problem Set
11	Composting Field Trip	Online Quiz
12	Soil Carbon and Respiration	Problem Set
13	Soil Colloids	Online Quiz
14	Soil Acidity and Adjusting Soil pH	Lab Summary
15	Soil Nutrient Management	Problem Set



Why Are Institution-specific Lab Manuals or Textbooks Necessary?

In General

- Specific regional examples
- More relatable examples for local students
- More pedagogical and content control for instructors
- Don't have to wait for me to fix typos!

Soil Science Example

- Regional geology, climate, and soils
- Regional agricultural practices and crops
- Student demographics differ among institutions
 - NC State: most students are in environmental-focused majors
 - K-State: most students are in agriculture-focused majors



Financial Impact

Previously

- Textbook: \$127
- Lab manual: \$112
- Additional fees: \$0
- **Total: \$239**

With Soils Laboratory Manual

- Textbook: \$127
- Lab manual: \$2
- Additional fees: \$10
- **Total: \$139**
- ***Savings: \$100/student**

*Based on current market value of Thien & Graveel (2008), which has dropped from \$165 to \$112 since this manual was published



Future Directions for the *Soils Laboratory Manual*

- Development of a Google+ community
 - Encourage communication and engagement among instructors using it
 - Provide feedback to us as primary authors
- Developing specific learning outcomes for each laboratory
- Conforming assignment design to the “Transparent Assignment Template” (Winkelmes, 2013) to better communicate
 - Purpose
 - Task
 - Criteria for success
- Conduct survey of faculty using the *Soils Laboratory Manual*
- Other related textbook projects in the works



Considerations

- Similar approaches to OER development could be used where content specific to the region or instructor style/pedagogy is needed
 - Especially in laboratory courses
 - Important for education in agricultural fields
- Keep accessibility aspects in mind
- Check how your bookstore prints and charges for course packets and lab manuals
- Try to be respectful of the primary author's intended style
- Be transparent with students, and remind them regularly that you're actively working to save them money



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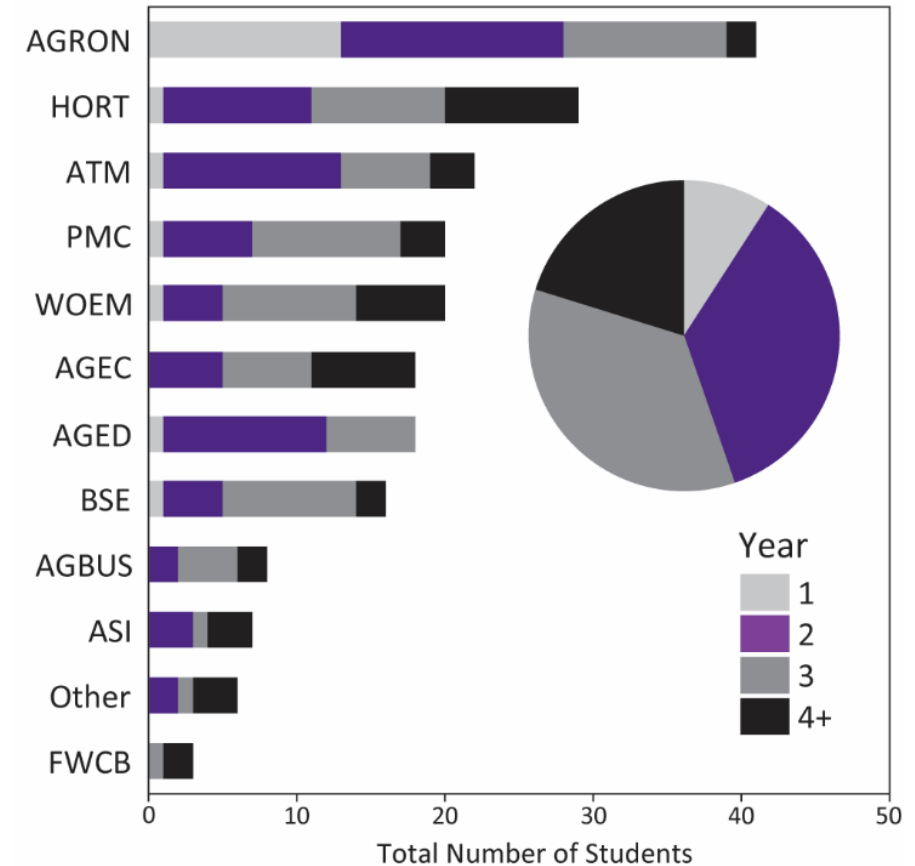
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Questions

Student Survey Methods & Demographics

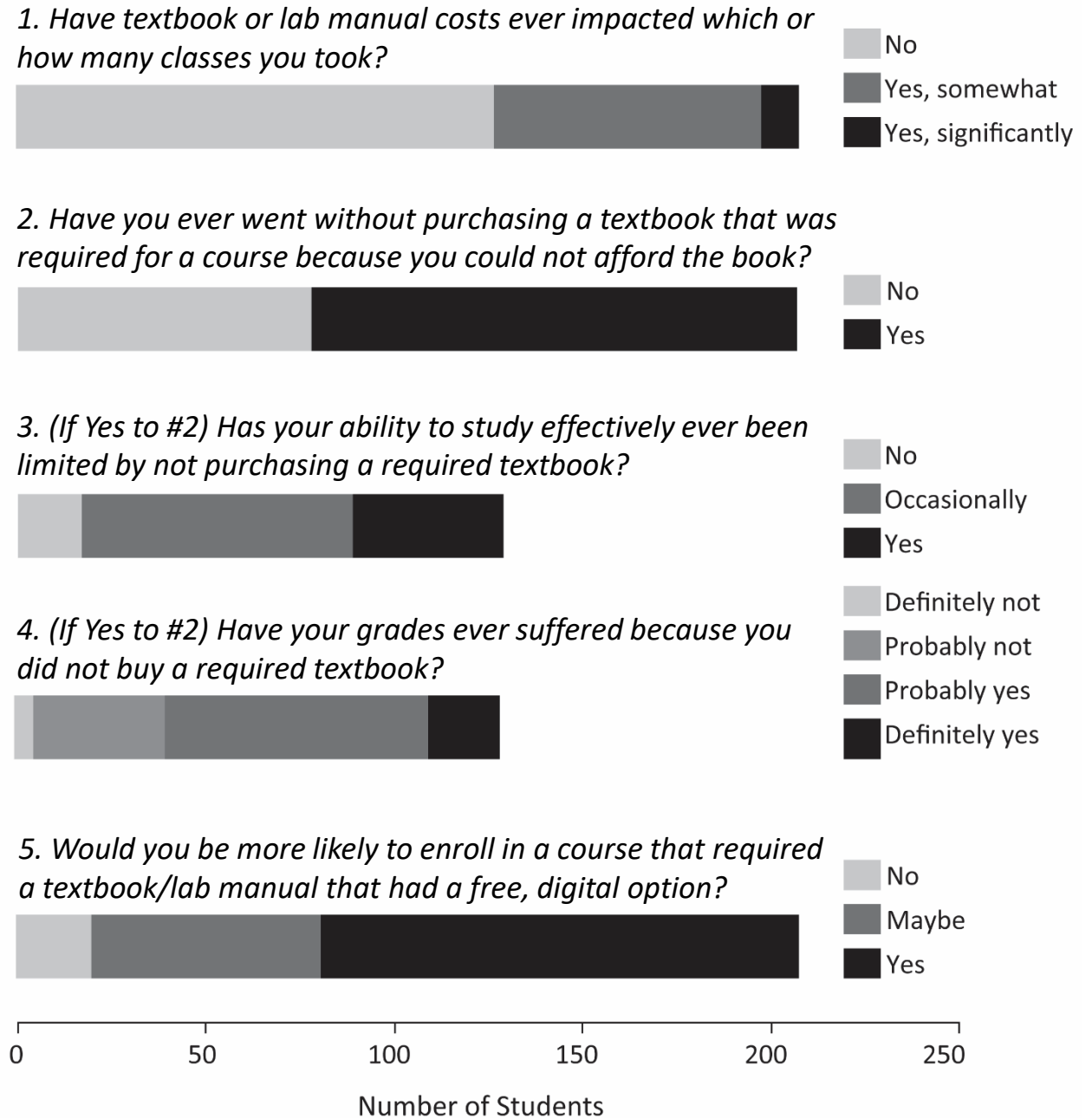
- Surveyed students at end of fall 2016 and spring 2017 semesters
- Response rates
 - Offered 30 points extra credit towards lab assignments (0.9% of final grade)
 - Names were used to assigned extra credit, then removed
 - 213 Respondents
 - Fall 2016: 107 responses out of 114 enrolled
 - Spring 2017: 106 responses out of 121 enrolled
- Conducted using Qualtrics





Impact of Textbooks

- Clear financial impact
- Clear academic impact
- Strong support for open textbooks





Preferred Format

- Fall 2016: Students had a choice between a free PDF and a printed copy from bookstore for \$27
- Spring 2017: Only choice was free PDF

6. Fall 2016: How did you access the Soils Laboratory Manual?



7. Fall 2016: (If they used the free PDF) How did you access the free PDF? ?



8. Spring 2017: How did you access the free PDF?



0 25 50 75 100 125
Number of Students

9. What type of device did you use to access the PDF electronically during lab?

