IAD 202
Analysis and Determinants of Farming Systems
Spring 2017

Environmental Horticulture - Room 148
Lectures: Tuesday/Thursday 10-11.50am

Instructor

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Pre-requisite: PLS110A or 110C

Course Overview

Many of you will be involved in agricultural development projects and will have to initiate and conduct projects independently and, often, with limited resources. This course will give you keys to approach, measure and analyze farming systems. The first module (M.Bell) will explore how to diagnose, set priorities and define work to be done when implementing a project at the village level. We will also introduce how to take observations on soil and crops and interpret them. A second module (A.Gaudin and guests) will go over basic principles of crop productivity and demonstrate how systems' approach can help intensify small holder farming systems in a sustainable way. We will explore applications for a diversity of production systems (orchards, vegetable, poultry, livestock and mixed systems), tackle issues related to postharvest processes and losses and linkages with nutrition. Hands on class/ outdoor exercises and take home assignments will complement the lectures and provide an opportunity to operationalize some of the concepts introduced in class. Finally, as professionals who manage, design and review agricultural projects, you will need to use the scientific literature to evaluate a proposal or identify key cropping system principles that apply to your region. This course will give you a basic understanding of how do you review and use the scientific literature to help you make decisions and recommendations.

Learning objectives

1- Understand linkages between soil, N inputs and crop ecology to be able to diagnose field problems, conduct appropriate measurements and interpret results.
2- Be able to critically appraise the fundamental drivers of crop productivity in a region of interest and use this knowledge for sustainable intensification.
3- Enhance your ability to review and use the scientific literature to help you make decisions and recommendations

Assignments (200 pts)

We will use Canvas to upload all take-home assignments and communicate. Assignments are due by class time (10AM) on due date, and must be submitted electronically via Canvas. Assignments have firm due dates and times and no accommodation will be given. Any assignments turned in after the class period in which it is due will be counted as late and downgraded 20% per day. Please do not send assignments via email, they will not be accepted.

1- ***Terminology Quiz (10%, 20pts):*** This is an in-class quiz going over basic terminology reviewed in the first module. This quiz is also useful to us to evaluate how effective we were in introducing and explaining these concepts.

2- ***Critical evaluation of peer reviewed journal articles (25%, 50 pts):*** The goal of this assignments is for you to develop critical reading and analysis skills for peer reviewed journal articles covering different agronomic topics. There is a lot of innovation happening all the time in the agricultural sciences, and it is important that you are able to research field studies and assess whether the results actually live up to the claims. It is always important to give farmers the best advice we can! Do not be afraid to criticize the authors, we are looking for critical thinking - just because the papers were published in peer-review journals does not mean you are not qualified to deconstruct them. This is a two-part assignment.

- *Paper review: read the assigned paper and submit a one-page review with (10%, 20pts)*
    - Concise summary of the paper. This should be short, so you have space for your critique, but should cover the main point of the paper.
    - Discussion / assessment of the experimental design
    - Critique of the data analysis and conclusions

Your critique needs to examine the specific results presented in the paper and determine if you think it supports the author's conclusions. You are expected to cite graphs and/or data tables from the paper in your review and give specific agronomic or scientific arguments to the strengths and weaknesses of the paper. The paper citation is Nezomba et al, Field Crops Research 115 (2010) 149–157.

- *Literature review: do your own research and write up a literature review (15%, 30pts)*

Review the scientific literature relating to "Conservation Agriculture" and provide a three-page review of this technology. We will provide you with two papers as a starting point for the topic. You are expected to include a minimum of 4 additional papers in your review and cite them in your discussion. You are allowed to cite the two papers that have been provided sparingly, if they constitute the bulk of your arguments you will lose points, as the focus of the assignment is for you to conduct independent research. Your write up should cover:

- How is conservation agriculture defined?
- Pros/Cons, opportunities and challenges, and the specific biological evidence for / against / lacking in regards to these claims from peer-reviewed research.
- Come to a conclusion/make a recommendation for an agroecosystem of your choice based on sound science and argument

3- Basic calculations in mixed systems (10%, 20pts)

The objective is to introduce very basic calculations and independent use of resources to determine the feasibility of a practice. The example chosen is a mixed cropping system with chicken grazing under citrus orchards. In general, mixed cropping systems provide half of the world food (Herrero et

al, Science, 2010) so it is important to be able to appraise these systems. Complete this assignment in Microsoft Excel. Please include written answers along with calculations and tables, within Excel, in an organized fashion (meaning you do not need to also write a Word document). You should perform your calculations within the Excel cells – i.e., use the spreadsheet as a computational tool, not just a table format. Please prepare this as if it was a professional product – use metric system and units for your quantities, headings for your rows and columns, and explain your calculations where it would be helpful.

Using the references below, you will determine if it is feasible to support the nitrogen needs of the citrus orchard just through poultry (laying hens) grazing in the orchard:

Poultry reference: http://ohioline.osu.edu/b804/804_3.html

Citrus reference: http://homeorchard.ucdavis.edu/files/140618.pdf

Givens:

- 400 birds
- Citrus N requirement:1-1.5 lb/tree/year
- Farm: Old Creek Ranch, 12520 Santa Rita Rd. Cuyocas Ca. 8 acres citrus. Use google earth and the ruler option to estimate distance between trees and thus plants per ac.

4- Science in practice (25%, 50 pts)

We visited in class an experiment comparing monocropping to intercropping of maize, squash and beans, a common and ancient intercrop in the developing world. The milpa systems of Central America still employs this companion planting.

Imagine you are an extension worker who, learning from your past experience in Honduras, want to evaluate the potential of this intercrop in the Kenyan highlands to decrease dependence on external inputs and alleviate food insecurity and poverty. You have ~$3000 of budget and want to conduct an outreach event. Write a single space 3-page max summary describing and justifying:

- How you would start this project, with whom/where would you conduct your evaluation
- Your experimental design and evaluation framework
- Your planned outreach event
- Expected outcomes and potential problems
- Scale up plan

5- N cost of sustainable food production (25%, 50 pts)

The goal of this assignment is to explore and evaluate the direct linkages between N input levels and food provision. You will calculate how many people can be fed on 1 hectare of land under a certain management practice over one year in a non-industrialized family-style farm in the region of your choice. You will be designing and comparing two approaches: one plot that will be farmed with organic fertilizer and one with inorganic fertilizer. Part of the goal of this assignment is to consider the tradeoffs between these two styles of management. You can choose to include livestock or garden vegetables as you wish, you are expected to discuss what nutrition is and isn't provided by your plot. You can do a cover crop rotation within your one-year cycle. You will have considerable latitude in answering this question. The idea is for you to think creatively about this issue. Calculations will be for nitrogen only.

Your project must:

1. Be realistic. That means your inputs (labor, capital, nutrients, etc.) must be available and affordable for the area you have chosen.
2. Your choices and data must be supported by evidence. You should consider differences in the research and state your assumptions and why you consider them reasonable assumptions.
3. You must critique the trade-offs you are making – what are the costs, benefits, risks to the system you have chosen to design?
4. You may not run the soil into the ground. You must have sustainable levels of soil fertility. This means if you take nitrogen out of the soil, you must put it back in.
5. Although your system must be realistic, you are not responsible for accounting for the labor inputs or economics of the farm. If one system requires more labor, or a prohibitive amount of labor, you should discuss this. But you shouldn't do calculations or labor/capital balances – this is not an LUS. The same goes for costs. If there are differences in input costs for mechanization or other things, that needs to be discussed, but briefly and qualitatively. The quantitative calculations that you do should be for nitrogen only.

You will work as a group of 4-5 students. You will submit (1) a master spreadsheet with all your calculations with references for your values. The spreadsheet will follow the same kind of standards as the Basic calculation assignment (#3) and (2) produce, print and present a poster in class. As an individual, you will submit a one-page single-spaced paper describing your project the week after your poster presentation.

Evaluation

Final marks will reflect the grades on: Terminology Quiz (10%, 20pts), Critical evaluation of peer reviewed journal articles (25%, 50 pts), Basic calculations in mixed systems (10%, 20pts), Science in practice (25%, 50pts), N cost of sustainable food production (25%, 50 pts), attendance (5%, 10pts). Total = 100%, 200 pts

Expectations and Administrative notes

You are expected to attend class, upload your take-home exams on time, and be prepared to engage in thoughtful and critical discussion of the material. Whenever we are in the classroom together, everyone is expected to treat one another with courtesy and respect. Each of us brings a unique perspective to the classroom that can enrich the learning experience of everyone. These perspectives will be used for insightful debates rather that stigmatization.

- If you are a student with a learning disability or similar difficulty and would like to discuss alternative academic accommodations, please let me know as soon as possible and we will make appropriate arrangements.
- University policy forbids academic dishonesty including copying other student's work, plagiarism in all forms, cheating, etc.
- If you do not already, please be sure to check your email and Canvas regularly. Important announcements will be communicated via the class email list.

Some references and website of interest

Ilaco, B.V. 1985. Agricultural Compendium. For Rural Development in the Tropics and Subtropics. Elsevier. NY.

> "If you work in agricultural development, and you own only one book, this should be it. Very dense and practical, including much information on design of land improvements. Accurate and up-tp-date. You could almost start a consulting company with this book alone." Amazon book review

Loomis, R.S., Connors, D.J. Cassman KG. 2011. Crop ecology: productivity and management in agricultural systems. Cambridge : Cambridge University. 550p.

Crops	
e-Afghan Ag	http://afghanag.ucdavis.edu
Horticulture	
Global Hort Knowledge Bank	http://hortkb.weebly.com
UC IPM	http://www.ipm.ucdavis.edu/index.html
UC Postharvest RIC	http://postharvest.ucdavis.edu/index.html
Cereals	
Rice Knowledge Bank	www.knowledgebank.irri.org
Field Crops	http://www.dpi.qld.gov.au/cps/rde/dpi/hs.xsl/26_3528_ENA_Print.htm
Maize Dr	http://maizedoctor.cimmyt.org/index.php
Rice Dr	http://www.knowledgebank.irri.org/riceDoctor/default.htm
Wheat Dr	http://www.cimmyt.org/english/wps/wheatdoctor/index.htm
UNFAO Field Food Crops Group	http://www.fao.org/ag/AGP/AGPC/doc/field/field.htm
Extension	
ICT in Extension	http://measict.weebly.com

Course outline and assignment/presentation schedule