
ENVS 805 Syllabus

Data Analysis and Management -MWS/MSEM

School of Environment and Sustainability

Term 1, 2019-2020



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Course notes: See course website <http://bblearn.usask.ca>

Grading Scheme

Assignment 1 – Open and Thematic Coding [Individual]	20%
Assignment 2 – Quantitative Data - How to Visualize Data [Individual]	20%
Assignment 3 – Mapping the Problem [Individual]	20%
Assignment 4 – Science Proposal Pitch [Group; including 20% peer evaluation]	20%
Assignment 5 – Science Proposal [Group; including 20% peer evaluation]	20%
Total	100%

Calendar description

Environmental data management is complex because of its volume, qualitative and quantitative forms, and temporal and spatial characteristics. This course introduces students to statistical, qualitative, and visual methods of problem solving and data reduction and representation and describes methods for managing large and complex data sets.

Learning Outcomes

The course aims to provide an interactive environment for students to develop their analytical and management skills for organizing, assessing and interpreting empirical data critically. The key learning outcome from this course is that students can use diverse data types to form, test and support their new concepts, hypotheses and theories. The course introduces various tools for data analysis, and upon completion of the course, students will be able to tackle three key questions:

- 1) What is the problem with an environmental system? Are there different viewpoints about the problem?
- 2) How does an environmental system work and respond to change? – Managing, organizing, visualizing and analyzing data.
- 3) What can we do about the problems? Bridging social science and physical science together to systematically address environmental problems.

Timeline / Schedule

Time	Topic	Assignments/ Deliverables
Session 1	Lecture: Class Intro; Syllabus Review; Revisit Ethics Considerations for Human Data Lab: Social Labs – What is the Problem?	
Session 2	Task: Transcription of Interviews from AM Readings: Rev Transcription Style Guide	
Session 3	Lecture: Data Capture, Storage, and Management; Meta-data	
Session 3	Pre-recorded lecture: Basics of Plotting	
Session 4	Social Science Methods: Grounded Theory Lab: Open and Thematic Coding in NVivo with Redberry Data	Transcripts of interviews due
Session 5	Pre-recorded lecture: Correlation and Regression, Hypothesis Testing	
Session 6	Lab: Introduction to Python programming language	
Session 7	Task: Produce code for Assignment 2 (due next day)	Assignment 1 – What is the problem? (11.59 PM)
Session 8	Lecture: Handling spatial and temporal dynamics; Geographic Information Systems (GIS) Lab: Mapping datasets using ArcGIS and Python	
Session 9	Task: Produce code for Assignment 3 (due Sept 25) Pre-recorded lecture: Basics of Multivariate Statistics	Assignment 2 – How to Visualize Data? (11.59 PM)
Session 10	Lab: Multivariate Statistics	
Session 11	Task: Produce code for Assignment 3 (due next day) Readings: Ozsesmi and Ozsesmi 2003; Strickert et al. 2014	
Session 12	Lecture: Integrated Mixed-Methods, Fuzzy Cognitive Maps Lab: Fuzzy Cognitive Maps, culminating in Q-Sort	
Session 13	Pre-recorded lecture: Q method - From How does it work? to What can we do about it? Readings: McKewon, B. and Thomas, D.B. (2013)	Assignment 3 – Mapping the Problem (11.59 PM)
Session 14	Lecture and Lab: Q-Method Analysis	
Session 15	BREAK	
Session 16	Proposal Work Session	
Session 17	Proposal Work Session	Assignment 4 – Science Project Proposal (11.59 PM)

Session 18	Presentation Work Session	
Session 19	Presentation Work Session	
Session 20	Student Presentations	Assignment 5 – Presentation and Engagement (in-class)
Session 21	Student Presentations (tentative)	Assignment 5 – Presentation and Engagement (in-class)
Session 22	Student Presentations	Assignment 5 – Presentation and Engagement (in-class)
Session 23	Student Presentations (tentative)	Assignment 5 – Presentation and Engagement (in-class)

*You can plan afternoons at your own discretion and there are no class activities scheduled. However, you will have access to your classroom after the scheduled class time for the entire duration of this course. Please make use of this resource! You will be working in teams for 2 group assignments, and you will need time to prepare for the following days through reading articles, watching pre-recorded lectures, or working through coding examples. It is required that you will have prepared for classes using the list of readings for each day of classes on your own time before the class starts.

Required readings

McKeown, B., & Thomas, D. B. (2013). *Q methodology* Chapter 1: Methodological Principals(Vol. 66). Sage publications, 2nd Edition, <https://dx.doi.org/10.4135/9781483384412, 1 – 16>.

Özesmi, U., & Özesmi, S. L. (2004). Ecological models based on people's knowledge: a multi-step fuzzy cognitive mapping approach. *Ecological modelling*, 176(1-2), 43-64.

Strickert, G. E. & Bradford, L. E. A. (2015). Of Research Pings and Ping-Pong Balls: The Use of Forum Theater for Engaged Water Security Research. *International Journal of Qualitative Methods*, 14(5), 1609406915621409.

Pre-recorded lectures may contain links to other external resources that are intended to help you work through the course materials.

Assignment 1: What is the problem? (20%)

The purpose of this assignment is to demonstrate your ability to systematically identify a wicked problem in the context of sustainable agriculture by drawing on your classmates' viewpoints and available datasets. Using Interviews and Focus Groups that will be conducted during class time, you will analyze the data to generate a hypothesis to test during the quantitative methods section of the course.

You will produce the following 5 items:

- 1) **Transcript of interviews** – transcribe the in-class interviews or focus groups verbatim.
- 2) **Codebooks for interviews / focus groups** – a list of open and thematic codes from both the interview and focus groups with exemplar quotes.
- 3) **A summary of important findings** – provide a 2 -3-page summary of important findings from the interviews and focus groups. You should weave a few exemplar quotes into the document. You are allowed to include a few references from peer reviewed literature, but the main thrust is to focus on what the participants said about sustainable agriculture.
- 4) **A diagram that illustrates your theory of the problem** – create a diagram that outlines what you think is the root of the environmental problem while drawing on the interviews and focus groups discussions.
- 5) **A clear research question** – your research question should be clear and will have emerged from the analysis of interviews and focus groups.
- 6) A copy of your recording for verification.

Grade allocation: This report is worth 20% of your total grade in this class.

Assignment 2: Quantitative Data - How to Visualize Data (20%)

The purpose of this assignment is to demonstrate your ability to present and interpret quantitative data using Python in Jupyter Notebooks. The data used for this exercise may be your own data from the field course in conjunction with data from previous years (provided by the instructors). Alternatively, you can use data that are publicly available (e.g. from <http://www.gapminder.org/data/>). You may choose any datasets you like, but make sure that the datasets you choose are suitable for the given problem. You must produce a single Jupyter Notebook *.ipyb file that will contain three cells with graphs. Each cell will contain one of the plots outlined below. Preceding each plot, write a short paragraph in a separate markdown cell that describes the plot and draws some simple interpretation from the data. This text should be as short as possible, e.g. "Figure 1 shows the average summer (June–August) precipitation in the Canadian Prairie Provinces (Alberta, Saskatchewan, Manitoba) between 1986 and 2019. There was a constant decrease in precipitation during the summer months over the past decades."

Superfluous code and messy plots will be penalized. Pay attention to the fact that the aesthetic quality of your plots and labeling (axis titles, including units; caption) is weighted heavily in the marking of this assignment. **The Jupyter Notebook *.ipyb file must be uploaded along with the *.csv raw data file onto Blackboard by the deadline of September 23th, 2019.** You will produce the following 3 plots:

Does your code run? (25%) - Whether your code runs to produce the required plots will be worth 25% of your mark.

Cell 1, plot 1 (25%) - A time series plot of data, showing how this variable has changed over a period of time.

Cell 2, plot 2 (25%) - Multi-factor plot (more difficult!). In this plot, select 3 to 5 datasets (i.e. one variable measured over time at various sampling sites, or a number of variables measured over time at one sampling site). Produce a single plot that contains multiple lines, i.e. one per dataset.

Cell 3, plot 3 (25%) - Bivariate plot (Bi=two, variate=variables). For the same sampling site, obtain two different datasets that you may suspect are somehow related to one another. Plot the data against one another (variable 1 on the x-axis, variable 2 on the y-axis). Add a regression line (if applicable) and provide the equation of the regression line, as well as a measure of correlation (i.e. the correlation coefficient).

Grade allocation: This report is worth 20% of your total grade in this class.

Assignment 3: Mapping the Problem (20%)

The purpose of this assignment is to demonstrate your ability to present the spatial dimension of datasets by mapping them. The data used for this exercise may be your own data from the field course in conjunction with data from previous years (provided by the instructors). Alternatively, you can use data that are publicly available (e.g. from <http://www.gapminder.org/data/>). You may choose any datasets you like, but make sure that the datasets you choose are suitable for the given problem. You must produce a single Jupyter Notebook *.ipynb file that will contain one or more cells with maps and potentially graphs. Each cell will contain only one map or graph. You may choose one of the three tasks outlined below. Preceding each map or plot, write a short paragraph in a separate markdown cell that describes the map or plot and draws some simple interpretation from the data. This text should be as short as possible, e.g. "Figure 1 shows the spatial distribution of precipitation across Saskatchewan in the Summer of 1969. Precipitation was greatest in Southern Saskatchewan around the City of Saskatoon."

Superfluous code and messy maps and plots will be penalized. Pay attention to the fact that the aesthetic quality of your maps and labeling is weighted heavily in the marking of this assignment. **The Jupyter Notebook *.ipynb file must be uploaded along with any required data files onto Blackboard by the deadline of September 25th, 2019.** You will perform one of the following 3 analyses:

Does your code run? (25%) - Whether your code runs to produce the required plots will be worth 25% of your mark.

Plot observations on a map (75%) – Using the tools introduced in the class, mark the geographic coordinates of an observation (i.e. detection of a species, occurrence of a hydrologic event, geopolitical conflicts, disease outbreak) on a map.

- **OR - Plot your quantitative dataset on a map (75%)** – Using the tools introduced in the class, plot a graphical representation of the spatial dimension of your dataset. Examples include bars at the location where a measurement was taken and Choropleth maps (i.e. maps where the color of each shape is based on the value of an associated variable; Note: this can also be done with categorical variables).

- **OR- Delineate a watershed (75%)** – Using the tools introduced in the class, delineate a watershed based on a digital elevation model (DEM) and a pour point that you specify. This pour point can be of hypothetical nature or based on empirical evidence. In addition to the delineated watershed, provide a graphical representation of flow accumulation and the river network.

Grade allocation: This report is worth 20% of your total grade in this class.

Assignment 4: Science Proposal (20%)

Your group must provide a 2-page clear language science proposal that addresses the wicked environmental problem in the context of sustainable agriculture and outlines the following:

- 1) A brief description of “wicked problem’s” context
- 2) A hypothesis statement or research question

- 3) A description of the data set
- 4) Strategy to use the data
 - a. Plotting
 - b. Analysis
- 5) A conceptual model that outlines the problem

- 6) Potential policy interventions to include in your Science Proposal Pitch

Grade allocation: This report is worth 20% of your total grade in this class. Note 20% of this work is subject to peer evaluation.

Assignment 5: Science Proposal Pitch (20%)

Your team will provide a short presentation about your science proposal. The presentation should describe the data, analysis, and results of your inquiry. The presentation should include the following: 1) What is the problem? - A clear outline and motivation for your topic of inquiry; 2) How you think it works? – Statement of research question or hypothesis; 3) How does it work? – A description of your quantitative and qualitative data sources and results; 4) A description of your ethical protocol for class engagement; 5) We expect you to draw on peer-reviewed literature to support your findings.

During the presentation, you will pitch a policy intervention to your classmates. You must follow appropriate ethical protocols to find out what they think about the policy intervention, and whether it meets the value proposition (Does it address the root cause? Will it solve the problem? Will the problem stay fixed? Would people do it?).

Assignment checklist:

Clear outline and motivation for your topic of inquiry – (What is the Problem?)	
Statement of your research question or hypothesis – (How you think it works?)	
A description of your data	
How was your data organized	
A description of your analytical approach (e.g. how you analyzed the data and assumptions)	
Results in a visualization, figure, table, or infographic (How does it work?)	
Policy Intervention (What can we do about it?)	
Description of your ethical protocol for engagement regarding policy interventions	
Success of your engagement (Peer & Instructor Assessment)	
Expressing gratitude for your participants	

Grade allocation: This report is worth 20% of your total grade in this class. Note 20% of this work is subject to peer evaluation.

TOTAL

/20

Submitting Assignments

All assignments will be posted on Blackboard on the same day and must be submitted through Blackboard until the specified due date. All assignments submitted after the due date are considered late.

Late Assignments

Assignments that are submitted later than the stated due date will be penalized 10% for each day late or part thereof. Assignments submitted more than 3 days after the due date will not be accepted. Exceptions will only be made when there are documented medical reasons or extraordinary circumstances.

Peer Evaluation (separate evaluations for assignments 4 and 5, worth 20% each)

Name: _____ Class: ENVS 805

Date: _____

Assignment: _____

Values: 1 = Strongly Disagree 2 = Disagree 3 = Agree 4 = Strongly Agree

Attribute	Yourself	1	2	3
Was dependable in attending team meetings.				
Willingly accepted assigned tasks.				
Contributed positively to team discussions.				
Completed work on time or made alternative arrangements.				
Helped others with their work when needed.				

Did work accurately and completely.				
Contributed a fair share to team tasks.				
Worked well with other team members.				
Made working in a team enjoyable for all team members.				
Overall was a valuable member of the team.				
Column Totals				

Each person will receive a mark that is an average of the self and team members' peer evaluations.

Integrity Defined (from the Office of the University Secretary)

The University of Saskatchewan is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Student Conduct & Appeals section of the University Secretary Website and avoid any behavior that could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

All students should read and be familiar with the Regulations on Academic Student Misconduct (<https://secretariat.usask.ca/documents/student-conduct-appeals/StudentAcademicMisconduct.pdf>) as well as the Standard of Student Conduct in Non-Academic Matters and Procedures for Resolution of Complaints and Appeals (<http://www.usask.ca/secretariat/student-conduct-appeals/StudentNon-AcademicMisconduct.pdf>)

For more information on what academic integrity means for students see the Student Conduct & Appeals section of the University Secretary Website at: <http://www.usask.ca/secretariat/student-conduct-appeals/index.php>

Examinations with Access and Equity Services (AES)

Students who have disabilities (learning, medical, physical, or mental health) are strongly encouraged to register with Access and Equity Services (AES) if they have not already done so. Students who suspect they may have disabilities should contact AES for advice and referrals. In order to access AES programs and supports, students must follow AES policy and procedures. For more information, check www.students.usask.ca/aes, or contact AES at 306-966-7273 or aes@usask.ca.

Students registered with AES may request alternative arrangements for mid-term and final examinations. Students must arrange such accommodations through AES by the stated deadlines. Instructors shall provide the examinations for students who are being accommodated by the deadlines established by AES.

Student Supports

Student Learning Services

Student Learning Services (SLS) offers assistance to U of S undergrad and graduate students. For information on specific services, please see the SLS web site <http://library.usask.ca/studentlearning/>.

Student and Enrolment Services Division

The Student and Enrolment Services Division (SESD) focuses on providing developmental and support services and programs to students and the university community. For more information, see the students' web site <http://students.usask.ca>.

Financial Support

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact Student Central (<https://students.usask.ca/student-central.php>).

Aboriginal Students Centre

The Aboriginal Students Centre (ASC) is dedicated to supporting Aboriginal student academic and personal success. The centre offers personal, social, cultural and some academic supports to Métis, First Nations, and Inuit students. The centre is also dedicated to intercultural education, bringing Aboriginal and non-Aboriginal students together to learn from, with and about one another in a respectful, inclusive and safe environment. Students are encouraged to visit the ASC's Facebook page (<https://www.facebook.com/aboriginalstudentscentre/>) to learn more.

International Student and Study Abroad Centre

The International Student and Study Abroad Centre (ISSAC) supports student success in their international education experiences at the U of S and abroad. ISSAC is here to assist all international undergraduate, graduate, exchange and English as a Second Language students and their families in their transition to the U of S and Saskatoon. ISSAC offers advising and support on all matters that affect international students and their families and on all matters related to studying abroad. Please visit students.usask.ca for more information.

D. School and University policy statements

1. Grading System Description

SENS uses the following grading system as adopted by the College of Graduate Studies and Research:

90-100 Exceptional

A superior performance with consistent strong evidence of

- a comprehensive, incisive grasp of subject matter;
- an ability to make insightful, critical evaluation of information;
- an exceptional capacity for original, creative and/or logical thinking;
- an exceptional ability to organize, to analyze, to synthesize, to integrate ideas, and to express thoughts fluently;
- an exceptional ability to analyze and solve difficult problems related to subject matter.

80-89 Very Good to Excellent

A very good to excellent performance with strong evidence of

- a comprehensive grasp of subject matter;
- an ability to make sound critical evaluation of information;
- a very good to excellent capacity for original, creative and/or logical thinking;

- a very good to excellent ability to organize, to analyze, to synthesize, to integrate ideas, and to express thoughts fluently;
- a very good to excellent ability to analyze and solve difficult problems related to subject matter.

70-79 Satisfactory to Good

A satisfactory to good performance with evidence of

- a substantial knowledge of subject matter;
- a satisfactory to good understanding of the relevant issues and satisfactory to good familiarity with the relevant literature and technology;
- a satisfactory to good capacity for logical thinking;
- some capacity for original and creative thinking;
- a satisfactory to good ability to organize, to analyze, and to examine the subject matter in a critical and constructive manner;
- a satisfactory to good ability to analyze and solve moderately difficult problems.

60-69 Poor

A generally weak performance, but with some evidence of

- a basic grasp of the subject matter;
- some understanding of the basic issues;
- some familiarity with the relevant literature and techniques;
- some ability to develop solutions to moderately difficult problems related to the subject matter;
- some ability to examine the material in a critical and analytical manner.

<60 Failure

An unacceptable performance.

2. Midterm and Final Examination Scheduling

Midterm and final examinations must be written on the date scheduled.

Final examinations may be scheduled at any time during the examination period; students should therefore avoid making prior travel, employment, or other commitments for this period. If a student is unable to write an exam through no fault of his or her own for medical or other valid reasons, documentation must be provided and an opportunity to write the missed exam may be given. Students are encouraged to review all examination policies and procedures:

<http://students.usask.ca/academics/exams.php>

3. Assessment Issues and Grade Disputes

A student shall be permitted to see any examination unless otherwise stated at the beginning of the course. Students dissatisfied with the assessment of their work in any aspect of course work, including midterm or final examination should consult the University policy '*Student Appeals or Evaluation, Grading and Academic Standing*' found at the Office of the University Secretary:

<http://policies.usask.ca/policies/student-affairs-and-activities/student-appeals.php>

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6. Recording

All lectures will be recorded and provided to students through Blackboard. With permission of the instructors, students are also allowed to make their own audio or video recordings in class.

Academic Integrity Checklist

Honesty and integrity are expected of every student at the University of Saskatchewan. There are many forms of academic misconduct; perhaps the most common is plagiarism. According to the University of Saskatchewan Guidelines for Academic Conduct:

“Plagiarism is the theft of the intellectual creation of another person without proper attribution. It is the use of someone else's words or ideas or data without proper documentation or acknowledgment. Quotations must be clearly marked, and sources of information, ideas, or opinions of others must be clearly indicated in all written work. This applies to paraphrased ideas as well as to direct quotations. A student must acknowledge and fairly recognize any contributions made to their personal research and scholarly work by others, including other students.”

There are many resources on campus to assist you with proper citation and paraphrasing.

- For guidance on when and how to quote from other documents and how to properly paraphrase information in other documents, see <http://library.usask.ca/howto/honesty.php>.
- To learn about different styles of citation and how to properly cite a variety of different sources including statistics, archival materials, maps, legal documents and government reports, see <http://libguides.usask.ca/citation>.

When in doubt about a citation requirement or your approach to paraphrasing, ask your librarian or your course instructor or your academic supervisor for assistance.

Before you submit any written work, review it against the following checklist:¹

- I have acknowledged the use of all ideas with accurate citations.
- I have used the words of another author, instructor, information source, etc., and I have properly acknowledged this and used proper citation.
- In paraphrasing the work of others, I have put the idea into my own words and did not just change some words or rearrange the sentence structure.
- I have checked my work against my notes to be sure that I have correctly referenced all quotes or ideas.
- When using direct quotations, I have used quotation marks (or other means to clearly identify the quoted text) and provided full citations.
- Apart from material that is a direct quotation, everything else in the work is presented in my own words.
- When paraphrasing the work of others, I have acknowledged the source or the central idea.
- I have checked all citations for accuracy (e.g. page numbers, journal volume, dates, web page addresses).
- I have used a recognized reference style (i.e. APA, MLA, Chicago etc.) consistently throughout my work.
- My list of references/ bibliography includes all of the sources used to complete the work.
- I have accurately and completely described any data or evidence I have collected or used.
- I fully understand all of the content (e.g., terms, concepts, theories, data, equations, ideas) of the work that I am submitting.
- The content of the work has not been shared with another student, unless permitted by the instructor.
- The content of the work reflects wholly my own intellectual contribution or analysis and not that of another student(s), unless the instructor approved the submission of group or collaborative work.

¹ Compiled based on York University (http://www.yorku.ca/tutorial/academic_integrity/acadintchecklist.html), Curtin University (<http://academicintegrity.curtin.edu.au/global/checklist.cfm>), University of Toronto (<http://www.utoronto.ca/academicintegrity/resourcesforstudents.html>), and Skidmore College (<http://cms.skidmore.edu/advising/integrity/checklist.cfm>) checklists for academic integrity.

- If another person proofread my work it was for the sole purpose of indicating areas of concern, which I then corrected myself.
- This work has not been submitted, whole or in part, for credit in another course or at another institution, without the permission of the current course instructor(s).
- I understand the University of Saskatchewan's policy and expectations concerning academic honesty and the consequences of plagiarism or other forms of academic misconduct.

Declaration of Syllabus Understanding ENVS 805

I _____ have read the syllabus, had an opportunity to ask questions, and I acknowledge my responsibilities for completing all readings, lectures, labs, as well as individual and group assignments.

Signature: _____

Date: _____