

Master of Science in Sustainability Management

SUMA PS 5240 Sustainable Agriculture

Dates: Session X (May 20 - Aug 9), Thursdays 6:10 pm-8:00 pm **Location:** TBD

3 Credits

[Area 5, Area 3 or Elective]

| | |
|---------------------------|---|
| Instructor: | Bruce M. Kahn, PhD, bk2501@columbia.edu , 917-509-3376 |
| Office Hours: | 2929 Broadway, 5th Floor Thursday 4:30-6 pm and by appointment. |
| Response Policy: | Preferred means of communication is via email and students can expect responses typically within 24 hours |
| Teaching Assistant | TBD |
| Office Hours: | 2929 Broadway, 5th Floor Thursday 4:30-6 pm and by appointment. |
| Response Policy: | Preferred means of communication is via email and students can expect responses typically within 24 hours |

Course Overview

This course is an introduction to how Global Agriculture and Sustainability issues are at the intersection of natural resource management and business. The course will devote a significant of time covering the fundamental principles of agribusiness and how sustainability issues are key factors in business decision making today and in the future.

The course will consider that agricultural production will need to double over the next three decades in order to meet growing demand. Demand for increased food, feed, fuel, and fiber is driven by increased population and an increase in the middle class in emerging economies. Coupled with a shift in dietary preferences from grains and staple carbohydrates to more protein-based diets including pork and beef (and perhaps fish), and biofuel production, more grains will be used to feed animals and fuel our automobiles. As an energy intensive sector, agriculture is closely linked to energy markets, with crop production and demand potentially adversely affected by higher oil prices, while crop inputs (such as fertilizer) may benefit from lower natural gas prices. These shifting dynamics will affect profit margins in different segments of the agricultural supply chain. In addition to energy prices, likely constraints to the productivity growth of agriculture include climate change, water resources, infrastructure, education and training of producers, and social / governmental policy that distort agricultural markets. New technologies, product platforms and innovative business models in agriculture technology and food systems will dominate the shift from industrial agriculture to a more socially just and environmentally sustainable food production and distribution system. The agricultural technology sector is large, comprising over 8,500 companies generating over \$1.3 trillion of revenue per year, in the US alone. Moreover, the volume of transactions in the agricultural sector is greater than \$15 billion per year with an estimated peak of over \$70 billion in 2007.

The course will satisfy the MS in Sustainability Management program's General and Financial Management curriculum requirement and the program's Integrative Sustainability Management requirement.

Learning Objectives

The primary goal for the course is to familiarize students with critical components of agribusiness and the metrics to evaluate the sustainability of these activities.

Students are assumed to have had no or little previous exposure to agriculture, agricultural economics or agriculture finance. A basic knowledge of Word, PowerPoint and Excel will be useful. By the end of the course, students will

be able to: (1) Demonstrate a solid understanding of the global sources of agricultural information such as production, yield and trade, (2) Understand how the global agriculture industry is challenged by sustainability risks, and (3) Apply a working knowledge of the rules and regulations that govern agriculture.

Readings

Session 1: Introduction to Agriculture

- OECD & FAO 2013-2022 Agriculture Outlook

Session 2: What is agriculture and how has it evolved

- (TEXTBOOK) Merchants of Grain
- Godfray HCJ, Beddington JR, Crute IR, Haddad L, Lawrence D, et al. (2010) Food security: The challenge of feeding 9 billion people. *Science* 327:812–818.

Session 3: Agriculture Asset Classes & Investment Trends; Global Trade Flows; Agricultural Finance

- DBCCA. (2009) Investing in Agriculture. Far-Reaching Challenge, Significant Opportunity: An Asset Management Perspective
- Chen *et al.* (2013) Investing in Agriculture as an Asset Class. Agribusiness and Applied Economics Report 711, North Dakota State University.
- Geman, H. and Martin, G. (2011) Understanding Farmland Investment as Part of a Diversified Portfolio. Bunge Global Agribusiness.
- Hoffman *et al.* (2012) Real Asset Replication
- Lang *et al.* (2017) Investing in Sustainable Food & Agriculture.
- TIAA-CREF (2014) Real Assets White Paper
- USSEC (2011) How the Global Oilseed and Grain Trade Works. HighQuest Partners, Danvers, CA.

Session 4: Soil fertility & fertilizers; GMOs and Organics; Chemicals: Pesticides, Insecticides, Fungicides

- Smil, V. (2011) Nitrogen cycle and world food production. *World Agriculture* 2:9-1.
- Foley J. A., Ramankutty, N., Brauman, K.A., Cassidy, E.S., Gerber, J.S., *et al.* (2011) Solutions for a cultivated planet. *Nature* 478: 337–342.
- UCS (2009) Failure to Yield: Evaluating the Performance of Genetically Engineered Crops. Union of Concerned Scientists.
- MSCI: Bayer AG. Report
- MSCI (2016) Specialty Chemicals
- (TEXTBOOK) Enriching the Earth, Vaclav Smil
- Whiting, D. *et al.* (2011) Estimating Soil Texture. Colorado State University.

Session 5: The US Farm Bill & Export Tariffs; Land Grab and Farmland Investment Principles, Infrastructure

- Hertel, T. W. (2011, January) The Global Supply and Demand for Agricultural Land in 2050. *American Journal of Agricultural Economics*.
- Murray, L. & McGrath, M. (2016) Sustainable Farmland Investment Strategies: An Introduction to Current

Conditions. *Independent Study* - Yale School of Management and Yale School of Forestry.

- Speller, W. *et al.* (2017) The Impact of Larger-Scale Agricultural Investments on Local Communities: Updated Voices from the Field. *World Bank Group*. Report Number 114431-GLB. Washington, D.C.

Session 6: Ranching & Rotational Grazing; Animals Husbandry and Antibiotics; Dairy

- Behnassi, M., Shahid, Shabbir, A., and D'Silva, J. (2011) Animal Husbandry in Focus of Sustainability, 2011 in Sustainable Agricultural Development.
- Eisler, M. C. & Lee, R. F. M. (2014, March 6) Steps to sustainable livestock. *Nature*. Vol: 507: 32 – 34.

Session 7: Commodities Trading; Futures & Forwards; Coffee & Cocoa and Sugar; Palm Oil

- WWF (2012) The 2050 Criteria. World Wildlife Fund.
- CES (2016) Ag. Markets Drivers into 2016 and Beyond
- Murphy, S., Burch, D. and Clapp, J. (2012) Cereal Secrets: The world's largest grain traders and global agriculture. Oxfam Research Reports.

Session 8: Biofuels & Biomass; Food for fuel; Migrant workers and Labor

- Speller, W. *et al.* (2017) The Impact of Larger-Scale Agricultural Investments on Local Communities: Updated Voices from the Field. *World Bank Group*. Report Number 114431-GLB. Washington, D.C.
- Grassroots International (2010) Food Sovereignty Booklet.

Session 9: Greenhouses, vertical farming & indoor farming; Aquaculture & Hydroponics; Ag. Tech

- Payne, L. (2012, November) Latest Agriculture Technology Innovation. Kachan & Co.
- DBCCA (2012) Cleaner Technologies Evolving Towards a Sustainable End-State Excerpt

Session 10: Climate Change; Water; Deforestation

- FAO. (2016) The State of Food and Agriculture 2016: Climate Change, Agriculture and Food Security. *Food and Agriculture Organization of the United Nations*. Rome.
- DBCCA (2012) Cleaner Technologies Evolving Towards a Sustainable End-State Excerpt
- Hertel, T. W. (2011) Global Supply and Demand for Agricultural Land in 2050. *American Journal of Agricultural Economics*.
- CERES (2014) Water & Climate Risk Facing US Corn Production: How Companies and Investors and Cultivate Sustainability.
- (TEXTBOOK) Out of the Earth

Session 11: Food Manufacturing & Supply Chains; Food Waste and Food Service; Farmers Markets & CSAs

- Gunders, Dana. (2012) Wasted: How America Is Losing Up to 40 Percent of Its Food from Farm to Fork to Landfill. Natural Resources Defense Council.

- Lipinski, B., Hanson, C., Waite, R., Searchinger, T., Lomax, J. and Kitinoja, L. (2013) *Creating a Sustainable Food Future, Reducing Food Loss and Waste*. World Resources Institute.
- UCS (2013, August) *The \$11 trillion dollar reward*. Union of Concerned Scientists.
- CDP (2016) *Supply Chain Report: Harnessing the Power of a Sustainable Future*, Carbon Disclosure Project.
- Stice *et al.* (2016) *De-risking protein strategies using a systems approach*. Lux Research.

Additional Readings (General):

- Caldecott, B., Howarth, N. & McSharry, P. (2013) *Stranded Assets in Agriculture: Protecting Value from Environment-Related Risks*. *Smith School of Enterprise and the Environment: University of Oxford*. Oxford.
- FAO (2015) *Natural Capital Impacts in Agriculture*. Food and Agriculture Organization of the United Nations, Rome.
- FAO. (2013) *Global agriculture towards 2050*. Rome, FAO. OECD/FAO (2013), *OECD-FAO Agricultural Outlook 2013–2022*, OECD Publishing and FAO.
- Rockström, J. *et al.* (2015) *Sustainable intensification of agriculture for human prosperity and global sustainability*. *Ambio 2017*. Vol 46: 4-17.
- Tilman D, Balzer C, Hill J, Befort BL (2011) *Global food demand and the sustainable intensification of agriculture*. *Proc Natl Acad Sci USA* 108: 20260–20264.
- World Economic Forum. (2012) *Putting the New Vision for Agriculture into Action: A Transformation is Happening*. *World Economic Forum*. Geneva.
- McKinsey: *Resource Revolution* (2011)
- UCS (2013) *The Healthy Farm: A Vision for US Agriculture*. Union of Concerned Scientists Policy Brief
- World Economic Forum. (2012) *Putting the New Vision for Agriculture into Action: A Transformation is Happening*. *World Economic Forum*. Geneva.

RECOMMENDED BOOKS:

Conkin, P.K. *A revolution down on the farm: The Transformation of American Agriculture since 1929*. The University Press of Kentucky. 2009.

Hillel, Daniel. *Out of the Earth. Civilization and the Life of the Soil*, N.P.: Aurum, 1992.

Morgan, Dan. *Merchants of Grain. The Power and Profits of Five Giant Companies at the Center of the World's Food Supply*. New York: Viking, 1979.

Smil, Vaclav. *Enriching the Earth: Fritz Haber, Carl Bosch, and the Transformation of World Food Production*. Cambridge, MA: MIT, 2001.

Regenesis: Feeding the World Without Devouring the Planet Paperback – August 2, 2022
by George Monbiot (Author). ISBN-10 : 0143135961. ISBN-13 : 978-0143135968

The Role of Biotechnology in a Sustainable Food Supply 1st Edition by Jennie S. Popp (Editor), Molly M. Jahn (Editor), Marty D. Matlock (Editor). 2012. ISBN-10 : 052119234X. ISBN-13 : 978-0521192347

<https://www-cambridge-org.ezproxy.cul.columbia.edu/core/books/role-of-biotechnology-in-a-sustainable-food-supply/4BC1C4D3490E0824D8D50F065F4A5ED3>

How to Feed the World 3rd None ed. Edition by Jessica Eise (Editor), Dr. Ken Foster (Editor). 2018. ISBN-10 : 1610918843. ISBN-13 : 978-1610918848.

<https://webpebscohostcom.ezproxy.cul.columbia.edu/ehost/ebookviewer/ebook/ZTAyNXhuYV9fMjAxMzcyOF9fQU41?sid=80d510f9-4a69-49d6-aa4c-3e906fbbe6cb@redis&vid=0&format=EB&rid=1>

Assignments and Assessments

The course will be imparted over 14 two-hour sessions. Introductory textbooks are recommended for the course and additional readings from key reports, websites and magazine/news articles will be supplemented by real, practical examples of sustainability issues in today's agribusiness industry.

Regular attendance in class is required and students are expected to have done the readings for each class. Grading for the course will be determined by the following:

1. Participation

Contribute to class discussions. This means enhancing the quality of the class experience for yourself and others. It involves making relevant, useful and non-obvious comments and posing pertinent questions in clear and succinct language. The Course will conduct 2 or 3 Fieldtrips to regional operating organic farms and to a Dairy Distribution Warehouse in the Hunt's Point Distribution Center in the Bronx, NY.

2. Research Projects:

You will complete 5 short assignments that consist of a research paper and in-class presentations covering key issues related to sustainability & agribusiness. Each paper will be worth 20 points.

The class will be organized by Modules. Each Module will contain a 20 minute in-class presentation and written report (maximum 25 pages). The report and oral presentation will be graded on a letter grade scale from F to A+. Projects will be evaluated for demonstration of knowledge of agribusiness and the implications for sustainability, and the demonstration of the use and analysis of agricultural data both quantitative and qualitative. All students in a group receive the same grade for the written report and an individual grade for their oral presentation. Students will form groups of 4-5 and will be assigned a project topic, assessing a sustainable agriculture theme.

The final course grade will be computed using a weighted index of numeric grades that combine the grades for papers, attendance and participation, and oral presentation, scaled into a letter final grade scale from F to A+.

Grading

The final grade will be calculated as described below:

FINAL GRADING SCALE

| Grade | Percentage |
|-------|-----------------|
| A+ | 98–100 % |
| A | 93–97.9 % |
| A- | 90–92.9 % |
| B+ | 87–89.9 % |
| B | 83–86.9 % |
| B- | 80–82.9 % |
| C+ | 77–79.9 % |
| C | 73–76.9 % |
| C- | 70–72.9 % |
| D | 60–69.9 % |
| F | 59.9% and below |

| Assignment/Assessment | % Weight | Individual or Group/Team Grade |
|-----------------------|----------|--------------------------------|
| Assignment 1 | 20 | Group |
| Assignment 2 | 20 | Group |
| Assignment 3 | 20 | Group |
| Assignment 4 | 20 | Group |
| Assignment 5 | 20 | Group |

Course Schedule/Course Calendar

| Session | Date | Presenting Group 1 | Presenting Group 2 | Presenting Group 3 | Topic 1 | Topic 2 | Topic 3 | Guest Lecturer |
|---------|---------|--------------------|--------------------|--------------------|---|---|---|------------------------------------|
| 1 | 23-May | | | | Introduction to Sustainable Agriculture | | | |
| 2 | 30-May | | | | Agronomy, Soil Chemistry, and Sustainable Agriculture | | | |
| 3 | 6-June | 3 or 4 Students | 3 or 4 Students | 3 or 4 Students | Agriculture Asset Classes and Investment Trends | Global Trade Flows | Agricultural Finance | |
| 4 | 13-June | 3 or 4 Students | 3 or 4 Students | 3 or 4 Students | Soil Fertility and Fertilizers | GMOS and Organics | Chemicals: Pesticides, Insecticides, Fungicides | |
| 5 | 20-June | 3 or 4 Students | 3 or 4 Students | 3 or 4 Students | US Farm Bill | Land Grab: Farmland Investment Principles | Infrastructure | |
| 6 | 27-June | 3 or 4 Students | 3 or 4 Students | 3 or 4 Students | Ranching and Rotational Grazing | Animal Husbandry and Antibiotics | Dairy | Alt Protein - Guest Speaker |

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|----|--------|-----------------|-----------------|-----------------|--|------------------------------|---------------------------|------------------------------------|
| | 4-Jul | NO CLASS | | | | | | |
| 7 | 11-Jul | 3 or 4 Students | 3 or 4 Students | 3 or 4 Students | Biofuels and Biomass | Cocoa, Coffee, and Sugar | Palm Oil | Commodities - Guest Speaker |
| 8 | 18-Jul | 3 or 4 Students | 3 or 4 Students | 3 or 4 Students | Greenhouse / indoor farming / vertical farming/hydropoincs | Aquaculture | Ag Tech | Bankers - Guest Speaker |
| 9 | 25-Jul | 3 or 4 Students | 3 or 4 Students | 3 or 4 Students | Migrant Workers and Labor | Water | Deforestation | |
| 10 | 1-Aug | 3 or 4 Students | 3 or 4 Students | 3 or 4 Students | Food Manufacturing and Supply Chains | Food Waste and Food Services | Farmers Markets and CSA's | |
| 11 | 8-Aug | 3 or 4 Students | 3 or 4 Students | 3 or 4 Students | Open Topics | Open Topics | Open Topics | |
| 12 | 15-Aug | 3 or 4 Students | 3 or 4 Students | 3 or 4 Students | Open Topics | Open Topics | Open Topics | |

Course Policies

Participation and Attendance

Students are expected to arrive on time, attend all classes, and to stay until the end of class unless they have notified the instructor at the beginning of the session that they will be leaving early. Each unexcused absence will result in a 1 point deduction from the participation grade.

Late Work

Assignments are due on the dates/times identified. One letter grade will be deducted from any assignment submitted after the due date/time. No assignment will be accepted after the deadline for submitting final grades.

Incompletes

As outlined in the School's grading and academic starts policy, "A grade of 'I' (incomplete) is a temporary grade indicating failure to complete assigned work. The mark is given only upon the request of the student and at the discretion of the instructor. The student and faculty member must sign a completed 'Request for Grade of Incomplete Form' before the final class session. The 'I' must be removed within one year after the end of the semester in which the student received the grade. Students seeking an extension of this time limit must have the approval of the instructor and successfully petition of the director of their program. If no petition is made, or if the petition is unsuccessful, the grade is changed to an N-Permanent Incomplete- which remains on the student's permanent record.

Citation & Submission

All written assignments must use standard citation format (e.g., MLA, APA, Chicago), cite sources, and be submitted to the course website (not via email).

School and University Policies and Resources

Copyright Policy

Please note—Due to copyright restrictions, online access to this material is limited to instructors and students currently registered for this course. Please be advised that by clicking the link to the electronic materials in this course, you have read and accept the following:

The copyright law of the United States (Title 17, United States Code) governs the making of photocopies or other reproductions of copyrighted materials. Under certain conditions specified in the law, libraries and archives are authorized to furnish a photocopy or other reproduction. One of these specified conditions is that the photocopy or reproduction is not to be "used for any purpose other than private study, scholarship, or research." If a user makes a request for, or later uses, a photocopy or reproduction for purposes in excess of "fair use," that user may be liable for copyright infringement.

Academic Integrity

Columbia University expects its students to act with honesty and propriety at all times and to respect the rights of others. It is fundamental University policy that academic dishonesty in any guise or personal conduct of any sort that disrupts the life of the University or denigrates or endangers members of the University community is unacceptable and will be dealt with severely. It is essential to the academic integrity and vitality of this community that

individuals do their own work and properly acknowledge the circumstances, ideas, sources, and assistance upon which that work is based. Academic honesty in class assignments and exams is expected of all students at all times.

SPS holds each member of its community responsible for understanding and abiding by the SPS Academic Integrity and Community Standards posted at <https://sps.columbia.edu/students/student-support/academic-integrity-community-standards>. You are required to read these standards within the first few days of class. Ignorance of the School's policy concerning academic dishonesty shall not be a defense in any disciplinary proceedings.

Diversity Statement

It is our intent that students from all diverse backgrounds and perspectives be well-served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that the students bring to this class be viewed as a resource, strength and benefit. It is our intent to present materials and activities that are respectful of diversity: gender identity, sexuality, disability, age, socioeconomic status, ethnicity, race, nationality, religion, and culture.

Accessibility

Columbia is committed to providing equal access to qualified students with documented disabilities. A student's disability status and reasonable accommodations are individually determined based upon disability documentation and related information gathered through the intake process. For more information regarding this service, please visit the University's Health Services website: <https://health.columbia.edu/content/disability-services>.

School Policies and Expectations:

Accessibility Statement – I want you to succeed in this course. Contact disability@columbia.edu for learning accommodations.

Names/Pronouns

You deserve to be addressed in a manner that reflects your identity. You are welcome to tell me your pronoun(s) and/or name (if different from University records) at any time, either in person or via email.

Discrimination

We embrace the diversity of gender, gender identity & expression, sex, sexual orientation, race, ethnicity, national origin, age, religion, disability status, family status, socioeconomic background, and other visible and non-visible identities. Columbia University does not tolerate unlawful discrimination, discriminatory harassment, sexual assault, domestic violence, dating violence, stalking, or sexual exploitation and all such conduct is forbidden by Columbia University Policy

Duty to Report

You deserve a University community free from discrimination, harassment, and gender-based misconduct including sexual harassment, sexual assault, domestic and dating violence, stalking, and sexual exploitation. It is therefore University policy to require Columbia faculty and staff to report to EOAA any instance or allegation of prohibited conduct involving any undergraduate or any graduate student that is disclosed to, observed by, or otherwise known

to that employee. This requirement to report is in place to help ensure that students are provided appropriate resources and to allow the University to mitigate harm to our community.

Confidential Resources

There are confidential resources on campus who do not have a Duty to Report, including: * Sexual Violence Response & Rape Crisis/Anti-Violence Support Center (SVR) * Ombuds Office * Medical Services * University Counseling and Psychological Services * University Pastoral Counseling * Columbia Office of Disability Services
University employees working in a confidential capacity will not report information shared with them.

Inclusion

In the M.S. in Sustainability Management program, faculty and staff are committed to the creation and maintenance of “inclusive learning” spaces – classrooms and other places of learning where you will be treated with respect and dignity, and where all individuals are provided equitable opportunity to participate, contribute, and succeed. All students are welcome regardless of race/ethnicity, gender identities, gender expressions, sexual orientation, socio-economic status, age, disabilities, religion, regional background, Veteran status, citizenship status, nationality and other diverse identities that we each bring to class.

Class Recordings

All or portions of the class may be recorded at the discretion of the Instructor to support your learning. At any point, the Instructor has the right to discontinue the recording if it is deemed to be obstructive to the learning process.

If the recording is posted, it is confidential and it is prohibited to share the recording outside of the class.

SPS Academic Resources

The Division of Student Affairs provides students with academic counseling and support services such as online tutoring and career coaching: <https://sps.columbia.edu/students/student-support/student-support-resources>.

Columbia University Information Technology

[Columbia University Information Technology](#) (CUIT) provides Columbia University students, faculty and staff with central computing and communications services. Students, faculty and staff may access [University-provided and discounted software downloads](#).

Columbia University Library

[Columbia's extensive library system](#) ranks in the top five academic libraries in the nation, with many of its services and resources available online.

The Writing Center

The Writing Center provides writing support to undergraduate and graduate students through one-on-one consultations and workshops. They provide support at every stage of your writing, from brainstorming to final drafts. If you would like writing support, please visit the following site to learn about services offered and steps for scheduling an appointment. This resource is open to Columbia graduate students at no additional charge. Visit <http://www.college.columbia.edu/core/uwp/writing-center>.

Career Design Lab

The Career Design Lab supports current students and alumni with individualized career coaching including career assessment, resume & cover letter writing, agile internship job search strategy, personal branding, interview skills, career transitions, salary negotiations, and much more. Wherever you are in your career journey, the Career Design Lab team is here to support you. Link to <https://careerdesignlab.sps.columbia.edu/>

Netiquette

Online sessions in this course may be offered through Zoom, accessible through Canvas. A reliable Internet connection and functioning webcam and microphone are required. It is your responsibility to resolve any known technical issues prior to class. Your webcam should remain turned on for the duration of each class, and you should expect to be present the entire time. Avoid distractions and maintain professional etiquette.

Please note: Instructors may use Canvas or Zoom analytics in evaluating your online participation.

More guidance can be found at: https://jolt.merlot.org/vol6no1/mintu-wimsatt_0310.htm

Netiquette is a way of defining professionalism for collaborations and communication that take place in online environments. Here are some Student Guidelines for this class:

- Avoid using offensive language or language that is not appropriate for a professional setting.
- Do not criticize or mock someone's abilities or skills.
- Communicate in a way that is clear, accurate and easy for others to understand.
- Balance collegiality with academic honesty.
- Keep an open-mind and be willing to express your opinion.
- Reflect on your statements and how they might impact others.
- Do not hesitate to ask for feedback.
- When in doubt, always check with your instructor for clarification.