Spring 2020 AOM 4932/6932
Course title: Agricultural Intensification: Tradeoffs or Synergies with the Environment and Livelihoods

Instructor: Cheryl Palm Agricultural and Biological Engineering Department and Institute for Sustainable Food Systems

Course Description: 2 credits. This interdisciplinary course is designed to teach students about the principles of sustainable agricultural intensification (SAI) and to explore the challenges to achieve SAI. We will begin with the history, science and impact of agricultural intensification, including the Green Revolution that doubled global food supplies between 1970 and 1995. We explore the effects of agricultural intensification on the environment (water quality, greenhouse gases, biodiversity), and human livelihoods (income, food security, nutrition). Though the focus is on developing countries the course will include temperate and regional comparisons for a broader understanding of the global food production system.

The course will combine readings and discussions sessions with occasional assignments.
There is an opportunity to take an additional section on data analysis that includes a specific topic of interest to the student.

1. **Pre-requisites and Co-requisites:** Students should have familiarity with agricultural production systems; however the course will provide basic background and reading materials to cover the interdisciplinary areas of agricultural production, economics, environment, and livelihood considerations.

   Those student selecting the data analysis and report section should be proficient in Microsoft Excel and/or some data analysis software including STATA, R, and such. Working knowledge of geospatial tools would also be of interest for projects.

2. **Course Objectives and specific Student Learning Outcomes (SLOs):**
   We begin with an overview of 1) the core bio-physical resources for food production: climate, soils, nutrients, water and biodiversity and 2) the socioeconomic economic conditions needed for agricultural intensification, and 3) the implications of agricultural intensification strategies to the environment (soils, water, air, carbon and biodiversity) and human livelihoods or human wellbeing (income, nutrition). We will spend most of the semester examining the tradeoffs and synergies among agricultural intensification strategies with the impact on environment and ecosystems services as well as socioeconomics and human wellbeing. The focus is primarily on the tropics and subtropics, where rapid population growth and expansion and intensification of agriculture is occurring, but we will also explore examples from the temperature region. The overall question is how to meet local and global food and fuel requirements that do not harm the long-term integrity of the environment as well as undermining food and nutritional security.

   The lab course will follow the lectures and will explore the various ways to explore datasets and calculate the various indicators within the five domains of sustainability. Tools for analyzing

tradeoffs and synergies among those domains and indicators will also be explored. *The objectives and student learning outcomes for the lab are designated in italics.*

Those successfully completing this course will be able to:

1. Describe the differences between agricultural extensification and intensification and the driving forces determining which will prevail in a landscape.
2. Describe the different domains and indicators of sustainable intensification.
3. Describe and give examples of policies and institutions that can be used to negotiate tradeoffs and synergies.
   SLO1/2/3: Students discuss papers that explore both agricultural intensification/ extensification, explain the reasons why they have different outcome indicators and potential policies that could change those outcomes.
4. Compare and discuss the tradeoffs and synergies among the five domains of sustainability that are associated with different agricultural systems.
   SLO4: Students write a case study of an agricultural system of their choice that explores the different domains of sustainability.
5. Learn to prepare and give oral presentations.
   SLO5: Students present a research paper from the literature to the class.
6. *(for the lab section) Learn to analyze, interpret, and compare (tradeoff and synergies) of different agriculture systems from a sustainable intensification perspective.*
   ***SLO6: :** Students assess tradeoffs and synergies among production, environment, economics, human and social domains for different farming systems or practices.*

3. Instructors contact information:

Dr. Cheryl Palm, Agricultural and Biological Engineering
Rogers Hall 223, Office: 352-392-1864 x223; cpalm@ufl.edu

Dr. Palm will return email messages within 24 hours. Do not expect messages to be returned over the weekend. Office hours can be made by scheduling appointments. Scheduling can be done by email or in person after class Meeting Time: Wednesday 3:00 – 5:00p.m.

4. Training Location: Room 283 Frazier Rogers Hall.

5. **Meeting time**: Lecture section -Wednesday Periods 8-9 (3:00-4:55 p.m.)
   Lab section – Monday Periods 8-10 (3:00-6:00 p.m.)

6. Material and Supply Fees: None.

7. Textbooks and Software Required:
No textbooks are required. All required reading material is available through websites or the UF library.

8. **Recommended Readings:**
   Readings be assigned on a weekly basis. The core list is provided below.

9. **Attendance and Expectations:** Students are expected to complete readings before class, actively participate in discussions, complete assignments, and write and present a specific case study. Those taking the lab on data analysis will be expected to write a short report, including data output and interpretations.

   Class discussions will focus on the key readings for the week (10 pts); occasional assignments will include presenting a lecture/example on one of themes, submitting summary points and questions from selected readings, and quizzes (50 pts), and a case study report and presentation (40 points). The case study will consist of applying the information learned from the class to a specific agricultural system and or commodity. The system can be from the student's research or interest area. The instructor will also have an example system option that can be used.

   Those taking the lab on data analysis will be expected to develop research questions and analyze data from existing studies. The results will be presented as tables and figures along with a discussion and interpretation of the results.

   Any work that is submitted should be the product of the student. Any assignments that are not the individual student's work will be given a 0 grade and further disciplinary action per UF policy.

   The preferred methods for private communication regarding the course is via email or a scheduled meeting with the instructor.

10. **Grading:** Participation in discussions 10%, assignments 50%, case study and presentation 40%.
    (for those taking the lab analysis credit – grading will be determined as follows- Participation in classroom 40%, project reports and presentation 60%)

11. **Grading Scale:** tentatively, standard UF scale (e.g., A = 90-100%, B+ = 87-89, B = 80-86); potentially, curved. We will update you about your standing a couple of times during the semester.

12. Online Course Evaluation Process

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/."

13. Honesty Policy – Academic Honesty

As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: *"We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity."* You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: "*On my honor, I have neither given nor received unauthorized aid in doing this assignment*."

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code.

14. Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting disability.ufl.edu/students/get-started. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester

14. Course Outline: schedule, sequencing of topics may be changed with advanced notice

Week (lab/lecture)	**Activities**
Jan. 6/8	**Lecture:** Introduction to course, discussion of agricultural extensification and intensification **Readings:** * Shriar, A. J. 2000. Agricultural intensity and its measurement in frontier regions. Agroforestry Systems 49: 301-319. *Godfray, H.C.J., Beddington, J.R., Crute, I.R., Haddad, L., Lawrence, D., Muir, J.F., Pretty, J., Robinson, S., Thomas, S.M. and Toulmin, C., 2010. Food security: the challenge of feeding 9 billion people. Science, 327(5967), pp.812-818.

	*Foley JA, Defries R, Asner GP, Barford C, Bonan G, Carpenter SR, Chapin FS, Coe MT, Daily GC, Gibbs HK, Helkowski JH, Holloway T, Howard EA, Kucharik CJ, Monfreda C, Patz JA, Prentice IC, Ramankutty N, Snyder PK. 2005. Global consequences of land use. Science. 309(5734):570-4. Geist, H. J., E. F. Lambin. 2002. Proximate Causes and Underlying Driving Forces of Tropical Deforestation: Tropical forests are disappearing as the result of many pressures, both local and regional, acting in various combinations in different geographical locations, *BioScience* 52: 143–150, https://doi.org/10.1641/0006-3568(2002)052[0143:PCAUDF]2.0.CO;2 FAO. The future of food and agriculture – Trends and challenges. Rome. **Case study:** Discussion of projects **Lab:** Introduction to lab course. Case study projects. Overview of calculation and datasets of production, productivity.
Jan. 13/15	**Lecture**: Sustainable Agricultural Intensification: Concept, Domains and Indicators: Context is Key **Readings:** *Pingali, P.L., 2012. Green Revolution: Impacts, limits, and the path ahead. Proceedings of the National Academy of Sciences, 109(31), pp.12302-12308. *Garnett, T., Appleby, M.C., Balmford, A., Bateman, I.J., Benton, T.G., Bloomer, P., Burlingame, B., Dawkins, M., Dolan, L., Fraser, D. and Herrero, M., 2013. Sustainable intensification in agriculture: premises and policies. Science, 341(6141), pp.33-34. *Tilman, D., Balzer, C., Hill, J. and Befort, B.L., 2011. Global food demand and the sustainable intensification of agriculture. Proceedings of the National Academy of Sciences, 108(50), pp.20260-20264. Musumba, M, Grabowski, P., Snapp, S, Palm, C. 2017; Guide for the Sustainable Intensification Assessment Framework. http://www.k-state.edu/siil/resources/framework/index.html Rockström, J., Williams, J., Daily, G., Noble, A., Matthews, N., Gordon, L., Wetterstrand, H., DeClerck, F., Shah, M., Steduto, P. and de Fraiture, C., 2017. Sustainable intensification of agriculture for human prosperity and global sustainability. Ambio, 46(1), pp.4-17. DfID, U.K., 1999. Sustainable livelihoods guidance sheets. London: DFID. **Case Study**: Meet with Palm to discuss case study **Lab:** Select country, find statistics for production, yields (and potential

	yields), areas in production for 3 crops. **Assignment:** attend (or watch video) Future of Food Forum afternoon schedule
Jan 20 holiday/ 22	**Lecture:** Tradeoff and Synergies **Readings:** *Kanter, D.R., Musumba, M., Wood, S.L., Palm, C., Antle, J., Balvanera, P., Dale, V.H., Havlik, P., Kline, K.L., Scholes, R.J. and Thornton, P., 2016. Evaluating agricultural trade-offs in the age of sustainable development. Agricultural Systems. pp 1-16. *Musumba, M, Grabowski, P., Snapp, S, Palm, C. 2017; Guide for the Sustainable Intensification Assessment Framework. http://www.k-state.edu/siil/resources/framework/index.html. **See example for indicator selection and tradeoff analysis.** *Power, A. G., 2010. Ecosystem services and agriculture: tradeoffs and synergies. Philos. T. R. Soc. B. 365, 2959-2971. Dale, V.H. and Polasky, S., 2007. Measures of the effects of agricultural practices on ecosystem services. Ecological economics, 64(2), pp.286-296. Klapwijk, C.J., van Wijk, M.T., Rosenstock, T.S., Van Asten, P.J.A., Thornton, P.K. and Giller, K.E., 2014. Analysis of trade-offs in agricultural systems: current status and way forward. Current Opinion in Environmental Sustainability, 6, pp.110-115. Stoorvogel, J.J., Antle, J.M., Crissman, C.C. and Bowen, W., 2004. The tradeoff analysis model: integrated bio-physical and economic modeling of agricultural production systems. Agricultural Systems, 80(1), pp.43-66.
Jan. 27/29	**Discussion:** Tradeoffs and Synergies **Lecture**: Soils, nutrients, and environment **Readings:** *Palm, C.A., P.A. Sanchez, S. Ahmed, A. Awiti. 2007. Soils: A Contemporary Perspective. The Annual Review of Environment and Resources. 32:99-1102 and 115-121. *Vitousek, Peter M., R. L. Naylor, T. Crews, M. B. David, L. E. Drinkwater, E. Holland, P. J. Johnes, J. Katzenberger, L. A. Martinelli, P. A. Matson, G. Nziguheba, D. Ojima, C. A. Palm, G. P. Robertson, P. A. Sanchez, A. R. Townsend, F. Zhang. 2009. Nutrient Imbalances Along Trajectories of Agricultural Development. Science 324: 1519-1520.

	*Chen, X., Cui, Z., Fan, M., Vitousek, P., Zhao, M., Ma, W., Wang, Z., Zhang, W., Yan, X., Yang, J. and Deng, X., 2014. Producing more grain with lower environmental costs. *Nature*, *514*(7523), pp.486-489. Palm, C., Neill, C., Lefebvre, P. and Tully, K., 2017. Targeting sustainable intensification of maize-based agriculture in East Africa. Tropical Conservation Science, 10, p.1940082917720670. **Lab:** Continue with FAOStats; Learn to develop tradeoff diagrams (spidergrams) **Assignment Due:** One page outline of proposed case study
Feb. 3, 5	**Lecture:** Agriculture, Climate, Carbon **Readings:** *Schlesinger, W.H. 2000. Carbon sequestration in soils: some cautions amidst optimism. Agriculture, Ecosystems, Environment 82: 121-127. *Giller, K.E., Witter, E., Corbeels, M. and Tittonell, P., 2009. Conservation agriculture and smallholder farming in Africa: the heretics' view. Field crops research, 114(1), pp.23-34. *Harvey, C. A., Chacón, M., Donatti, C. I., Garen, E., Hannah, L., Andrade, A., Bede, L., Brown, D., Calle, A., Chará, J., Clement, C., Gray, E., Hoang, M. H., Minang, P., Rodríguez, A. M., Seeberg-Elverfeldt, C., Semroc, B., Shames, S., Smukler, S., Somarriba, E., Torquebiau, E., van Etten, J. and Wollenberg, E. (2014), Climate-Smart Landscapes: Opportunities and Challenges for Integrating Adaptation and Mitigation in Tropical Agriculture. Conservation Letters, 7: 77–90. doi: 10.1111/conl.1206 Thornton, P.K. and Herrero, M., 2010. Potential for reduced methane and carbon dioxide emissions from livestock and pasture management in the tropics. Proceedings of the National Academy of Sciences, 107(46), pp.19667-19672 Palm, C., Blanco-Canqui, H., DeClerck, F., Gatere, L. and Grace, P., 2014. Conservation agriculture and ecosystem services: An overview. Agriculture, Ecosystems & Environment, 187, pp.87-105. (Read: Section 2.1 pp 88-92) FAO (2014) Agriculture, Forestry and Other Land Use Emissions by Sources and Removals. **Lab:** Digital soil maps, Yield and yield potential
Feb 10, 12	**Lecture**: Agriculture, Climate and Water

	Readings: * Gordon, L. J., C.M. Finlayson, M.Falkenmark. 2009. Managing water in agriculture for food production and ecoysystem services. Agricultural Water Management: doi:10.1016/j.agwat.2009.03.017 De Fraiture, C., D. Molden, D. Wicelns. 2010. Investing in water for food, ecosystems and livelhoods. Agricultural Water Management 97: 495-501. Bossio, D., K. Geheb, W. Critchley. 2010. Managing water by managing land: Addressing land degradation to improve water productivity and rural livelihoods. Agricultural Water Management 97: 536-542 *Falkenmark, M. and Rockstrom, J. 2006. The new blue and green water paradigm. Journal of Water Resources Planning and Management 132. Gathala, M.K., Kumar, V., Sharma, P.C., Saharawat, Y.S., Jat, H.S., Singh, M., Kumar, A., Jat, M.L., Humphreys, E., Sharma, D.K. and Sharma, S., 2014. Optimizing intensive cereal-based cropping systems addressing current and future drivers of agricultural change in the Northwestern Indo-Gangetic Plains of India. Agriculture, Ecosystems & Environment, 187, pp.33-46. Beddington, J.R., Asaduzzaman, M., Fernandez, A., Clark, M.E., Guillou, M., Jahn, M.M., Erda, L., Mamo, T., Bo, N.V., Nobre, C.A. and Scholes, R.J., 2012. Achieving food security in the face of climate change: Final report from the Commission on Sustainable Agriculture and Climate Change. **Lab:** Carbon stocks, GHG values, IPCC carbon default values
Feb. 17, 19	**Lecture:** Biodiversity and Intensification Tradeoffs and Synergies **Readings:** Kremen, C. and A. M. Merenlender. 2018. Landscapes that work for biodiversity and people. Science 362 Phelan et al. **Lab:** Water availability, quality
Feb. 24, 26	**General Discussion about production and environmental domains** **Readings**: *Herrero, M., Thornton, P.K., Gerber, P. and Reid, R.S., 2009. Livestock, livelihoods and the environment: understanding the trade-offs. Current Opinion in Environmental Sustainability, 1(2), pp.111-120.

	*Springmann, M. et al. 2018. Options for keeping the food system within environmental limits. Nature 562: 519-525. *Clark, M. and D. Tilman. 2017. Comparative analysis of environmental impacts of agricultural production systems, agricultural input efficiency, and food choice. Environmental Research Letters 12:111002 Swinton, S.M., Lupi, F., Robertson, G.P. and Hamilton, S.K., 2007. Ecosystem services and agriculture: cultivating agricultural ecosystems for diverse benefits. **Assignment:** Course exam – handed out – due Friday Feb 28 **Assignment Due**: Final outline due for case study **Lab:** GIS, Spatial analysis
Mar. 2, 6	**SPRING BREAK**
Mar. 9, 11	**Lecture**: Agriculture as an engine for growth **Reading**: *Johnston, B.F. and Mellor, J.W., 1961. The role of agriculture in economic development. The American Economic Review, 51(4), pp.566-593. *Barrett, C.B., Christian, P. and Shiferaw, B.A., 2017. The structural transformation of African agriculture and rural spaces: introduction to a special section. Agricultural Economics, 48(S1), pp.5-10. *Jayne, T.S., S. Snapp, F.Place, N. Sitko. 2019. Sustainable agricultural intensification in an era of rural transformation in Africa. Global Food Security 20: 105-113. Barrett, C.B., Carter, M.R. and Timmer, C.P., 2010. A century-long perspective on agricultural development. American Journal of Agricultural Economics, 92(2), pp.447-468. De Janvry, A. and Sadoulet, E., 2009. Agricultural growth and poverty reduction: Additional evidence. The World Bank Research Observer, 25(1), pp.1-20. **Lab:** poverty, income
Mar. 16, 18	**Lecture**: Discussion on technology adoption and agricultural markets continued **Readings**

	*** Lee, D.R. 2005.Agricultural sustainability and technology adoption: Issues and policies for developing countries American Journal of Agricultural Economics 87: 1325-1334. *** Jayne, T. and Rashid, S. 2013. Input subsidy programs in SubSaharan Africa: a synthesis of recent evidence. Agricultural Economics 44: 547 - 562 *** Liverpool-Tasie, L.S.O., Omonona, B.T., Sanou, A. and Ogunleye, W.O., 2017. Is increasing inorganic fertilizer use for maize production in SSA a profitable proposition? Evidence from Nigeria. Food Policy, 67, pp.41-51. De Janvry, A., Fafchamps, M. and Sadoulet, E., 1991. Peasant household behaviour with missing markets: some paradoxes explained. The Economic Journal, 101(409), pp.1400-1417. Fafchamps, M. 2003. Market Institutions in SubSaharan Africa: Theory and Evidence (selected portions) Nkonya, Marenya, P, C.B. Barrett. 2007. Household-level determinants of adoption of improved natural resources management practices among smallholder farmers in western Kenya. Food Policy 32: 515-536**.** **Lab:**
Mar. 23, 25	**Lecture**: Food Security, Nutrition, and Health – From definition to measurement **Readings:** *FAO, IFAD, UNICEF, WFP and WHO. 2017. *The State of Food Security and Nutrition in the World 2017. Building resilience for peace and food security*. Rome, FAO. ** Gero Carletto, Marie Ruel, Paul Winters & Alberto Zezza (2015) Farm-Level Pathways to Improved Nutritional Status: Introduction to the Special Issue, The Journal of Development Studies, 51:8, 945-957, DOI: 10.1080/00220388.2015.1018908 Webb, P. and Kennedy, E., 2014. Impacts of agriculture on nutrition: nature of the evidence and research gaps. Food and nutrition bulletin, 35(1), pp.126-132. ** Jones, Andrew D. 2017. Critical review of the emerging research evidence on agricultural biodiversity, diet diversity, and nutritional status in low-and middle-income countries. Nutrition Reviews 75: 769-782.

	Poppy, G. M., Chiotha, S., Eigenbrod, F., Harvey, C. A., Honzák, M.,Hudson, M. D., et al. (2014). Food security in a perfect storm: using the ecosystem services framework to increase understanding. Philosophical Transactions of the Royal Society B, 369(1639), 20120288. Ranganathan, J. et al., 2016. Shifting Diets for a Sustainable Food Future, Washington, DC. http://www.wri.org/sites/default/files/Shifting_Diets_for_a_Sustainable_Food_Future.pdf. **Lab:** food security, nutrition
Mar 30, Apr 1	**Lecture**: Food Security, Nutrition, and Health – continued * Jones, A.D., Ngure, F.M., Pelto, G. and Young, S.L., 2013. What are we assessing when we measure food security? A compendium and review of current metrics. Advances in Nutrition: An International Review Journal, 4(5), pp.481-505. *Frelat, R. S. Lopez-Ridaura, K. E. Giller, M. Herrero, S. Douxchamps, A. A. Djurfeldt, O. Erenstein, B. Henderson, M. Kassie, B. K. Paul, C. Rigolot, R. S. Ritzema, D. Rodriguez, P. J. A. van Asten, and M. T. van Wijk. 2016. Drivers of household food availability in sub-Saharan Africa based on big data from small farms. PNAS 113: 458-463. * DeFries, R., Fanzo, J., Remans, R., Palm, C., Wood, S. and Anderman, T.L., 2015. Metrics for land-scarce agriculture. Science, 349(6245), pp.238-240. *Willett, W. et al. 2019. Food in the Anthropocene : the EAT-*Lancet* Commission on healthy diets from sustainable food systems. Lancet 393: 447-492. Clark, M. A., M. Springmann, J. Hill, D. Tilman. 2019. Multiple health and environment impacts of foods. PNAS 1906908 1 16. Herrero, M., Thornton, P.K., Power, B., Bogard, J.R., Remans, R., Fritz, S., Gerber, J.S., Nelson, G., See, L., Waha, K. and Watson, R.A., 2017. Farming and the geography of nutrient production for human use: a transdisciplinary analysis. The Lancet Planetary Health, 1(1), pp.e33-e42. Headey, D., 2011. Turning economic growth into nutrition-sensitive growth. Washington, DC: International Food Policy Research Institute. *Anderman, T. L., R. Remans, S. A. Wood, K. DeRosa, R. S. DeFries. 2014. Synergies and tradeoffs between cash crop production and food security: a case study in rural Ghana. Food Sec. DOI 10.1007/s12571-014-0360-6

	*Cooper, M. W. and C. T. West. 2017. Unraveling the Sikasso Paradox: Agricultural Change and Malnutrition in Sikasso, Mali, Ecology of Food and Nutrition, 56:2, 101-123, DOI: 10.1080/03670244.2016.1263947 **Lab**: work on case study analyses
Apr. 6, 8	**Lecture:** Policies, institutions and methods for negotiating tradeoffs and implementing sustainable agricultural intensification. ***Reardon, T., Barrett, C., Kelly, V. and Savadogo, K., 1999. Policy reforms and sustainable agricultural intensification in Africa. Development policy review, 17(4), pp.375-395. Lybbert, T.J. and Sumner, D.A., 2012. Agricultural technologies for climate change in developing countries: Policy options for innovation and technology diffusion. Food Policy, 37(1), pp.114-123. Rocha, C., 2009. Developments in national policies for food and nutrition security in Brazil. Development Policy Review, 27(1), pp.51-66. Wodon, Q. and Zaman, H., 2009. Higher food prices in Sub-Saharan Africa: Poverty impact and policy responses. The World Bank Research Observer, 25(1), pp.157-176. Dorward, A., Fan, S., Kydd, J., Lofgren, H., Morrison, J., Poulton, C., Rao, N., Smith, L., Tchale, H., Thorat, S. and Urey, I., 2004. Institutions and Policies for Pro-poor Agricultural Growth. Development Policy Review, 22(6), pp.611-622. DeFries, R.S., Fanzo, J., Mondal, P., Remans, R. and Wood, S.A., 2017. Is voluntary certification of tropical agricultural commodities achieving sustainability goals for small-scale producers? A review of the evidence. Environmental Research Letters, 12(3), p.033001. * Leach, A. M., K. A. Emery, J. Gephart, K. F. Davis, J. W. Erisman, A. Leip, M. L. Pace, P. D'Odorico, J. Carr, L. C. Noll, E. Castner, J. N. Galloway. 2016. Environmental impact food labels combining carbon, nitrogen, and water footprints. Food Policy 61:213–223. *Pingali, P. L. and M. W. Rosegrant. 1995. Agricultural commercialization and diversification: processes and policies. Food Policy 20: 171-185. *Smith, V.H., 2016. Producer insurance and risk management options for smallholder farmers. The World Bank Research Observer, 31(2), pp.271-289. Kozar, R. and Scherr, S.J., 2013. WFP Promotes Resilience in Chronic Food

	Insecure Areas of Ethiopia. Washington, DC: EcoAgriculture Partners. **Discussion** on policies and institutions that promote SAI
Apr. 13, 15	**Lecture:** Gender, equity **Readings: tbd** **Lab**: Women's empowerment index
Apr. 20, 22	Wrap up: Discussion overview, key points of semester **Discussion** **Case study:** Hand in case study 24 April **Lab:** Present case study findings

15. Services for Students with Disabilities

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, www.dso.ufl.edu/drc/) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.
0001 Reid Hall, 352-392-8565, **www.dso.ufl.edu/drc/**

16. Software Use – All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

17. Services for Students with Disabilities.
Services for Students with Disabilities
The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation

0001 Reid Hall, 352-392-8565, www.dso.ufl.edu/drc/

18. Your well-being is important to the University of Florida.

Campus Helping Resources

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575, www.counseling.ufl.edu

Counseling Services

Groups and Workshops

Outreach and Consultation

Self-Help Library

Wellness Coaching

- U Matter We Care, www.umatter.ufl.edu/

- Career Resource Center, First Floor JWRU, 392-1601, www.crc.ufl.edu/next-level

19. Student Complaints:

- Residential Course: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf
- Online Course: http://www.distance.ufl.edu/student-complaint-process