-- PRINCIPLES OF SOIL FERTILITY--
ENST 411/611 ----- Course Syllabus ----Spring 2011

PROFESSOR:	Ray Weil, Room 1119 H.J. Patterson Hall; Phone: 301/405-1314, e-mail: rweil@umd.edu; Office hrs. Tu, Th 2:00-3:00 PM, or by appointment.
Prerequisites:	Introduction to Soil Science (ENST 200), **or** similar course, **or** permission of instructor.
Textbook:	Brady and Weil. 2008. *The Nature and Properties of Soils*. 14th Edition. ***Revised printing*** Prentice Hall.
Course Notes:	Weil, R. 2011. *Lecture Notes: Principles of Soil Fertility* for ENST 411. Univ. of Maryland. (Class Packet available only at Md Book Exchange, Rte. 1)
Webpage:	http://www.enst.umd.edu/People/Weil/Courses.cfm (for syllabus & nutrient deficiency symptoms photos). Also a Blackboard site at ELMS.umd.edu
Library:	The McKeldin and Nat Ag Libraries and the Internet will be needed for term papers.

ASSIGNMENTS: A term paper of one of the types outlined below will account for 25% of your grade.

A. For Graduate Students: Critical Literature Review. This should assess the state of the science on a well-defined topic. Discuss your topic ideas with me before going very far, as the topic must be focused and timely. The review should include at least 20 original research papers, including at least 10 no more than 5 years old. The text of the review should be about 15 double-spaced pages (12 pt typeface) plus an abstract of 200 to 250 words. Also, include at least 5 referenced tables and/or figures (with captions that make them self explanatory) of research data to clarify or substantiate your main points. Use the style of Soil Sci Soc Amer J. for references and tables. Include your definition of the topic, its importance, and a critical look at the work done on the topic. Express your own evaluation of the research that was done. Compare research reported by different authors to assess how they support or contradict each other. For at least one concept, attempt to bring together the results of several authors to synthesize your own conclusion or assessment of the matter. This synthesis (meta analysis) may result in a new table or graph in which each author's work is one line or data point. Finally, state your conclusions about what is known and what still needs to be researched. Graduate students will review each others' papers and then make revisions accordingly. Your review of your classmate's paper, the review of your paper, and the reviewed and final drafts will all be handed in together for grading. If there are sufficient graduate students enrolled, we will hold occasional graduate seminar sessions in which we will discuss class topics and present the graduate papers, seminar style.

B. For Undergraduate students: Contest manuscript. The purposes of this assignment are 1) to help develop your writing skills, 2) to allow you to delve more deeply into an area of soil fertility of particular relevance to you, and 3) to give you the opportunity to win national recognition and money (up to $500). ENST 411 students have won 1st, 2nd and 3rd prize in the past few years. The paper may be a traditional term paper that reviews the literature and integrates your own thoughts and opinions, or it may be a report of an experiment you have carried out. Choose a topic of practical and timely interest regarding a soil fertility issue or application for growing some kind of vegetation. The topic and style will be appropriate for entry into the Agronomy Society of America *student manuscript contest* (which offers potential fame and fortune for SASES club members who enter!). The first draft will be reviewed *by two other students* and will then be revised accordingly. Specific guidelines for reviewers are enclosed. The revised paper will be reviewed again, revised again and then turned in for grading and entrance into a local contest to determine which papers may be sent in to the national contest. **Two copies** of the first draft, revised draft and final version (both on paper and CD) will be due as scheduled. The paper will comprise 7 to 8 pages of text (double spaced, 12 pt; 1.0 inch margins, page number bottom center). In addition, it must include a title page (title, author, institution, author's address, purpose of article and type of audience for which it would be appropriate), at least 2 illustrations (drawings, graphs, charts, scanned photographs etc. no smaller than 3 x 5 inches, excluding margins) of *publication quality* with complete captions, plus at least one table. For any data, facts or figures used, **references** must be cited in the body of the text and listed at the end (a minimum of 10 references, 5 no more than 5 years old). See "official scorecard" for grading criteria. Cite complete references for all facts and ideas not original to you. Read and understand the University policy on academic integrity. Use a diversity of sources to check the facts. Show critical judgment on the reliability of sources, especially from the web. **See review guidelines and any article in Soil Science Society of Amer. Journal for style details**. ***All drafts and reviews+ original photos (e-file, slide or print)*** **are to be handed in for grading with the final draft.**

♣ PRINCIPLES OF SOIL FERTILITY ♣
SPRING 2011--Lecture Schedule--ENST 411 / 611

Date	LECTURE TOPICS	Notes	Readings (subject to change)
1/25	Introduction to course and Physical Soil Factors affecting Plant Growth	1-8	Brady&Weil: 4.5-4.8, 5.8-5.10,7.4-7.6, 7.8-7.11
2/27	Plant Roots and the Rhizosphere	9-16	Brady&Weil: 11.7, Images of plant roots in their natural environment. http://ic.ucsc.edu/~wxcheng/wewu/index.html
2/01	Rhizosphere Phenomena: Mycorrhiza, Allelopathy	16-28	Walnut Allelopathic Effects and Tolerant Plants http://www.ext.vt.edu/pubs/nursery/430-021/430-021.html AM fungi: http://www.anbg.gov.au/fungi/mycorrhiza.html
2/03	Soil Organic Matter Roles and Dynamics	28-34	Brady&Weil: 12.2-7, 11.9-11.14 Weil(2001) : http://www.enst.umd.edu/files/weilsustainable.pdf
2/08	Soil Organic Matter Management	34-41	Brady&Weil:12.7-12.13,16.3-16.6, 20.1, 20.2, 20.8 Organic farming: wave of the future? Collection of articles in Nature. http://www.nature.com/nature/focus/organicfarming/ Research in Switzerland studies organic fertility. Check nutrient balance. http://www.fibl.org/english/research/soil-sciences/dok/index.php
2/10	Nutrient Uptake by Plant Roots	42-52	Brady&Weil: 1.17-1.18. Weaver (1926) root development with great illustrations: http://soilandhealth.org/01aglibrary/010139fieldcroproots/010139toc.html
2/15	Cation and Anion Exchange	53-61	Brady&Weil: 8.6-8.13.
2/17	Soil pH and Problems of Acidity	62-72	Brady&Weil:9.1-9.8
2/22	Aluminum (and Mn) Toxicity and Its Management **OUTLINES DUE**-grad & undergrad	73-76	Brady&Weil: 9.9-9.10 Fenn et al. 2006. Status of soil acidification in north America. Journal of Forest Science 52:3–13 http://www.cazv.cz/attachments/JFS_Special_52_3_13.pdf
2/24	Soil Alkalinity and Salinity	77-82	Brady&Weil: 10.1-10.11
3/01	**Exam 1**		
3/03	Nitrogen in Plants and Soils	82-91	Brady&Weil: 13.1-13.4, 12.2-12.3 Nutrient Deficiencies in Trees, with color photos from the University of Tennessee. http://www.utextension.utk.edu/publications/spfiles/SP534.pdf
3/08	N Cycle in Soils	91-101	Smil: Global Pop and Nitrogen Cycle: http://hollandimac.chem.rochester.edu/n2cycle.pdf Brady&Weil: 12.3, 13.5-13.9
3/10	Biological Nitrogen Fixation and Legumes	102-105	Brady&Weil.13.10-13.13; 16.2-16.3
3/15	Nitrogen Management **1ST DRAFT DUE –undergrad paper**	105-108	Brady&Weil: 13.14-13.15; 16.6-16.9

3/17	Sulfur in Plants and Soils	108-113	Brady&Weil: 13.16-13.22 Fogonazos. 2008. Hell exists, it's full of sulfur and it's located at Indonesia: http://www.fogonazos.es/2008/05/sulfur-mine-indonesia-ijen-volcano.html Coal Plant, Blamed For 'Environmental Catastrophe http://www.huffingtonpost.com/2010/12/28/farmers-pecan-growers-say_n_801945.html?view=screen#s216082&title=Vegetative%20Wasteland
21-25	********SPRING BREAK********		
3/29	Sulfur Cycling in Soils	113-115	Global sulfur reservoirs, fluxes, and turnover times: http://www.ess.uci.edu/~reeburgh/fig6.html
3/31	Phosphorus **1ST SET OF REVIEWS DUE**	116-121	Brady&Weil: 14.1-14.5; 16.1 Phosphate reserves and production. http://minerals.usgs.gov/minerals/pubs/commodity/phosphate_rock/phospmcs07.pdf
4/05	Phosphorus in Soil	121-126	Brady&Weil, 14.6-14.9, 16.12 "Phosphorus in Urban Runoff" at http://wi.water.usgs.gov/pubs/WRIR-99-4021/index.html
4/07	Boron **2ND UNDERGRAD PAPER DRAFT DUE**	127-130	Brady&Weil: 15:3-15.6, 15.9
4/12	Calcium & Magnesium	131-136	Brady&Weil: 15.1-15.2
4/14	Potassium in Plants and Soil **2ND SET OF REVIEWS DUE** **GRAD PAPER DRAFT DUE**	136-141	Brady&Weil.14.10-14.17 Organic Potassium for Plants: http://www.ehow.com/facts_7678903_organic-potassium-plants.html
4/19	Iron in Plants and Soil,	141-147	Clemens...Chelates.., Brady&Weil: 7.3, 15.7-15.8, 15.10-15.12
4/21	Manganese in plants and Soil **GRAD REVIEWS DUE**	147-150	Summary of chemistry of chelates and chelating agents: http://scifun.chem.wisc.edu/CHEMWEEK/chelates/chelates.html
4/26	Zinc, Copper, Molybdenum and Chloride	151-156	Nutrient disorders of Common Houseplants: http://www.apsnet.org/online/feature/abiotic/nutrition.html Training Manual for Organic Agriculture in the Tropics, from International Federation of Organic Agriculture Movements. http://www.fibl.org/english/index.php
4/28	**EXAM II**		
5/03	Soil Testing	157-163	Brady&Weil: 16.10-16.11, 16.13 SoilTesting the Easy Way Video: http://www.youtube.com/watch?v=xIjxBgLs4Q8&feature=player_embedded#!
5/05	Soil Testing and Fertilizer Recommendations **FINAL UNDERGRAD PAPER DUE**	163-169	Understanding a standard soil test report: http://www.agr.state.nc.us/agronomi/pdffiles/ustr.pdf Alternative soil testing labs: http://attra.ncat.org/attra-pub/soil-lab.html Cation balancing lab site: http://www.swep.com.au/pdf/Example%20Standard%20Report.pdf
5/10	Tissue Testing and Interpretation **FINAL GRAD PAPERS DUE**	169-174	Brady&Weil:16.10 *Using plant analysis as a diagnostic tool [Online]*. http://www.soils.wisc.edu/extension/publications/horizons/2000/Plant%20Analysis%20as%20Tool.pdf.
5/17	**FINAL EXAM**, Tuesday May 17 1:30-3:30 PM **rm 1104 HJP**		

GRADING SCHEME: **LETTER GRADES:**

(approximate)

3 EXAMS @ 100 PTS.....	300	85+ = A
TERM PAPER @ 100 PTS	100	75-84 = B
TOTAL	400	65-74 = C
		55-64 = D

DISABILITIES: **If you have a documented disability and wish to discuss academic accommodations, please see me in person during the first week of the semester.**

Outlines for ENST 411 Term Papers (due 5th week of class)

Graduate students:

The graduate outline should be one page.

It should include:

1. a good informative working title (< 15 words, most important terms first),
2. a few points about the context/justification/background
3. enough outline points to should how you plan to organize the paper,
4. the main working hypotheses, etc.
5. A few (3 or 4) key references examined so far.

Note: I realize how much is on a grad student's plate and that efficient use of time is important. So getting two birds with one stone is okay with me. It is fine with me if you want to do your 411 paper on the same topic as your thesis research.

Undergraduate students:

The outline should include:

- A good working title (12 words or less, with *most important* words first). Do NOT start with "Effects of …." or "A study of…", etc.
- 1 or 2 points (topics) under each of the main sections.
    1. Introduction and justification: What is the issue or problem? Why is it important?
    2. Body. What is known, what are the solutions to the problem or principles of the issue?
    3. Conclusions. …give 2 or 3 main conclusions you expect to draw.

At least three (3) preliminary references to show you are digging up the information you will need. References (use Soil Sci. Soc. Amer. Journal style). IMPORTANT: check an SSSAJ paper to see referencing style details.

Hints for Science writers: Here are a few suggestions for a **good title.**

1. Don't begin with "filler" words like "Effect of", Evaluation of". Instead begin with words that evoke the main topic.
2. Be as specific as possible. For example, if your paper is only about turfgrass use: "Turfgrass Disease Suppression by Manipulating Soil pH" rather than just "Disease Suppression by Manipulating Soil pH"
3. Try to keep the title to 10 words or less.
4. Try to make the title say something about the take home lesson – rather than just name the topic. E.g. use "Liming Can Reduce Turfgrass Disease" rather than "Effect of Lime on Turfgrass Disease"

ENST 411 Reviewer's Guidelines for Undergraduate Term Papers

The reviewer may mark spelling and grammar corrections directly on the manuscript, but all reviews will include a separate sheet (or more) of comments, suggestions and corrections as indicated below. Be sure to make two copies of your review, one for the author and one for the instructor. One copy of the review is to be handed in for grading and a second copy handed to the author for help in revising the manuscript. The review should be polite and helpful, but also objective and specific. The **written** review should include the following parts:

1. General comments/overall assessment of the manuscript. Address each of the following points.

- ❑ Was it clearly and concisely written?
- ❑ Is the type of paper or purpose indicated on the title page? Is the intended audience stated? (e.g. "a how to article for professional landscapers")
- ❑ Is the writing and content appropriate for the stated purpose of the paper?
- ❑ Did it *exactly* follow *all* the assignment guidelines and ASA contest rules?
- ❑ Can the organization (logical flow of ideas) and level of detail be improved?
- ❑ Suggest how improvements could be made.

2. Specific comments/corrections. Identified these by page and paragraph (e.g. page 3, para 2).

a. Be sure to evaluate *each* of the tables and figures.

- ❑ Does the table or figure add valuable information?
- ❑ Will the smallest lettering on figures be legible when reduced to the size of a quarter of a page?
- ❑ Are they self-explanatory (note all tables and figures should be able to "stand alone")?
- ❑ How could they be made clearer and more useful to the reader?
- ❑ Are tables composed according to the ASA style? (See recent issue of Soil Sci. Soc. America Journal or Agronomy Journal for examples). Note placement of units and footnote symbols used.

b. Evaluate the accuracy and completeness of the information given. Compare the facts with what you have learned in class, from the textbook, and elsewhere. Is enough information (or directions to further sources) given to be useful to a reader from the identified audience? Make suggestions and corrections as needed.

c. Correct grammatical mistakes and suggest ways to improve conciseness and clarity. Point out wordiness and redundancy if it occurs.

3. Check off (√) the adequate presence of these assigned parts:

- ❑ **Title** and **type of paper** and **audience intended**. Title to be no more than 12 words.
- ❑ Abstract (includes a summary of all main parts of the paper - including rationale for writing it). 250 words max.
- ❑ Introduction - why is the subject important? Do not use phrases like "This paper discusses..."
- ❑ Two (2) figures (appropriate, useful, clear, professional looking). Figures should be high resolution (800 x 1000 pixels) and caption should include full information on the source (e-mail or phone if appropriate).
- ❑ Table(s) (appropriate, useful, clear, well-organized, proper number of digits, decimals aligned, appropriate statistical indicators?). Must follow exact style of Agronomy Journal. Do not just "cut and paste" an existing table. Word process tables to fit page.
- ❑ Captions and table headings (do they make the figures and tables self-explanatory without reading the paper?)
- ❑ Complete & correct citations (e.g. Lastname, F. M. and F. M. Author. 2007. Title of paper. Journal name 44:23-30.).
- ❑ **Web sites** must be cited by author or agency (e.g. US Dept. of Agric. or Smith, J. S.), year (latest update), Title, complete URL and *date verified by you*. Right click on web page, check "properties" or "info". No more than 1/2 of the references may be from the web.
- ❑ Are references from reliable, objective sources? Is any bias indicated? If a whole book, give specific pages.
- ❑ At least 10 references (on a separate bibliography page, if citations in the paper are not appropriate)
- ❑ At least 5 references no more than 5 years old?
- ❑ Text portion of paper is 6 to 8 double spaced pages (no more), 1-inch margins (0.7 inch on bottom with page number in center), 12-point type. Tables, figures, references, etc. are in addition to this.
- ❑ Each table or figure is printed on a *separate page*, with its title or caption, ***not*** mixed in with the text.
- ❑ All major ideas and facts are referenced in the body: "Smith et al. (2006) found that…" **or** "Sulfur deficiency is common in Africa (Weil and Mughogho, 2000)". Use "et al." if for 3+ authors, but include *all* authors in the reference list.

Form for peer grading of second draft (attach with your comments & scores to the draft):
Copy this form, fill it out and hand in a completed copy with each of your reviews.

Author of paper graded: _____

Person grading: _____

1. **General Worth 10**
Justification of the topic to its intended audience.

2. **Content *30***
- Accuracy 10
- Quality 10
- Conclusion 10

3. **Readability 25**
- Clarity 10
- Spelling and Punctuation *5*
- Sentence Structure *5*
- Paragraph Structure *5*

4. **Organization 15**
Material should be presented in a logical and concise order that is easy for readers to follow.

5. **Figures and Tables 10**
Quality, appropriateness for the paper with meaningful captions.

6. **Identification of Sources *5***
Statements of facts and use of data from other sources should be acknowledged by naming or referencing the sources.

7. Neatness *5*
General overall appearance of the paper.

Total out of 100 =

Comments:

Sample Copyright Permission Request

The question has come up about copyright permission for papers to be submitted to the SASES contest. I encourage you to create your own drawings or photographs if you can. If you use a figure made by someone else (that is downloaded, copied or scanned), or if you use a complete table made by someone else, you will need to contact the copyright owner for permission. If you make a figure yourself, but it is based closely on one in a publication, you will need permission for that, too. However, if you make a diagram that is your idea and is substantially different form ones you've seen or if you make a new graph or table out of data found in a paper, those should not need permission because they are essentially your original work (of course you still must cite the source of the data or concept). In addition, if the work is written by Federal government (USDA, EPA, etc.) employees or in US Government publications, no permission is needed (just cite the source). Generally, images on the web are not of sufficient resolution (at least 200 dpi) for printing and therefore you may have to contact the owner for a higher resolution image file (jpg or tif).

How do you get permission for use of figures or tables? The copyright for technical publications is usually owned by the publisher, not the author. Check the front (just behind the title page) of the book or journal for the publisher and address, often an address (or e-mail) is given for "permissions". For example, if your figure is in an article in Soil Science Society of America journal, the copyright belongs to the Soil Sci. Soc. of America in Madison, WI (or see www.soils.org). For books, the owner is usually a publisher such as Wiley and Sons, Inc. or Prentice Hall, Inc. You can then write a request such as the following:

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Dear “owner”,

I would like permission to use Figure 3 from Jones et al. 1999. *The ABCs of Soil*, pages 50-55 in Wetland Journal Vol. 13. This figure would be redrawn (or reproduced) in a paper I am submitting for possible publication in hard copy and electronic format in The Journal of Life Sciences and Natural Resources Education. I would include the following credit line in the Figure caption:

"Redrawn from Jones, et al. (1999) with permission of XYZ Publishing, Inc."

If you agree to give me such permission, please signify by signing below. Thank you very much.

Your name.

Permission granted:

_____

Name, title date

ENST 611 GRADUATE STUDENT PAPER

GRADING CRITERIA

Assigned attributes:

- 5%…20 references in SSSAJ style (10 from the last 5 years). Quality and diversity.
- 5%…appropriate title; 200-250 word abstract, 15-20 double spaced, 12 pt font pages
- 15%…At least five (*self explanatory*) tables and /or figures of referenced research data.
- 15%…Original critical evaluation of research reported (critique of methods used as appropriate for objectives, validity of conclusions, relationships to other work, etc.).
- 10%…Original synthesis of results from several studies into a larger picture.
- 10%…Statistical or quantitative handling of this synthesis as in at least one new table or figure (a meta-analysis).
- 10%…Original conclusions about the state of knowledge.
- 10%…Original conclusions about what research still needs to be done to fill in gaps and answer new or unanswered questions.

Writing attributes:

- 10%…Logical organization, argument and flow of ideas.
- 10%…Clarity and accuracy of writing. Sentence and paragraph structure.

- Total: _____/ 100