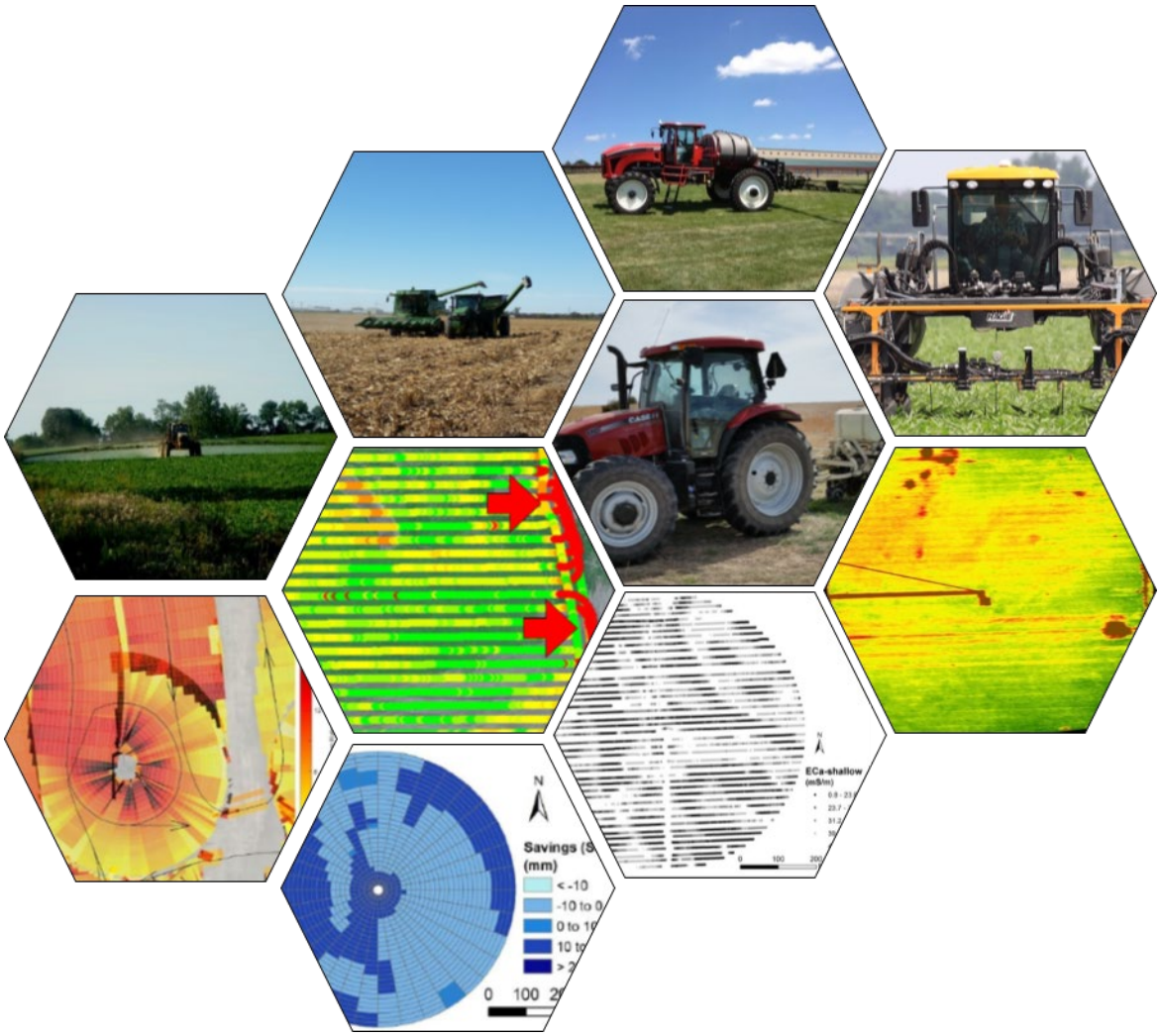
Site-Specific Crop Management



UNIVERSITY OF NEBRASKA - LINCOLN

Agronomy and Horticulture

Biological Systems Engineering

Fall 2021

Instructors:

Dr. Laila A. Puntel

Dr. Yeyin Shi

Course Description

AGRO/MSYM/AGEN 431. Site-Specific Crop Management (3 credit hours; 2 hours lecture and 2 hours laboratory). Prerequisites: AGRO/SOIL 153 and AGRO 204 or granted by instructors. The course is limited to senior level only or by permission.

Time and Location

Lectures begin remotely on Tuesday, August 24th; and in-person lab sessions begin on Monday, August 23rd. The semester will complete on Friday, December 17th. See detailed class schedule at the end of this document and the university academic calendar at https://registrar.unl.edu/academic-calendar/2021-2022/.

As we have a big class, we will adopt a "hybrid" style of teaching and learning which combines on-line and face-to-face activities with the safety concern of all the students, TAs, and instructors:

- Lectures are 100% on-line. Lectures are pre-recorded and are available at the beginning of each week. An online quiz will be assigned after each lecture for you to complete during the next 24 hours.
- Labs are face-to-face and will be in 214 Keim Hall during the time you enrolled in - Monday 4:00 - 6:00 PM, Tuesday 2:00 - 4:30 PM, or Thursday 2:00 - 4:30 PM. Students who are off campus please contact us in the first week of classes, and we will provide remote computer access for you to work from home.

  IMPORTANT! Please communicate with us by August 27th so that we can arrange remote computer access for your lab section. If no email is received, we would assume you will be on campus and attend the labs in person.

Purpose of the Course

The course overviews principles and applications of precision agriculture. It focuses on hands-on experience using hardware/software such as variable-rate sensing and application systems and information management systems for mastering the essential skills to adopt site-specific crop management.

Course Objectives

At the end of this course, you will be able to:

1. Use global navigation satellite system (GNSS) receivers for geo-referenced data collection and understand the meaning of geo-referenced data [ABET 6].
2. Use geographic information system (GIS) software to accomplish spatial data management [ABET 6].
3. Interpret data from yield monitoring systems and other relevant data acquisition equipment [ABET 6].
4. Differentiate major sources of errors and choose proper data handling strategies [ABET 6].
5. Identify potential uses of remote sensing and automated on-the-go measurement systems.
6. Explain the principles of variable rate application of seed, water, fertilizer, lime, and pesticides.
7. Examine yield and soil nutrient maps with other geo-referenced data to develop and demonstrate effective site-specific crop management programs [ABET 6].
8. Apply a systems approach combined with common sense to identify causes of spatial variability and develop corresponding recommendations.
9. Evaluate potential advantages (both economic and environmental) and current limitations of precision agriculture.
10. Communicate in both written, graphical, and oral forms an evidenced-based management plan to a customer (e.g., farmers) [ABET 3].
11. Demonstrate each of the five behaviors of an effective team member at least at the expected level [ABET 5].

ABET Outcomes

ABET 6: an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

ABET 3: an ability to communicate effectively with a range of audiences.

ABET 5: an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

Instructors

Laila Puntel, 175 Keim Hall, 402-472-6449, lpuntel2@unl.edu

Yeyin Shi, 213 Chase Hall, 402-4722140, yshi18@unl.edu

Office Hours: Monday 3-4 PM and by appointment.

Teaching Assistants / Laboratory Managers

Lin Wang, PhD student in Biological Systems Engineering, lin.wang@huskers.unl.edu

Jose Pinto, PhD student in Agronomy, jcesariopereirapin2@huskers.unl.edu

TA 3: TBD

Class Resources

Course materials and grades will be posted on Canvas.

Calculators and Computers

A calculator is required during tests and selected classroom exercises, cell phones won't be allowed. You are required to use computers for all your projects and assignments. The ability to effectively use composing (e.g., Word), spreadsheet (e.g., Excel), and slide presentation (e.g., PowerPoint) software is required. You are encouraged to bring a USB thumb drive (8 GB in size or greater) to save your files for lab activities (lab instructions, data, and GIS documents).

Building Access:

Keim Hall computer lab 214 is open during normal business hours. A special request can be made to access the building and lab during weekends and evening hours.

Course Administration

1. **Lectures:** Two lectures per week will be devoted to selected topics on site-specific crop management.

   Students are expected to study the pre-recorded lectures no later than the end of each lecture period. Students are also expected to attend the labs in-person unless you communicate with the instructor at the beginning of the semester that you will not be on campus this fall. Students should contact (email) the instructor prior to absences from lab periods. Up to 20 bonus points may be given for attendance and active participation in class discussions. Additional bonus points may be provided through the semester as deemed appropriate by the instructors.

2. **Quizzes:** Quizzes will be conducted throughout the semester after each lecture, each worth 10 points. Quizzes will be due by 12:00 PM on the same day of the lecture.

3. **Labs and Homeworks:** Lab attendance is mandatory for completion of homework assignments. Excused absences and/or advanced notice must be given to the instructor if you're unable to attend your lab session. Labs will be devoted to hands-on use of software and selected outside activities. Homework assignments will require computer laboratory software and will be assigned in-lab.

   Homeworks (assignments) are due one-week from the date of assignment at 12:00 PM for Monday, Tuesday, and Thursday Labs, respectively. Late assignments will not be accepted unless an excused absence or pre-approved (by the instructor) absence has been filed by the student. No points will be given for omitted assignments. ****A bonus homework will allow you to replace one (lowest) homework score from the previous assignments.**

4. **Exams:** Two exams will be given at around 1/3 and 2/3 of the semester, both covering materials specific to the preceding section of the course.

5. **Term Project:**

   The team project (and team members) will be assigned in the beginning of October. Details regarding specific requirements will be provided at that time; however, teams will be responsible for creating a project presentation (given in class during dead week) and project report that will be due on 11/15 by 12 PM CST).

Evaluation:

1. UNL policies for Pass/No Pass, Incompletes and Withdrawals apply.
2. Your final grade will be based upon your accumulated point total as a percentage of a possible 680 points (based on the Grading System in the UNL Undergraduate Bulletin):

A+	98 - 100%	B+	88 - 89%	C+	78 - 79%	D+	68 - 69%	F	0 - 60%
A	92 - 97%	B	82 - 87%	C	72 - 77%	D	62 - 67%		
A-	90 - 91%	B -	80 - 81%	C -	70 - 71%	D -	60 - 61%		

3. Allocation of points:

Quizzes	200
Lab Assignments / Homeworks	300
Exams	200
Term Project	100
Attendance & Participation Bonus	30
Total	830

Academic Dishonesty: The Code of Conduct published in the UNL Student Handbook concerning academic dishonesty applies. Students are expected to adhere to guidelines concerning academic dishonesty outlined in Section B of the University's Student Code of Conduct http://stuafs.unl.edu/dos/code. Students are encouraged to contact the instructor for clarification of these guidelines if they have questions or concerns.

Students with Disabilities Policy: Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 472-3787 voice or TTY.

Emergency Response Information

- **Fire Alarm (or other evacuation):** In the event of a fire alarm: Gather belongings (Purse, keys, cellphone, N-Card, etc.) and use the nearest exit to leave the building. Do not use the elevators. After exiting notify emergency personnel of the location of persons unable to exit the building. Do not return to building unless told to do so by emergency personnel.
- **Tornado Warning:** When sirens sound, move to the lowest interior area of building or designated shelter**.** Stay away from windows and stay near an inside wall when possible.
- **Active Shooter**
  - **Evacuate:** if there is a safe escape path, leave belongings behind, keep hands visible and follow police officer instructions.
  - **Hide out:** If evacuation is impossible secure yourself in your space by turning out lights, closing blinds and barricading doors if possible.
  - **Take action**: As a last resort, and only when your life is in imminent danger, attempt to disrupt and/or incapacitate the active shooter.
- **UNL Alert:** Notifications about serious incidents on campus are sent via text message, email, unl.edu website, and social media. For more information go to: http://unlalert.unl.edu.
- Additional Emergency Procedures can be found here: http://emergency.unl.edu/doc/Emergency_Procedures_Quicklist.pdf

COVID Responses

You are required to follow the University of Nebraska COVID-19 guidelines. You can find more details in the following link https://covid19.unl.edu/students .

If you're not feeling well call the University Health Center at 402-472-5000 and press 1 on the menu to arrange a tele-health appointment. Do not wait to reach out. Symptoms of COVID-19 include fever, cough, sore throat and shortness

of breath or difficulty breathing. If you are experiencing these symptoms, you should self-quarantine and call the University Health Center or your health care provider before visiting.

Tentative Class Schedule - Site-Specific Crop Management 2021

Date			Lecture Topic	Lab #- Topic
Week 1	8/24/2021	T	**Introduction, Class Overview**	
	8/26/2021	Th	**GIS & Coordinate Systems**	
Week 2	8/30/2021	M		**1-ArcMap Intro**
	8/31/2021	T	**Spatial variability & Management zones**	**1-ArcMap Intro**
	9/2/2021	Th	**Soil Sampling and Analysis**	**1-ArcMap Intro**
Week 3	9/6/2021	M	**Labor Day – No Class/Lab**	
	9/7/2021	T	**Global Navigation Satellite Systems**	**2- GNSS Intro**
	9/9/2021	Th	**Soil Sensors**	**2- GNSS Intro**
Week 4	9/13/2021	M		**2- GNSS Intro**
	9/14/2021	T	**Terrain Analysis**	**3- Accessing Public Data**
	9/16/2021	Th	**Crop Canopy Sensors**	**3- Accessing Public Data**
Week 5	9/20/2021	M		**3- Accessing Public Data**
	9/21/2021	T	**Remote Sensing for Precision Ag**	**4- Soils Data Processing**
	9/23/2021	Th	**N Recommendations from Crop Canopy Sensors**	**4- Soils Data Processing**
Week 6	9/27/2021	M		**4- Soils Data Processing**
	9/28/2021	T	**Discussion session LIVE via Zoom**	**5- UAV Image Processing**
	9/30/2021	Th	**Exam I**	**5- UAV Image Processing**
Week 7	10/4/2021	M		**5- UAV Image Processing**
	10/5/2021	T	**Exam I Review & Discussion session LIVE via Zoom**	**6- Yield Data Processing**
	10/7/2021	Th	**Yield Monitoring Systems**	**6- Yield Data Processing**
Week 8	10/11/2021	M		**6- Yield Data Processing**
	10/12/2021	T	**Yield Data Accuracy and Post Processing**	**7- Yield Editor Software**
	10/14/2021	Th	**Site-specific Nutrient Management I**	**7- Yield Editor Software**
Week 9	10/18/2021	M	**Fall Break – No Class/Lab**	
	10/19/2021	T	**Fall Break – No Class/Lab**	
	10/21/2021	Th	**Site-Specific Nutrient Management II**	**8- Rx Map Development**
Week 10	10/25/2021	M		**7- Yield Editor Software**
	10/26/2021	T	**Crop Modeling for site specific management I**	**8- Rx Map Development**
	10/28/2021	Th	**Crop Modeling for site specific management II**	**9- Field Data Analysis (Planting)**
Week 11	11/1/2021	M		**8- Rx Map Development**
	11/2/2021	T	**Technologies enabling VRA**	**9- Field Data Analysis (Planting)**
	11/4/2021	Th	**X-Planting Tech**	**10 - Field Data Analysis (SENSE)**
Week 12	11/8/2021	M		**9- Field Data Analysis (Planting)**
	11/9/2021	T	**Guest Lecture - Ag Economics Intro**	**10- Field Data Analysis (SENSE)**
	11/11/2021	Th	**Discussion session LIVE via Zoom**	**11- Profitability Analysis-Bonus HW / Work on Project**
Week 13	11/15/2021	M		**10- Field Data Analysis (SENSE)**
	11/16/2021	T	**Exam II**	**11- Profitability Analysis-Bonus HW / Work on Project**
	11/18/202	Th	**Exam II Review & Discussion session LIVE via Zoom**	**Work on Project**
Week 14	11/22/2021	M		**11- Profitability Analysis-Bonus HW / Work on Project**
	11/23/2021	T	**TBD**	**Work on Project**

	11/25/2021	Th	**Thanksgiving Break**	
Week 15	11/29/2021	M		**Work on Project**
	11/30/2021	T	**Guest Lecture - On Farm Research with Precision Ag**	**Work on Project**
	12/2/2021	Th	**Guest Lecture - Robotics and Machine Automation**	**Work on Project**
Week 16	12/6/2021	M		**Work on Project**
	12/7/2021	T	**Graduate student lectures**	**Work on Project**
	12/9/2021	Th	**Graduate student lectures**	**Work on Project**
Week 17	12/13/2021	M		**In Lab Project Presentation**
	12/14/2021	T	**No Class**	**In Lab Project Presentation**
	12/16/2021	Th	**No Class**	**In Lab Project Presentation**