

Syllabus

Topics in Agronomy PLNT 7620

Course title: Natural systems agriculture

PLNT 7620

Fall Term, 2025

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Faculty of Agricultural and Food Sciences

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COURSE DETAILS

Course Title & Number:	Topics in Agronomy PLNT 7620: Natural Systems Agriculture
Number of Credit Hours:	3
Class Times & Days of Week:	Once per week, 2.5 hours per meeting; Summer Institute classes May-July
Location for classes/labs/tutorials:	In-person, with on-line option
Pre-Requisites:	Please check with professor before registering

Instructor Contact Information

Instructor(s) Name & Preferred Form of Address:	Professor Entz
Office Location:	309 Plant Science
Office Hours or Availability:	I am widely available to students for consultation out of class or field tour hours. Please send me an email to arrange a meeting time.
Office Phone No.	204 474-6077
Email:	I will return a phone call or email-within 24 hrs (except weekends). All email communication must conform to the Communicating with Students university policy.
Contact:	I prefer students contact me by Email. If there is an urgent need for a meeting, students are welcome to drop by my office or lab – though I may not be in.

Course Description

U of M Course Calendar Description

An in-depth study of a nature-based agricultural paradigm.

Multiple course formats

Regular UM students; Students from other Universities; Non-University community members interested in the Certificate version. Note that this syllabus only applies to students taking the course for credit.

Course Calendar

The course will be offered from late May to early December, 2025. The summer institute will be required for all students.

2025			
January	February	March	April
S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S
1 2 3 4	1	1	1 2 3 4 5
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12 13 14 15 16 17 18	9 10 11 12 13 14 15	9 10 11 12 13 14 15	13 14 15 16 17 18 19
19 20 21 22 23 24 25	16 17 18 19 20 21 22	16 17 18 19 20 21 22	20 21 22 23 24 25 26
26 27 28 29 30 31	23 24 25 26 27 28	23 24 25 26 27 28 29	27 28 29 30
May	June	July	August
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4 5 6 7 8 9 10	8 9 10 11 12 13 14	6 7 8 9 10 11	3 4 5 6 7 8 9
11 12 13 14 15 16	15 16 17 18 19 20 21	13 14 15 16 17 18	10 11 12 13 14 15 16
17 18 19 20 21 22 23	22 23 24 25 26 27 28	20 21 22 23 24 25	17 18 19 20 21 22 23
24 25 26 27 28 29 30		27 28 29 30 31	24 25 26 27 28 29 30
September	October	November	December
S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S
1 2 3 4 5 6	1 2 3 4	1	1 2 3 4 5 6
7 8 9	5 6 7 8 9 10	8 9 10 11 12 13	8 9 10 11 12 13
14 15 16	12 13 14 15 16 17	15 16 17 18 19 20	15 16 17 18 19 20
21 22 23 24 25 26 27	19 20 21 22 23 24 25	22 23 24 25 26 27 28	22 23 24 25 26 27
28 29 30	26 27 28 29 30 31	29 30	29 30 31

The Summer Institute

This course module will consist of three sessions where students will visit farms, learn field methodology and interact with scientists involved in the UM LEAP project.

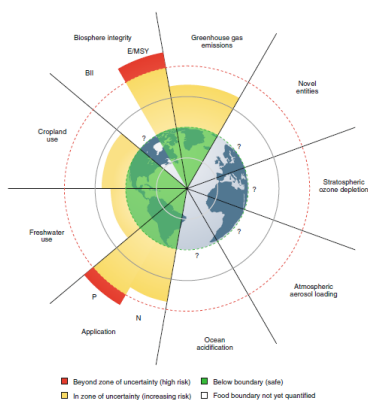
- Farm visits will be arranged so that students will experience how farmers design integrated systems that rely on nature-based practices to achieve the goals of nature-based, net zero aspiring, biodiverse, sustainable systems. Both settler and indigenous farming systems will be included.
- Students will spend time at the Natural Systems Agriculture Learning Centre and at the field sites connected to the LEAP project to learn field measurements involved in natural systems agriculture. The list of field measurements are included in the Landscape portion of the LEAP project at <https://umanitoba.ca/agricultural-food-sciences/leap>.
- The exact dates of the Summer Institute sessions will be dictated by student availability, which will be discerned through a student survey in April, 2025.

General Course Description

Through readings, discussion and other interactions, the course provides students with an in-depth examination of the scientific advances in natural systems agriculture in Canada and around world.

Course Goals

Humanity and other life on the planet may be approaching a catastrophic tipping point (Steffen et al., 2015). Of the 10 human managed processes described by Rockström et al. (2009) three are considered immediate threats. Biodiversity loss, use of reactive N and P in agriculture (ie., biogeochemical disturbance) and climate change have already exceeded the safe zone for humans. Future global food systems must be built on a foundation of sustainable primary production that bring human managed processes back into the safe zone.



This is not the first-time alarm bells have sounded. Canadian scientists raised concerns about soil organic matter (SOM) loss over 100 years ago and suggested more complex (permanent) farming systems (Janzen, 2001). Indeed, the first 100 years of Canadian prairie grain production were a tale of biophysical and social destruction. Indigenous peoples were cleared from the plains (Daschuk, 2013) so that European settlers could spend 100 years building a grain industry based on nutrients extracted from the soil's organic matter (Morrison and Kraft, 1994). Reconciliation with both indigenous peoples and the land is urgently required.

Some limited progress has been made. For example, while droughts of the 1930's wiped out crops across a large swath of the Canadian prairie, recent droughts were much less damaging. Improvements in soil water conservation, through a combination of higher SOM (St. Luce et al. 2024), reduction in summerfallow, and improved machinery and pest control technology (Lafond et al. 1996), have made Prairie cropping systems more resilient to weather stresses (Lychuck et al. 2019). Fertilization has "restored" nutrient balances after 100 years of nutrient mining (Morrison and Kraft, 1994) and the adequate nutrient supply coupled with greater carbon return to the land has facilitated improved soil biological function (Lupwayi et al. 1998). We must build on the successes of this "conservation agriculture revolution" to address the complex problems of biodiversity loss and climate change while at the same time rebalancing the planet's biogeochemical cycles.

The late John C. Gardner (Washington State Univ) stated "we have come through the mechanical and chemical eras of North American agriculture, and must now embrace the biological era". "Nature-based solutions" (NBS) are being used to describe this "biological era" (Miralles-Wilhelm 2022) and can involve conserving or rehabilitating natural ecosystems and/or the enhancement or the creation of natural process in modified or artificial ecosystems. Central to NBS is biodiversity.

This course offers a theoretical framework that blends ecological knowledge with the managed system that is agriculture. Diversity within Canadian society will also be discussed including overlooked knowledge and perspectives. For example, indigenous communities adapted agriculture to fit their ecosystems and social circumstances on the Great Plains for much of the previous millennia and were described by anthropologists as the tallest people in the world, an indication of a superior diet (Steckel and Prince, 2001). Another set of underrepresented voices are new Canadians. Canada is welcoming climate migrants from around the world (Khanna 2021), many from agrarian communities. Pathways for displaced communities to contribute to more sustainable agricultural systems are needed.

Critique of economic and social systems will focus on energy and power structures. University of Manitoba energy scholar Vaclav Smil (2022) shows how fossil fuels allowed food production to be uncoupled from many of the planet's critical ecological processes leading to simplified food systems that lack resilience in the face of stresses. Agricultural Economist John Ikerd (1993) argues that the apparent success of industrial thinking (i.e., the processes of mechanization, specialization, simplification, standardization, and centralization) is possible only because this energy has substituted for local ecological knowledge. Ikerd's assertion challenges the assumptions that we as crop and soil scientists have used to justify our "agriculture sustainability" efforts. Is our apparent success simply a thermodynamic miscalculation? Fortunately, University of Manitoba's Fikret Berkes et al. (2020) shows a hopeful path where local indigenous knowledge is embraced to improve sustainable resource management.

Finally, this course embraces Brian McLaren's (author of "Life after Doom" 2024) assertion that "We're either going to flock and circle with older generations that are trying to hold on to what they have and defend what they've done, or we're going to join with younger generations and with their desire to take these issues seriously because their entire future is going to unfold in a climate-changed world."

Course Learning Objectives

Course Objectives

- 1) Define nature-based solutions (NBS) and locate them within agricultural systems.
- 2) Learn how the NBS initiative evolved within national and international organizations and institutions and how it has increased engagement by non-primary agriculture production actors in food systems.
- 3) Study literature that:
 - a. Defines planetary boundaries (PB)
 - b. Explains how 10 billion people can be sustainably nourished while staying within PB
 - c. Understand the critical role of nature-based processes in achieving this goal
- 4) Learn about practical NBS examples in Canada and around the world.
- 5) Examine how the NBS approach can be blended with new and emerging technologies, for example, within the paradigm of "precision agroecology".
- 6) Learn how NBS are being explored in research using the example of the UM LEAP project.
- 7) Interview international NBS scholars.

- 8) Experience NBS on farms on the Canadian Prairies during the summer institute.

Textbook, Readings, and Course Materials

Students will be assigned weekly readings and the professor will post all papers on UM learn for ready student access.

Required textbook – There is no textbook for this course.

Supplementary readings – will be posted on UM Learn.

Recommended or required materials (e.g. lab equipment, art supplies, computers, etc.) – none required.

Using Copyrighted Material

Please respect copyright. We will use copyrighted content in this course. I have ensured that the content I use is appropriately acknowledged and is copied in accordance with copyright laws and university guidelines. Copyrighted works, including those created by me, are made available for private study and research and must not be distributed in any format without permission. Do not upload copyrighted works to a learning management system (such as UM Learn), or any website, unless an exception to the *Copyright Act* applies or written permission has been confirmed. For more information, see the University's Copyright Office website at <http://umanitoba.ca/copyright/> or contact um_copyright@umanitoba.ca.

Course Technology

The course will be offered in person, or a combination of in-person and on-line platforms. Students are free to use tablets, cellphones, laptops, etc. in the classroom provided these are used in a responsible, efficient, ethical and legal manner.

The course material will be available on UM Learn. Students can access UM learn using their UM user id's.

All written material will be checked for AI use. If AI programs, such as ChatGPT are used, this must be clearly stated and the section of the report that was created by ChatGPT must be clearly identified.

Expectations: I Expect You To

All students are expected to complete weekly reading before class. All students are expected to participate in class discussions. All students are expected to attend all classes. We will adhere to the UM's respectful work and learning policy See [Respectful Work and Learning Environment Policy](#).

Class Communication:

You are required to obtain and use your University of Manitoba email account for all communication between yourself and the university. All communication must comply with the Electronic Communication with Student Policy:

http://umanitoba.ca/admin/governance/governing_documents/community/electronic_communication_with_students_policy.html.

Academic Integrity:

Each student in this course is expected to abide by the University of Manitoba [Academic Integrity principles](#). Always remember to reference the work of others that you have used. Also be advised that you are required to complete your assignments independently unless otherwise specified. If you are encouraged to work in a team, ensure that your project complies with the academic integrity regulations. You must do your own work during exams. Inappropriate collaborative behavior and violation of other Academic Integrity principles, will lead to the serious [disciplinary action](#). Visit the [Academic Calendar](#), [Student Advocacy](#), and [Academic Integrity](#) web pages for more information and support.

Refer to specific course requirements for academic integrity for individual and group work such as:

- I. Group projects are subject to the rules of academic dishonesty;
- II. Group members must ensure that a group project adheres to the principles of academic integrity;
- III. Students should also be made aware of any specific instructions concerning study groups and individual assignments;
- IV. The limits of collaboration on assignments should be defined as explicitly as possible; and
- V. All work should be completed independently unless otherwise specified.

Recording Class Lectures:

Given the ease of audio and video recording and the tendency of some students to post the class lecture to the internet, the instructor should give some consideration as to whether or not they are comfortable with being recorded. A statement about copyright should be included here. Please note: if you are an UMFA member, you own your course content and, thus, the copyright to all your courses. If you are a sessional instructor, the university owns the course content and the copyright to the course.

Example: No audio or video recording of lectures or presentations is allowed in any format, openly or surreptitiously, in whole or in part without permission {YOUR NAME.} Course materials (both paper and digital) are for the participant's private study and research.

Student Accessibility Services:

The University of Manitoba is committed to providing an accessible academic community. [Students Accessibility Services \(SAS\)](#) offers academic accommodation supports and services such as note-taking, interpreting, assistive technology and exam accommodations. Students who have, or think they may have, a disability (e.g. mental illness, learning, medical, hearing, injury-related, visual) are invited to contact SAS to arrange a confidential consultation.

Student Accessibility Services
520 University Centre
Phone: (204) 474-7423
Email: Student_accessibility@umanitoba.ca

Expectations: You Can Expect Me To

I will be in class for 10 minutes prior to and after the class time to discuss any questions or comments you may have. I am also available to discuss class material and answer questions outside of class time. Please email to make an appointment.

I will return assignments within one week of receiving them. Each assignment will receive feedback in terms of content, level of insight and analysis, and grammar and overall composition. The varied set of assignments provides students with a variety of learning strategies.

CLASS SCHEDULE AND COURSE EVALUATION

This schedule is subject to change at the discretion of the instructor and/or based on the learning needs of the students but such changes are subject to [Section 2.8 of ROASS](#).

As a graduate course, the meeting time for the class will not be determined until schedules of all students are known. The class will meet once per week. Each in-class meeting will be 2.5 to 3 hours in length, with a 15 minute break. The first half will involve student led presentations and or discussion. The second half will be Dr. Entz (or guest) provide background material on next's weeks topic. Consideration will be given to student participation in other graduate studies commitments such as conferences.

Date	Class Content & Teaching Strategies	Readings and Pre-class Preparation	Evaluation		
			Type of Assessment		
Module 1	Define nature-based solutions (NBS) and locate them within agricultural systems. The "problem of agriculture"	Reading list	Introductory class	0	
Module 2	Learn how the NBS initiative evolved: History and rationale for NBS.	Reading list	Weekly written summary and in-class discussion	4	
Module 3	Define planetary boundaries (PB); Feeding 10 billion people staying within PB	Reading list	Weekly written summary and in-class discussion	4	
Module 4	The critical role of nature-based processes in achieving food security. Indigenous knowledge and feminist agroecology	Reading list	Weekly written summary and in-class discussion	4	
Module 5	NBS examples in Canada and around the world I. Precision agroecology	Reading list (Dr. Sasha Loewen)	Weekly written summary and in-class discussion	4	
Module 6	NBS examples in Canada and around the world II. A natural systems approach to plant genetic improvement	Reading list (Dr. Michelle Carkner)	Weekly written summary and in-class discussion	4	
Module 7	NBS in research	The UM-led LEAP project	Weekly written summary and	4	

Topics in Agronomy 7660: Natural Systems Agriculture

			in-class discussion		
Module 8	Policy and business initiatives	Reading list (Drs. Ronnie Drever and Bruno Dyck)	Weekly written summary and in-class discussion	4	
Module 9	Researcher profile assignment			15	
	Literature review			25	
Module 10	Summer Institute	Three one-day sessions during summer, 2025	Farm mind map and case study	15	
			Field methods practicum	10	
	Class engagement, attendance			7	
Total				100	

Evaluation for students receiving full course credit

Each student will prepare a response to weekly reading/resource material beginning in week 2 (7 x 4 = 28%).

- 1) Each student will write a literature review on a subject of natural systems agriculture. A list of topics will be provided or students can make suggestions to instructor (25%)
- 2) Interview report (15%)
- 3) Summer Institute farm case study and mind map (15%)
- 4) Summer Institute methodology develop assignment (10%)
- 5) Class engagement including attendance, participation in discussion, initiative, and active listening. (7%)

Grading

Indicate your grading scale. A sample is given below that you can adjust to your course expectations.

Letter Grade	Percentage out of 100	Grade Point Range	Final Grade Point
A+	95-100	4.25-4.5	4.5
A	86-94	3.75-4.24	4.0
B+	80-85	3.25-3.74	3.5
B	72-79	2.75-3.24	3.0
C+	65-71	2.25-2.74	2.5
C	60-64	2.0-2.24	2.0
D	50-59	Less than 2.0	1.0
F	Less than 50		0

Voluntary Withdrawal

Please refer to the [Registrar's Office](#) web page for more information. Also identify if you are willing to discuss student's progress and strategies for improvement prior the withdrawal date.

ASSIGNMENT DESCRIPTIONS

TITLE: Weekly written summary

GOAL: To provide critical background information on the week's topic and to enable students to reflect on the subject.

PROCEDURE: Students must review the 2 or 3 assigned papers and write a 500 word reflection. The reflection should focus on the week's theme and include some insights from all assigned papers that week. The reflection should be approximately 400 words. Additional options include a table (organizing your thoughts on the subject) or a conceptual diagram (perhaps the paper stimulated you to think of some novel ways that processes could be measured, etc). Each weekly reflection is worth 4 marks. The 7, 400 word reflections are worth 28%, which is about the value of a 3000 word essay. For additional details, see Appendix 1).

SUBMISSION GUIDELINES: Written reflections should be emailed to Professor Entz by 2 PM the day before the respective class.

EVALUATION CRITERIA: The reflection will be evaluated for quality of discussion and creativity of analysis.

TITLE: Researcher profile assignment

GOAL: This assignment will allow students to understand how Natural Systems Agriculture scholars approach their work, how they organize research, and how they reflect on the research progress.

PROCEDURE: Each student will get to know the work of one internationally recognized research scientist in the area of natural systems agriculture. Students will be provided with the name and contact information of the researcher by this course's instructor. Students will contact the researcher and arrange a time for an interview. Students should conduct research to learn about the researcher's accomplishments before the interview. Perhaps the researcher will provide students with reading or other resource material in preparation for the interview. Main items to cover in the assignment: 1) Researcher career path and current position/institution; 2) Current program/projects and research direction; 3) Collaborations: why, how, what, where, who; 4) The top 2 scientific publications. (Criteria could include: The most challenging research project; The most impactful in terms of scientific contribution; The most interesting and enjoyable study; Unique collaborations); 5) Perspectives on the future of scientific endeavours in natural systems agriculture; 6) Advice to a graduate student; and 6) Researcher's interests outside of their work life.

SUBMISSION GUIDELINES: Students will give a 20 to 30 minute presentation addressing the questions outlined in the procedures section (above). Deadlines will be communicated to students within the first 2 weeks of the course.

EVALUATION CRITERIA: The grade will be based on the quality of the student presentation with respect to the 6 criteria outlined in the procedures section (above).

TITLE: Literature review

GOAL: To review the scholarly literature on a subject of interest to the student, but relevant to the theme of “Natural Systems Agriculture”. The goal is to provide students the opportunity to delve into a subject in greater detail.

PROCEDURE: The literature review should include at least 15 scientific sources and be a minimum of 2500 words. Citation formats should adhere to those of APA. The literature review topic must be approved by the instructor.

SUBMISSION GUIDELINES: Papers should be emailed to the instructor on or before the due date.

EVALUATION CRITERIA: The literature reviews will be evaluated on the basis of 1) quality of papers reviewed (how relevant to subject and do these papers add significantly to the area of study); 2) quantity of material reviewed; and 3) quality of the writing and formatting.

TITLE: Summer Institute: Mind mapping

GOAL: To allow students the opportunity to see the “big picture” with regard to farming and agricultural systems built on a foundation of natural systems.

PROCEDURE: Students will visit a farm or agricultural enterprise and construct a mind map of the operation. This will be accompanied by a written description of the “system”. See appendix 2 for additional details.

SUBMISSION GUIDELINES: The completed assignment must be emailed to the instructor on or before the due date.

EVALUATION CRITERIA: Evaluation will be based on how well students were able to construct the mind map to thoroughly describe the system that they reviewed.

TITLE: Summer Institute: Field methods practicum

GOAL: To allow students the opportunity to get hands on experience generating data from natural systems agriculture research.

PROCEDURE: Students will visit a field site where scientists involved in the LEAP project are working. They will spend several hours collecting data. Students will then compile the data, thereby learning about trends in the data.

SUBMISSION GUIDELINES: The individual instructors supervising the students in their field practicum will grade the student out of 10 marks.

EVALUATION CRITERIA: Evaluation will be based on students completing the data collection and providing a preliminary summary of the results, orally.

TITLE: Class engagement, attendance.

GOAL: To encourage students to actively participate in the classes and in the discussion that takes place within the classes.

PROCEDURE: Students will be encourage to active listening, active participation in discussion, and the desire to new insights from the material presented by instructors and students in the course.

SUBMISSION GUIDELINES: Instructor will meet with each student 1/3 way into class to provide some early feedback on the student’s participation performance.

EVALUATION CRITERIA: Evaluation will be based on student attendance and active participation.

Referencing Style

Assignments should use the APA reference style as outlined in the text: American Psychological Association. (2009). Publication manual of the American Psychological Association (6th ed.). Washington, DC: Author.

Assignment Feedback

I will return assignments within one week of receiving them. Each assignment will receive feedback in terms of content, level of insight and analysis, and grammar and overall composition. There will be both formative (i.e., comments) and summative (i.e., grade) feedback. The feedback will be delivered via paper and electronically.

Assignment Extension and Late Submission Policy

The weekly written assignment is due the day before each class. No exceptions. More detailed deadlines for all other assignments will be given the first week of class – once it is clear how many students are registered. All assignments must be submitted to pass the course. Reasonable requests in the case of late assignments will be considered.

UNIVERSITY SUPPORT OFFICES & POLICIES

Instructors shall provide to every student the information on university support offices and policies in [Schedule “A”](#) within the first week of classes, either through a paper copy and/or via the university’s student information system (i.e., Aurora, UM Learn, or such other university information system as may be approved by the university from time to time).

Schedule “A”

Section (a) sample re: A list of academic supports available to Students, such as the Academic Learning Centre, Libraries, and other supports as may be appropriate:

Writing and Learning Support

The Academic Learning Centre (ALC) offers services that may be helpful to you throughout your academic program. Through the ALC, you can meet with a learning specialist to discuss concerns such as time management, learning strategies, and test-taking strategies. The ALC also offers peer supported study groups called Supplemental Instruction (SI) for certain courses that students have typically found difficult. In these study groups, students have opportunities to ask questions, compare notes, discuss content, solve practice problems, and develop new study strategies in a group-learning format.

You can also meet one-to-one with a writing tutor who can give you feedback at any stage of the writing process, whether you are just beginning to work on a written assignment or already have a draft. If you are interested in meeting with a writing tutor, reserve your appointment two to three days in advance of the time you would like to meet. Also, plan to meet with a writing tutor a few days before your paper is due so that you have time to work with the tutor’s feedback.

These Academic Learning Centre services are free for U of M students. For more information, please visit the Academic Learning Centre website at: <http://umanitoba.ca/student/academiclearning/>

You can also contact the Academic Learning Centre by calling 204-480-1481 or by visiting 205 Tier Building.

University of Manitoba Libraries (UML)

As the primary contact for all research needs, your liaison librarian can play a vital role when completing academic papers and assignments. Liaisons can answer questions about managing citations, or locating appropriate resources, and will address any other concerns you may have, regarding the research process. Liaisons can be contacted by email or phone, and are also available to meet with you in-person. A complete list of liaison librarians can be found by subject: <http://bit.ly/WcEbA1> or name: <http://bit.ly/1tJ0bB4>. In addition, general library assistance is provided in person at 19 University Libraries, located on both the Fort Garry and Bannatyne campuses, as well as in many Winnipeg hospitals. For a listing of all libraries, please consult the following: <http://bit.ly/1sXe6RA>. When working remotely, students can also receive help online, via the Ask-a-Librarian chat found on the Libraries' homepage: www.umanitoba.ca/libraries.

Section (b) sample: re: A statement regarding mental health that includes referral information:

For 24/7 mental health support, contact the Mobile Crisis Service at 204-940-1781.

Student Counselling Centre

Contact SCC if you are concerned about any aspect of your mental health, including anxiety, stress, or depression, or for help with relationships or other life concerns. SCC offers crisis services as well as individual, couple, and group counselling. *Student Counselling Centre:*

<http://umanitoba.ca/student/counselling/index.html>

474 University Centre or S207 Medical Services

(204) 474-8592

Student Support Case Management

Contact the Student Support Case Management team if you are concerned about yourself or another student and don't know where to turn. SSCM helps connect students with on and off campus resources, provides safety planning, and offers other supports, including consultation, educational workshops, and referral to the STATIS threat assessment team.

Student Support Intake Assistant <http://umanitoba.ca/student/case-manager/index.html>

520 University Centre

(204) 474-7423

University Health Service

Contact UHS for any medical concerns, including mental health problems. UHS offers a full range of medical services to students, including psychiatric consultation.

University Health Service <http://umanitoba.ca/student/health/>

104 University Centre, Fort Garry Campus

(204) 474-8411 (Business hours or after hours/urgent calls)

Health and Wellness

Contact our Health and Wellness Educator if you are interested in [peer support from Healthy U](#) or information on a broad range of health topics, including physical and mental health concerns, alcohol and substance use harms, and sexual assault.

Health and Wellness Educator <https://umanitoba.ca/student/health-wellness/welcome-about.html>
britt.harvey@umanitoba.ca

Live Well @ UofM

For comprehensive information about the full range of health and wellness resources available on campus, visit the Live Well @ UofM site:

<http://umanitoba.ca/student/livewell/index.html>

Section (c) sample: re: A notice with respect to copyright:

All students are required to respect copyright as per Canada's *Copyright Act*. Staff and students play a key role in the University's copyright compliance as we balance user rights for educational purposes with the rights of content creators from around the world. The Copyright Office provides copyright resources and support for all members of the University of Manitoba community. Visit <http://umanitoba.ca/copyright> for more information.

Section (d) sample: re: A statement directing the student to University and Unit policies, procedures, and supplemental information available on-line:

Your rights and responsibilities

As a student of the University of Manitoba you have rights and responsibilities. It is important for you to know what you can expect from the University as a student and to understand what the University expects from you. Become familiar with the policies and procedures of the University and the regulations that are specific to your faculty, college or school.

The [Academic Calendar](http://umanitoba.ca/student/records/academiccalendar.html) <http://umanitoba.ca/student/records/academiccalendar.html> is one important source of information. View the sections *University Policies and Procedures* and *General Academic Regulations*.

While all of the information contained in these two sections is important, the following information is highlighted.

- If you have questions about your grades, talk to your instructor. There is a process for term work and final **grade appeals**. Note that you have the right to access your final examination scripts. See the Registrar's Office website for more information including appeal deadline dates and the appeal form <http://umanitoba.ca/registrar/>
- You are expected to view the General Academic Regulation section within the Academic Calendar and specifically read the **Academic Integrity** regulation. Consult the course syllabus or ask your instructor for additional information about demonstrating academic

integrity in your academic work. Visit the Academic Integrity Site for tools and support <http://umanitoba.ca/academicintegrity/> View the **Student Academic Misconduct** procedure for more information.

- The University is committed to a respectful work and learning environment. You have the right to be treated with respect and you are expected to conduct yourself in an appropriate respectful manner. Policies governing behavior include the:

Respectful Work and Learning Environment

http://umanitoba.ca/admin/governance/governing_documents/community/230.html

Student Discipline

http://umanitoba.ca/admin/governance/governing_documents/students/student_discipline.html and,

Violent or Threatening Behaviour

http://umanitoba.ca/admin/governance/governing_documents/community/669.html

- If you experience **Sexual Assault** or know a member of the University community who has, it is important to know there is a policy that provides information about the supports available to those who disclose and outlines a process for reporting. The **Sexual Assault** policy may be found at:
http://umanitoba.ca/admin/governance/governing_documents/community/230.html
More information and resources can be found by reviewing the Sexual Assault site
<http://umanitoba.ca/student/sexual-assault/>
- For information about rights and responsibilities regarding **Intellectual Property** view the policy [https://umanitoba.ca/governance/sites/governance/files/2021-06/Intellectual Property Policy - 2013_10_01 RF.pdf](https://umanitoba.ca/governance/sites/governance/files/2021-06/Intellectual_Property_Policy_-_2013_10_01_RF.pdf)

For information on regulations that are specific to your academic program, read the section in the Academic Calendar and on the respective faculty/college/school web site

<http://umanitoba.ca/faculties/>

Contact an **Academic Advisor** within our faculty/college or school for questions about your academic program and regulations <http://umanitoba.ca/academic-advisors/>

Student Advocacy

Contact Student Advocacy if you want to know more about your rights and responsibilities as a student, have questions about policies and procedures, and/or want support in dealing with academic or discipline concerns.

<http://umanitoba.ca/student/advocacy/>

520 University Centre

204 474 7423

student_advocacy@umanitoba.ca

Reading List (subject to minor changes based on background of students registered and reading suggestions from guest instructors)

Module 1 Define nature-based solutions (NBS) and locate them within agricultural systems. The “problem of agriculture”

Schulte, R.P. and Ditzler, L., 2024. Beyond sustainability: five shades of green for tomorrow’s farming and food. In *Future Food Systems* (pp. 17-30). Academic Press.

Shen, H., Chen, Y., Hu, Y., Ran, L., Lam, S.K., Pavur, G.K., Zhou, F., Pleim, J.E. and Russell, A.G., 2020. Intense warming will significantly increase cropland ammonia volatilization threatening food security and ecosystem health. *One Earth*, 3(1), pp.126-134.

Qualman, D., 2019. Tackling the Farm Crisis and the Climate Crisis.

Addy, J.W., Ellis, R.H., MacLaren, C., Macdonald, A.J., Semenov, M.A. and Mead, A., 2022. A heteroskedastic model of Park Grass spring hay yields in response to weather suggests continuing yield decline with climate change in future decades. *Journal of the Royal Society Interface*, 19(193), p.20220361.

Seddon, N., Chausson, A., Berry, P., Girardin, C.A., Smith, A. and Turner, B., 2020. Understanding the value and limits of nature-based solutions to climate change and other global challenges. *Philosophical Transactions of the Royal Society B*, 375(1794), p.20190120.

Pennino, M.J., Compton, J.E. and Leibowitz, S.G., 2017. Trends in drinking water nitrate violations across the United States. *Environmental science & technology*, 51(22), pp.13450-13460.

Module 2. Learn how the NBS initiative evolved: History and rationale for NBS.

Miralles-Wilhelm, F. 2022. Nature-based solutions in agriculture: Sustainable management and conservation of land, water and biodiversity. Food and Agriculture Organization of the United Nations and The Nature Conservancy Virginia.

Drever, C.R., Cook-Patton, S.C., Akhter, F., Badiou, P.H., Chmura, G.L., Davidson, S.J., Desjardins, R.L., Dyk, A., Fargione, J.E., Fellows, M. and Filewod, B., 2021. Natural climate solutions for Canada. *Science Advances*, 7(23), p.eabd6034.

Buscher, B. and Fletcher, R., 2020. *The conservation revolution: radical ideas for saving nature beyond the Anthropocene*. Verso Books.

Snapp, S.S., Kebede, Y., Wollenberg, E.K., Dittmer, K.M., Brickman, S., Egler, C. and Shelton, S.W., 2021. Agroecology and climate change rapid evidence review: Performance of agroecological approaches in low-and middle-income countries.

Module 3. Define planetary boundaries (PB); Feeding 10 billion people staying within PB

Lade, S.J., Steffen, W., De Vries, W., Carpenter, S.R., Donges, J.F., Gerten, D., Hoff, H., Newbold, T., Richardson, K. and Rockström, J., 2020. Human impacts on planetary boundaries amplified by Earth system interactions. *Nature sustainability*, 3(2), pp.119-128.

Gerten, D., Heck, V., Jägermeyr, J., Bodirsky, B.L., Fetzer, I., Jalava, M., Kummu, M., Lucht, W., Rockström, J., Schaphoff, S. and Schellnhuber, H.J., 2020. Feeding ten billion people is possible within four terrestrial planetary boundaries. *Nature Sustainability*, 3(3), pp.200-208.

Burian, A., Kremen, C., Wu, J.S.T., Beckmann, M., Bulling, M., Garibaldi, L.A., Krisztin, T., Mehrabi, Z., Ramankutty, N. and Seppelt, R., 2024. Biodiversity–production feedback effects lead to intensification traps in agricultural landscapes. *Nature Ecology & Evolution*, 8(4), pp.752-760. Dunlop et al. 2024
Buscher and Fletcher “Convivial conservation”

Seddon, N., Chausson, A., Berry, P., Girardin, C.A., Smith, A. and Turner, B., 2020. Understanding the value and limits of nature-based solutions to climate change and other global challenges. *Philosophical Transactions of the Royal Society B*, 375(1794), p.20190120.

Module 4. The critical role of nature-based processes in achieving food security. Indigenous knowledge

Berkes, F., Colding, J. and Folke, C., 2000. Rediscovery of traditional ecological knowledge as adaptive management. *Ecological applications*, 10(5), pp.1251-1262.

Woroniecki, S., Spiegelenberg, F.A., Chausson, A., Turner, B., Key, I., Md. Irfanullah, H. and Seddon, N., 2023. Contributions of nature-based solutions to reducing people’s vulnerabilities to climate change across the rural Global South. *Climate and Development*, 15(7), pp.590-607.

Entz, M.H. and Van Die, M., 2024. Nurturing Canadian agronomy with nature: theory and practice. In *Future Food Systems* (pp. 3-16). Academic Press.

Bezner Kerr, R., 2023. Feminist agroecology viewed through the lens of the plantationocene. *Annals of the American Association of Geographers*, pp.1-8.

Keesstra, S., Nunes, J., Novara, A., Finger, D., Avelar, D., Kalantari, Z. and Cerdà, A., 2018. The superior effect of nature based solutions in land management for enhancing ecosystem services. *Science of the Total Environment*, 610, pp.997-1009.

Module 5: NBS examples in Canada and around the world I. Precision agroecology

Duff, H., Hegedus, P.B., Loewen, S., Bass, T. and Maxwell, B.D., 2021. Precision agroecology. *Sustainability*, 14(1), p.106.

Tittonell, P., El Mujtar, V., Felix, G., Kebede, Y., Laborda, L., Luján Soto, R. and de Vente, J., 2022. Regenerative agriculture—agroecology without politics?. *Frontiers in Sustainable Food Systems*, 6, p.844261.

Mwale, M., Muzekenyi, M., Tjale, M.M., Kabiti, H.M., Zuwarimwe, J. and Mudimeli, R.N., 2022. Harnessing the Opportunities for Sustainable Small-Scale Rural Farming Towards Attaining Food Security in Southern Africa. In *Food Security and Safety Volume 2: African Perspectives* (pp. 307-328). Cham: Springer International Publishing.

Maxwell, B. and Duff, H., 2024. Increasing the scope and scale of agroecology in the Northern Great Plains. *Journal of Agriculture, Food Systems, and Community Development*, 13(3), pp.1-6.

Ditzler, L. and Driessen, C., 2022. Automating agroecology: How to design a farming robot without a monocultural mindset?. *Journal of Agricultural and Environmental Ethics*, 35(1), p.2.

Module 6. NBS examples in Canada and around the world II. A natural systems approach to plant genetic improvement

Shelton, A.C. and Tracy, W.F., 2016. Participatory plant breeding and organic agriculture: A synergistic model for organic variety development in the United States. *Elementa*, 4, p.000143.

Colley, M.R., Dawson, J.C., McCluskey, C., Myers, J.R., Tracy, W.F. and van Bueren, E.L., 2021. Exploring the emergence of participatory plant breeding in countries of the Global North—a review. *The Journal of Agricultural Science*, 159(5-6), pp.320-338.

Carkner, M.K., Gao, X. and Entz, M.H., 2023. Ideotype breeding for crop adaptation to low phosphorus availability on extensive organic farms. *Frontiers in Plant Science*, 14, p.1225174.

Carkner, M.K. and Entz, M.H., 2024. Determining adaptability of farmer bred spring wheat (*Triticum aestivum* L.) genotypes to Canadian organic production using stability analysis. *Plant Breeding*.

Module 7. NBS in research

Tittonell, P., Piñeiro, G., Garibaldi, L.A., Dogliotti, S., Olff, H. and Jobbagy, E.G., 2020. Agroecology in large scale farming—A research agenda. *Frontiers in Sustainable Food Systems*, 4, p.584605.

Hatt, S. and Döring, T.F., 2023. Designing pest suppressive agroecosystems: principles for an integrative diversification science. *Journal of Cleaner Production*, p.139701.

Ditzler, L., Rossing, W.A., Schulte, R.P., Hageman, J. and van Apeldoorn, D.F., 2023. Prospects for increasing the resolution of crop diversity for agroecosystem service delivery in a Dutch arable system. *Agriculture, Ecosystems & Environment*, 351, p.108472.

Overview of UM's LEAP project <https://umanitoba.ca/agricultural-food-sciences/leap> with presentations by several project scientists.

Summer Institute

Lalani, B., Aminpour, P., Gray, S., Williams, M., Büchi, L., Hagggar, J., Grabowski, P. and Dambiro, J., 2021. Mapping farmer perceptions, Conservation Agriculture practices and on-farm measurements: The role of systems thinking in the process of adoption. *Agricultural Systems*, 191, p.103171.

Upadhaya, S., Arbuckle, J.G. and Schulte, L.A., 2023. Farmer typologies integrating latent and observed characteristics: Insights for soil and water conservation outreach. *Land Use Policy*, 134, p.106889.

Duru, M., Therond, O. and Fares, M.H., 2015. Designing agroecological transitions; A review. *Agronomy for Sustainable Development*, 35, pp.1237-1257.

Chausson, A., Welden, E.A., Melanidis, M.S., Gray, E., Hirons, M. and Seddon, N., 2023. Going beyond market-based mechanisms to finance nature-based solutions and foster sustainable futures. *PLoS Climate*, 2(4), p.e0000169.

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Berkes, F., Colding, J. and Folke, C., 2000. Rediscovery of traditional ecological knowledge as adaptive management. *Ecological applications*, 10(5), pp.1251-1262.

Daschuk, J.W., 2013. *Clearing the plains: Disease, politics of starvation, and the loss of Aboriginal life* (Vol. 65). University of Regina Press.

Ikerd, J.E., 1993. The need for a system approach to sustainable agriculture. *Agriculture, Ecosystems & Environment*, 46(1-4), pp.147-160.

Janzen, H.H., 2001. Soil science on the Canadian prairies-Peering into the future from a century ago. *Canadian Journal of Soil Science*, 81(4), pp.489-503.

Khanna P (2021) *Move: The forces uprooting us*. Scribner.

Lupwayi, N.Z., Rice, W.A. and Clayton, G.W., 1998. Soil microbial diversity and community structure under wheat as influenced by tillage and crop rotation. *Soil Biology and Biochemistry*, 30(13), pp.1733-1741.

Lychuk, T.E., Moulin, A.P., Lemke, R.L., Izaurralde, R.C., Johnson, E.N., Olfert, O.O. and Brandt, S.A., 2019. Climate change, agricultural inputs, cropping diversity, and environment affect soil carbon and respiration: A case study in Saskatchewan, Canada. *Geoderma*, 337, pp.664-678.

Miralles-Wilhelm, F. 2022. Nature-based solutions in agriculture: Sustainable management and conservation of land, water and biodiversity. Food and Agriculture Organization of the United Nations and The Nature Conservancy Virginia.

Morrison, I.N. and D. Kraft 1994. International Institute for Sustainable Development, 1994. *Sustainability of Canada's Agri-Food System—A Prairie Perspective*.

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F.S., Lambin, E.F., Lenton, T.M., Scheffer, M., Folke, C., Schellnhuber, H.J. and Nykvist, B., 2009. A safe operating space for humanity. *Nature*, 461(7263), pp.472-475.

Smil, V., 2022. *How the World Really Works: The Science Behind How We Got Here and Where We're Going*. Penguin.

Steckel RH and Prince JM (2001) Tallest in the world: Native Americans of the Great Plains in the nineteenth century. *American Economic Review*, 91(1): 287-294.

Steffen, W., Richardson, K., Rockström, J., Cornell, S.E., Fetzer, I., Bennett, E.M., Biggs, R., Carpenter, S.R., De Vries, W., De Wit, C.A. and Folke, C., 2015. Planetary boundaries: Guiding human development on a changing planet. *Science*, 347(6223), p.1259855.

St. Luce, M., McConkey, B., Schoenau, J., Brandt, K., Hangs, R.D. and Zhang, H., 2024. Impacts of conservation agriculture on soil C and N stocks and organic matter fractions: comparing commercial producer fields with a long-term small-plot experiment in Brown Chernozems of Saskatchewan. *Canadian Journal of Soil Science*, (ja).

Appendix 1. Examples of comments for written reflections

Here are some examples of reflections that some students made of the Evans (1998) paper. I am sending them to all of you as a help for future reflections. These examples demonstrate how different students have taken a point, a conclusion or an assertion (either direct or oblique) and reflected on that point in a short statement – one that leads to further discussion, or allows the student to present an opinion or challenge.

- What I have learned from this article is an appreciation for agricultural changes that have already occurred in response to growing population, and the constraints that will shape the future strategy towards “Feeding the 10 billion”.
- I appreciated the sub-chapter, “Dilemmas for agriculturalists, young and old”, because it illustrated that increasing yields are not the only challenges agriculturalists face. It’s not a cut and dry problem/solution. Our attitudes and goals will dictate not only “if” we can feed the ten billion but also “how”, given that currently we are (by caloric count) feeding the current population. Despite this, 1.4 billion people are overweight and 770 million people are chronically malnourished (World Health Organization, 2014; Food and Agriculture Organization, 2014).
- There is a somewhat oblique reference to agricultural stages of development: ‘...once the stage of grazing animals on pasture leys as a source of farmyard manure is passed...’ (p. 203). While the theory that agricultural societies inevitable pass through distinct phases of development is useful, is it necessarily inevitable? If we are to take seriously the challenge of feeding the world sustainably, isn’t it important that we challenge and perhaps change this paradigm?
- Taken as a whole, this chapter is a useful example of the challenges of modern science in dealing with the *wicked* problems of our day. Modern science has long held that there is one objective ‘truth’. Those who take a more complex view of science would rather assert that multiple perspectives are essential. Dr. Evans’ arguments are useful and important; but so are those who would argue differently about many of the points raised above, and taking all into consideration will be essential if we are to effectively address this great challenge of feeding the world in the future.

Appendix 2. Mind Map Assignment (15% of final grade)

The Assignment

- Draw a mind map for the farm that you visit. This should include a hand-drawn (or computer generated) map on one page. In your mind map, you may not be able to capture all aspects of the farm, but make sure the basic farm structure and function are included. After describing the farming system within your map, include climate smart soil practices (that farmers are either considering or already putting into practice) in the mind map.
- Use your mind map to
 - Document how the climate smart/conservation practices used by the farmer(s) affect the whole system. This can be achieved by:
 - Adding new components to the mind map
 - Including roadblocks that farmers described when planning or implementing CSS practices
 - Labelling flows between components of the farm system more negative and more positive
 - Other
- Describe your mind map and how the farmer(s) is attempting to incorporate climate smart/conservation processes into the farm in a 1000-word report. Due (as per instructions on course outline).

Background material (From: Rhodes, J.S., 2021. Mind Maps. Published By: JJ Fast Publishing, LLC)

What is a mind map, and why use them?

- To make a mind map, you begin with a central topic, and then you move outward towards related topics. From those topics you can progress further into other related subtopics. Sometimes there are relationships between the subtopics, so you will find them cross referencing each other. Sometimes you will find these subcategories looping back into one another in a way that this is similar to how flow charts work.
- A great way to think about a mind map is to think of it as a planetary system, the sun being the central point which is being orbited by planets. Each planet is also being orbited by its own moon.
- Some of the smartest and most efficient people in history used mind maps regularly. Da Vinci used mind maps for note taking. Albert Einstein was an avid user of mind maps. He rejected many types of linear, numerical, and even verbal and created ways of thinking. Einstein said "Imagination is more important than knowledge because imagination is unlimited." Not only do mind-maps help you to unfold your imaginative ideas, but they help you to bottle them in such a way that you can understand it, spread it, teach it, share it, and use it.
- Perhaps the most important thing about mind maps is that they will allow you to understand a topic in its entirety. You are also able to view the most critical elements of that topic at a glance. They also allow us to visually explain things to other people in a way that is very simple to understand. When we have content that is organized and structured it is much easier to understand ourselves and to teach to other people. In fact, it pushes and even forces clarity in thinking.
- You don't need to use a sophisticated computer program to create a mind map. You can draw one out very quickly on a standard sheet of paper.

- When you are mind mapping, you are able to move around all of your topics and subtopics. As you move the information you will find that a little tiny opening for creativity presents itself.

Different Ways to Put Together Mind Maps

1. Create the mind map as you visit the farm. In this way you are using mind mapping to supplement any notes or pictures that you record on the farm visit. So, it means you are note taking and mind map drawing at the same time.
2. Take notes, then mind map later. This way you formulate a mind map out of the information in your notes. This method is a little bit more advanced than the previous one as you are starting with a pool of information rather than just diving right in. But do not wait too long after the farm visit to actually create a first draft of the mind map.
3. A combination of steps 1 and 2 work too!