An exploration of quantitative methods for use in interdisciplinary contexts and socio-ecological systems research

RES 500E
Tuesdays 9:00 am - 12:00 pm
Location: AERL 419

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Office Hours: By appointment

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Course Canvas page: https://canvas.ubc.ca/courses/109871
Course syllabus: RES 500E Syllabus - 2022W T2

Course Requirements and Purpose:
This course is open to graduate students (or advanced undergraduates with instructor approval and completed G+PS form) interested in quantitative and mixed-methods approaches to research. It is expected that students will come from a range of backgrounds and that many students who take the course will have limited (or no) prior training in quantitative methods. The course is designed to present a “buffet” of methods and best practices commonly used in environmental research. Students will cover select 1-2 methods to explore in more depth through a course project that they can then apply to their graduate research and/or additional specialized courses.

Course Description
This course will explore quantitative methods and data used in interdisciplinary contexts, including social-ecological systems and related research. Topics will include commonly used approaches from a range of fields. The course is designed to be accessible to students without prior expertise in quantitative methods while also providing opportunities for in-depth exploration of topics and methods for more experienced students.

We will cover topics from field data & instrumentation, community science (i.e., citizen science), geospatial (e.g., GIS) and remote sensing data, network data, time-series data, systematic reviews & meta-analyses, bibliometrics and science mapping. Specific topics and methods to be covered during the term will be adjusted based on student interests. The course will also touch on some philosophical aspects that students might not otherwise cover in their training (e.g., "What is data"?) and provide students with exposure to strategies for effective and ethical data collection, management, and integrating quantitative approaches into mixed-methods research.
Format

The course focuses on exposure to a range of quantitative approaches, including data sources and tools for using them. Each week’s class will comprise: 1) a brief presentation introducing the concepts and methods for the week; 2) a discussion on any assigned readings; and 3) a short hands-on workshop, giving students a foundation for future research and experimentation. For their final project, students will apply one or more quantitative methods to a topic relevant to their graduate research domain.

The course is organized around three overarching themes:
1. Defining, Collecting, and Managing Data
2. Environmental Modelling and Mapping
3. Networks, Bibliometrics, and Systematic Reviews

Learning Outcomes

- Understand philosophical assumptions related to the collection and use of quantitative data.
- Become conversant in a wide range of quantitative methods used in social-ecological systems research and related fields.
- Understand how to design and carry out mixed-methods research in environmental science that will get published.
- If you are primarily trained in quantitative methods, the course will provide opportunities for:
  - Exposure to new methods
  - Strengthen your existing methods knowledge and understand them in a new light.
- If you are primarily trained in qualitative methods, the course will provide opportunities for:
  - Introduction to an array of quantitative approaches, from “low-tech” to “high-tech”
  - Learn how quantitative colleagues are thinking and how to collaborate
- Co-creation of a living document of resources to draw on in the future.

Course Materials

Required readings and datasets will be made available on the course’s Canvas website.
### Assessment Matrix

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Marks</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Defining quantitative research</td>
<td>5%</td>
<td>Jan 17</td>
</tr>
<tr>
<td>2. Talking across the aisle</td>
<td>10%</td>
<td>Jan 24</td>
</tr>
<tr>
<td>3. Article analysis and reflection</td>
<td>10%</td>
<td>Feb 7</td>
</tr>
<tr>
<td>4. Prospectus for Research Proposal or Paper</td>
<td>5%</td>
<td>Feb 17 (before reading week)</td>
</tr>
<tr>
<td>5. Geospatial dataset description and analysis</td>
<td>15%</td>
<td>Feb 28</td>
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<tr>
<td>6. Network analysis</td>
<td>10%</td>
<td>Mar 21</td>
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<tr>
<td>7. Science mapping analysis</td>
<td>10%</td>
<td>Mar 28</td>
</tr>
<tr>
<td>8. Research Proposal or Paper (20%) and In-class Presentation (5%)</td>
<td>25%</td>
<td>April 11 (presentation); April 18 (paper/proposal)</td>
</tr>
<tr>
<td>9. Course reflection (and reflecting back on your submission for 1st assignment)</td>
<td>5%</td>
<td>April 14</td>
</tr>
<tr>
<td>Class participation (attendance, readings, and participation in class discussions/activities)</td>
<td>5%</td>
<td>N/A</td>
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</tbody>
</table>

Assignments are described below (after the detailed schedule).
## Detailed Schedule

<table>
<thead>
<tr>
<th>Date</th>
<th>Week</th>
<th>Theme</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>2023-01-10</td>
<td>1</td>
<td>Defining, collecting, and managing data</td>
<td>Introduction / What is data?</td>
</tr>
<tr>
<td>2023-01-17</td>
<td>2</td>
<td></td>
<td>Field data</td>
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<tr>
<td>2023-01-24</td>
<td>3</td>
<td></td>
<td>Data wrangling and visualization</td>
</tr>
<tr>
<td>2023-01-31</td>
<td>4</td>
<td></td>
<td>Managing and reporting data</td>
</tr>
<tr>
<td>2023-02-07</td>
<td>5</td>
<td>Environmental modelling and mapping</td>
<td>Geospatial data I (GIS)</td>
</tr>
<tr>
<td>2023-02-14</td>
<td>6</td>
<td></td>
<td>Geospatial data II (Remote Sensing)</td>
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<tr>
<td>2023-02-21</td>
<td></td>
<td>Reading week</td>
<td>NA</td>
</tr>
<tr>
<td>2023-02-28</td>
<td>7</td>
<td></td>
<td>Environmental modelling</td>
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<tr>
<td>2023-03-07</td>
<td>8</td>
<td></td>
<td>Time series data</td>
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<tr>
<td>2023-03-14</td>
<td>9</td>
<td>Networks, bibliometrics, and systematic reviews</td>
<td>Network analysis</td>
</tr>
<tr>
<td>2023-03-21</td>
<td>10</td>
<td></td>
<td>Bibliometrics and science mapping</td>
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<tr>
<td>2023-03-28</td>
<td>11</td>
<td></td>
<td>Systematic reviews and meta-analyses</td>
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<tr>
<td>2023-04-04</td>
<td>12</td>
<td></td>
<td>Community / Citizen science</td>
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<tr>
<td>2023-04-11</td>
<td>13</td>
<td></td>
<td>Presentations</td>
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<tr>
<td>2023-04-14</td>
<td>NA</td>
<td>Final presentations and wrap-up</td>
<td>Course reflection</td>
</tr>
<tr>
<td>2023-04-18</td>
<td>NA</td>
<td></td>
<td>Paper/proposal due</td>
</tr>
</tbody>
</table>

*Note: The following schedule is provisional. Specific topics and methods to be covered during the term may be adjusted based on student interests. For the most up-to-date schedule, please check the class [Google Sheet](#).*
Week 1: Introductions + What is data?

- Introductions to each other and to the course
- Overview of basic philosophical and quantitative concepts
- Consider the influence of context and interpretation in data

Workshop Activity

- Group exercise and discussion on the role of evidence in science

Readings and other assigned materials


Additional resources (i.e., optional)


Week 2: Field Data

- Key considerations for field survey design and collection
- Tools and concepts
- Examples from different disciplines

Workshop Activity

- Facilitated discussion based around sensors used in environmental monitoring, including issues related to accuracy, precision, and uncertainty.

Readings and other assigned materials


Additional resources


Week 3: Data Wrangling and Visualization

- Assignment 2 presentations
- Simple/informal data visualizations as exploratory analysis
- Best practices and rules of thumb
- Telling a story with data

Workshop Activity

- Hands-on with R and ggplot
  - Posit Cloud
    - Data Visualization Basics ([https://posit.cloud/learn/primers/1.1](https://posit.cloud/learn/primers/1.1))
    - If interested, you can explore other topics in the Primers section
  - Exploratory Data Analysis ([https://tutorials.shinyapps.io/01-Exploratory-Data-Analysis/#section-welcome](https://tutorials.shinyapps.io/01-Exploratory-Data-Analysis/#section-welcome))
    - Shiny-based GUI for learning and generating ggplot code (you can even upload your own dataset) ([https://shiny.gmw.rug.nl/ggplotgui/](https://shiny.gmw.rug.nl/ggplotgui/))

Readings and other assigned materials


- Fundamentals of Data Visualization ([https://clauswilke.com/dataviz/](https://clauswilke.com/dataviz/)) [Read Sections 1 through 5]

Additional resources


- Data Wrangling in R with dplyr and tidyr

### Week 4: Managing and Reporting Data

- Organizing project data
- Metadata
- Interoperability and open data
- Data Management Plans / Project Organization
- Data longevity/sustainability (e.g. FAIR + CARE)
- Open Science vs. Reproducibility
- Data ethics

#### Workshop Activity

- Preparing reproducible data and reports.

#### Readings and other assigned materials


Week 5: Geospatial Analysis I (GIS)

- Overview of GIS concepts
- Types of geospatial data
- Spatial reference systems and projections
- GPS
- Combining multiple forms of data
- Cartography and visualizing geospatial data
- Critical GIS

Workshop Activity

- Hands-on with GIS data: Exploring various datasets, basic geospatial analyses and visualizations

Readings and other assigned materials

Gimond M. 2022. Intro to GIS and Spatial Analysis.

https://mgimond.github.io/Spatial/index.html [Read Chapters 1 through 10]
http://dx.doi.org.ezproxy.library.ubc.ca/10.1214/088342305000000241

http://dx.doi.org.ezproxy.library.ubc.ca/10.1016/B978-0-08-102295-5.10530-X

Additional resources


Guide to UBC Library Geospatial Services and Resources.

Week 6: Geospatial Analysis II (Remote Sensing)

- Overview of remote sensing concepts
- Types of sensors
- Ground-truthing
- Indices
- Change detection
- The relationship between GIS and remote sensing
- Critical remote sensing

Workshop Activity

- Hands-on activity with remote sensing data

Readings and other assigned materials

  Mapping the Invisible: Introduction to Spectral Remote Sensing


http://dx.doi.org.ezproxy.library.ubc.ca/10.1177/03091325221074691.

Additional resources


NASA page: What is Remote Sensing?

*EarthNow!*: Watch live and recent acquisitions of Landsat 8 and Landsat 9.


Week 7: Environmental Modelling

- Overview of concepts and approaches to different types of modelling
- How to get from the field to the computer
- Concepts and techniques for verification, validation, and interpretation
- Big data

Workshop Activity

- Hands-on with Shiny-based water balance tool, species distribution model, Whitebox, and/or flood model.

Readings and other assigned materials

http://dx.doi.org.ezproxy.library.ubc.ca/10.1002/9781118351475.ch2


[Read Chapter 1. Introduction]

Additional resources


Week 8: Time Series Analysis

- Purpose and Approaches
- Trend identification
- Change point analysis
- Periodization (how much data is enough, when to slice it)
- Gap-filling

Workshop Activity

- Hands-on activity with time-series datasets and visualizations

Readings and other assigned materials

Fundamentals of Data Visualization (https://clauswilke.com/dataviz/)
  - [Read Chapters 13 and 14]

Additional resources

TBD

Week 9: Topic: Network Analysis.

- Relational data and Graph Theory
- Network analysis: Theory or method?
- Various applications in environmental research (e.g., social networks, social-ecological networks, biophysical networks, discourse networks, geographical networks)
- The non-trivial nature of how nodes and ties are conceptualized
- Quali-quantitative approaches to network analysis

Workshop Activity

Guest lecture: Dr. Cayelan Carey, Ecological Forecasting (wrapping up module on)

- Hands-on exercise with Gephi network software

Readings and other assigned materials

Introduction to Social-Ecological Networks Part 1. 2020. [Up to 10:40]


Additional Resources


Week 10: Bibliometrics and Science Mapping

- How do we get a sense of a topic or study area when there is so much science being produced!?
- Conducting inductive analysis of documents
Workshop Activity

- Hands-on with Web of Science
  - Construct search queries and download data
- Hands-on with bibliometrix and/or VOSViewer and/or CitNetExplorer
  - Import a bibliographic dataset downloaded from Web of Science
  - Summarize the data (publications over time, author productivity, institutional affiliation, geographic location, etc).
  - Compare collaboration networks based on authors, affiliations, and countries
  - Compare networks based on citation, bibliographic coupling, and co-citation

Readings and other assigned materials


Additional resources


A network of science: 150 years of Nature papers https://www.nature.com/articles/d41586-019-03325-6


Week 11: Systematic Reviews and Meta-analyses

- How to extract and analyze data from extant sources
- Designing a study for deductive analysis of documents
- Querying bibliographic databases (e.g. Web of Science)
- PRISMA Flow Diagram / Cochrane Standards
- Examples

Workshop Activity

- Hands-on with listsearchr

Readings and other assigned materials


Additional resources


- The paper presents an approach for conducting keyword search for systematic reviews using the R package litsearchr. See related video at https://www.youtube.com/watch?v=Z0GWTzl9OCE


Gough D, Oliver S, Thomas J. 2017. An Introduction to Systematic Reviews. SAGE.

- Which type of review is right for you? Flowchart from Cornell University Library.
- Systematic and Scoping Reviews. Resources from UBC Library.
- PRISMA EcoEvo
- PreicTER - Predicting Time Requirements for Evidence Reviews

Week 12: Community & Citizen Science

- Debates over efficacy/validity of data collected by “non-experts”
- Power dynamics
- Terminology: Citizen science v. Community Science v. Community Monitoring
Transdisciplinarity

Tools/Software

Workshop Activity

- Hands-on with community/citizen science tools (e.g., CitSci.org, Field Papers, KoboToolbox)

Readings and other assigned materials


Liboiron, M. 2019. The Power (Relations) of Citizen Science. CLEAR. https://civiclaboratory.nl/2019/03/19/the-power-relations-of-citizen-science/


Additional resources


PGIS and Participatory Mapping/Cartography in Understanding and Use of (Rural) Space, Utilising Local People's Local Spatial Knowledge A Bibliography. Available from [https://www.researchgate.net/publication/366977222_PGIS_and_Participatory_Mapping_Cartography_in_Understanding_and_Use_of_Rural_Space_Utilising_Local_People's_Local_Spatial_Knowledge_A_Bibliography](https://www.researchgate.net/publication/366977222_PGIS_and_Participatory_Mapping_Cartography_in_Understanding_and_Use_of_Rural_Space_Utilising_Local_People's_Local_Spatial_Knowledge_A_Bibliography)


Week 13: Project Presentations / Reflection Discussion

- Presentations
- Discussion reflecting on the methods and how they think about data now they’ve “sampled” all of these methods.
Assignment Details

Unless otherwise stated, please submit assignments via Canvas. When an assignment is due on a class day, it is to be submitted prior to class. Assignments due on days that are not class days are to be submitted by 11:59 pm on the date due.

Assignment 1: Defining quantitative research (due January 17)
Define quantitative research in your own terms (no more than 300 words). Include what its strengths and weaknesses are and any groupings or categories of methods you observe. Each student will submit their response on Canvas and also share their definition with the class for discussion. [Note: You will revisit this assignment at the end of the course to provide an opportunity to self-reflect on how your definition may have changed].
Submission details: Submit to Canvas as a discussion post. Once you have submitted yours, you will be able to view and reply to other posts.

Assignment 2: Talking Across the Aisle (due January 24)
Imagine the following scenario: You come across an interesting quantitative method that you would like to use in your collaborative research project. Explain the method to a team member or potential collaborator who is not familiar with it. What is the basis of the method and how do you envision applying it? What kind of data does it require? What assumptions does it make? Can you imagine ways to mix it with other methods?

This is a chance to practice talking outside your comfort zone!
- If you are more comfortable with qualitative methods, imagine you are explaining it to a quantitative researcher.
- If you are more comfortable with quantitative methods, imagine you are explaining it to a qualitative researcher.

Your specific strategy is up to you, but a good rule of thumb is to avoid highly specific terms and jargon. You will present to the class in the form of a short 'lightning' talk for constructive feedback.
Submission details: Provide an in-class summary presentation (no more than 5 minutes). If you plan to use slides, please upload your presentation file to Canvas to facilitate file organization.

Assignment 3: Article analysis and reflection (due February 7)
Critically read and analyze a research paper. The paper should use a quantitative method or mixed-methods approach that you are familiar with. Check with the instructor if you are having trouble identifying or selecting a paper. This assignment is a chance to demonstrate and integrate your knowledge of the major themes of the first month of the course.

Use the list below as a guide for what to analyze (these are guidelines, not strict requirements):
● Basic Philosophical Assumptions
  ○ Ontology, epistemology, philosophical perspective (see Moon & Blackman 2014)
  ○ Are these implicit or explicit in the paper?

● Data and Analytical Approach
  ○ What method(s) were used in the analysis?
  ○ What data were collected and how?
  ○ What was the sampling design?
  ○ How were the data described?
  ○ How was uncertainty assessed and/or communicated?

● Visualization
  ○ What visualization techniques were used?
  ○ Were the visualizations effective? Why or why not?

● Representativeness and Reproducibility
  ○ Is the study generalizable? If so, to what extent? If not, why?
  ○ Is the study reproducible? If so, to what extent? If not, why?
  ○ Is the data and/or code included?
  ○ Is there metadata? Is it sufficiently detailed?

● Context
  ○ Did they adequately describe the study area/domain?
  ○ Did they state whether they had a permit for any field work conducted?
  ○ Is the positionality of the authors stated anywhere (e.g. who they are, their thought styles, values/motivations)?

● Reflection
  ○ Are you convinced by the argument/evidence enough to cite the paper?
  ○ Did the authors sufficiently explain their methods and interpretation?
  ○ How might the data collection and/or analytical approach be improved?
  ○ How might the paper itself (e.g. writing/organization) be improved?
  ○ What else would you do differently?

Submission details: Upload a 1-page (single-spaced, 12-point font) document (.docx or .pdf) to Canvas and be prepared to discuss your selected paper in class on Feb 7.

Assignment 4: Prospectus for Research Proposal or Paper (due February 17)
Provide a high-level summary of your proposed term project (see Assignment 8). This will consist of a condensed proposal/research design summary for peer-review. Feel free to discuss ideas with the instructor beforehand.
Submission details: Upload a 1-page (single-spaced, 12-point font) document (.docx or .pdf) to Canvas.
Assignment 5: Geospatial dataset description and analysis (due Feb 28)

Choose a dataset from WRI’s Resource Watch (https://resourcewatch.org/) or other sources (confirm with the instructor) to address a question of interest.

1. Describe the dataset(s) attributes, including but not limited to:
   - Creator
   - Source / Host
   - Resolution (spatial, spectral, temporal, etc.)
   - Accuracy / Precision
   - Uncertainties
   - Potential applications

2. Analyze the dataset(s) to address a question (this can emerge from your exploration of the data)

3. Create 1-3 visualizations that convey the key information

4. Provide a mini-report including an introduction, methods, summary statistics, results and discussion of findings

5. Present your results in a 5-minute lightning talk (in class on Feb 28)

Submission details: Upload a 2-page (single-spaced, 12-point font, including 1-3 figures) document (.docx or .pdf) to Canvas, and provide an in-class summary presentation (no more than 5 minutes).

Assignment 6: Network analysis (due Mar 21)

Use Gephi to analyze the network dataset provided (Les Miserables) or a dataset of your choice (but best to use one of the sample datasets available when opening Gephi).

![Welcome to Gephi](image)

Import the dataset as an undirected network. Use default settings for all statistics. Write a report that answers the following questions. Include 1-3 figures that demonstrate your observations and interpretations (screenshots are fine):

1. Compute the Average Degree and Weighted Degree
   a. Does this network have a skewed distribution?
b. Size the nodes based on Degree
   c. Which node has the highest Degree?
2. Compute the Network Diameter
   a. What is the Network Diameter and what does it mean?
   b. Which node has the highest Betweenness Centrality? (this was calculated in the last step)
   c. Is it the same as the node with the highest Degree?
   d. Size the nodes based on Betweenness Centrality. What does this mean in the context of this dataset?
3. Compute the Modularity
   a. Color the data based on the modularity class
   b. How many communities are there with at least 4% of the network?
   a. How does the network (and your interpretation of it) change based on the layout?
   b. Do you see advantages/disadvantages to each layout?
5. Describe one additional characteristic of the network that you find interesting (and why).

Submission details: Upload a 2-page (single-spaced, 12-point font, including 1-3 figures) document (.docx or .pdf) to Canvas

Assignment 7: Science mapping analysis (due Mar 28)

Use the Web of Science (or other data source) to conduct a basic science mapping analysis of a field or topic of interest to you. Use one or more of the following software programs in your analysis: bibliometrix, VOSviewer, or CitNetExplorer. Write up your results in a report that answers the following questions:
- Do you observe any trends in the bibliographic data? If so, describe them.
- Describe the conceptual structure
  - What terms and keywords are most frequent? central? peripheral?)
- Describe the social structure
  - What co-authorship communities exist? What is their focus of study?
  - Do you notice any structural holes or gaps?
- Describe the intellectual structure
  - What citation patterns do you see?
- How has the structure changed over time?
  - Changes in size, shape, themes, etc.?
Include figures that demonstrate your observations and interpretations as necessary (don’t worry about image quality; screenshots are fine).

Submission details: Upload a 2-page (single-spaced, 12-point font, including 1-3 figures) document (.docx or .pdf) to Canvas
This is the summative course assignment, and as such, it is designed to give you an opportunity to apply and demonstrate your knowledge of multiple aspects of quantitative research design and methods in the context of your own research. The assignment consists of three components:

1. [5%] Condensed proposal/research design summary for peer-review (due Feb 17)
   ○ 1-page, single-spaced, 12 pt font size [See Assignment 4]
2. [5%] Short class presentation of proposal/research design (In class April 11)
   ○ ~10 minutes [Upload presentation file to Canvas prior to class on Apr 11]
3. [20%] Written proposal/paper uploaded to Canvas (due April 18)
   ○ See instructions below [Upload assignment to Canvas by 11:59p on Apr 18]

This course is intended to be useful to you. As each student may be at different stages of their research program, there are three options for this course's “major paper” component (please confirm your proposed idea with the instructor in advance).

**Option 1: Preliminary Research Proposal**

**Instructions for proposal assignment**

This is the final assignment for the course and is designed to allow you to demonstrate what you have learned about quantitative inquiry, project design, and methods in the context of your own research interests. You may propose a mixed-methods study, but quantitative methods should play a central role.

The development of a rigorous research design and proposal is an iterative process that involves multiple rounds of feedback with your supervisor and committee members outside the bounds of this course. This assignment is intended to get you started on that process. Your proposal should contain the following components:

**Formatting requirements**: 6 pages maximum, excluding bibliography and appendices (no page limits for bibliography and appendices). Single-spaced, 12 pt font size.

- **Introduction**: What question or issue are you addressing with this research? This should be as clear as possible to grab your reader’s attention and be widely understandable to people outside your field (~ half page).

- **Background/Literature Review**: How has this problem been understood and examined in the literature so far? What is known and not known? What questions remain? This does
not have to be comprehensive—you just need to provide some background to the problem so as to identify “the gap” that your research will address (~ half page).

- **Research Objective**: State your research objective(s). This should flow from the previous two sections and can be in bullet form or embedded in the text. (1-2 sentences)

- **Conceptual Framework**: What literature(s) will you draw from to achieve your stated objectives? Again, this should not be highly in-depth— you simply need to provide some indication of the types of theories/frameworks/philosophical perspectives that may be relevant to your topic (~ half page).

- **Research Question(s)**: What specific research questions does the above lead to? (quarter page). For the purposes of this assignment, we recommend developing a single research question, but you may include one or two more if necessary. Make sure to choose a question that can be addressed using a quantitative (or at least mixed-methods) approach (2-3 sentences)

- **Methodology**: This is the core of this assignment. What approach, study boundaries, data collection, and method(s) of analysis are you going to use to answer your research question(s)? Cite the methodological literature as needed (3-4 pages).
  - **Approach**: Clearly identify your methodological approach and justify why this approach is implicated by your specific objectives.
  - **Study boundaries / Case study selection**: Describe the logic for and boundaries of your proposed research site(s) (or topic), including anticipated issues related to and your proposed strategies to address them.
  - **Data collection**: Clearly describe the rationale for your proposed method(s) of data collection. If you plan to conduct fieldwork, describe your plan for accessing the field site. If you plan to use existing data sources, describe their characteristics and where you will access them.
  - **Sampling**: Clearly describe the details of your sampling strategy (e.g., plot design, instrumentation, existing data sources). If you are building your strategy from others in the literature, be sure to cite them.
  - **Analysis**: Describe and justify your planned approach to analysis, ensuring that these plans are appropriate for, and coherent with the proposed approach, methods, and the research question(s) being asked.
  - **Data management plan**: Describe how and where you will store and organize your data, as well as what metadata you will create. If you plan to share the data,
describe how (e.g., institutional repository, Zenodo.org). If you don’t plan to share the data, justify why not.

- **Ethics**: Discuss how you will ensure overall adherence to ethical principles throughout the project.

- **Expected Results & Outcomes**:
  - Describe what you expect to find and what the implications of the research will be. This will require some speculation on your part (which is OK, this is research after all!). Be honest and confident. You want to give the reader a sense of the outcomes of your project without overstating it (quarter page).

- **Bibliography**:
  - Include literature related to your specific research problem as well as the relevant methodological literature (as many pages as needed).

- **Appendices**:
  - Include any other relevant information. This could be field plans, permits, timelines, etc. (as many pages as needed).

**Option 2: Review Paper** (with permission of the instructor – please confirm by February 15)

**Instructions for review paper assignment**
Select a particular method/family of methods (e.g. hydrologic field instrumentation, remote sensing, species distribution modelling, etc.) that you are interested in learning more about. Research its history, foundations, the types of research questions and approaches for which the method/approach is appropriate, modifications over time, emerging directions, central debates, and key issues to be resolved. The end results should be a fully cited, up-to-date literature review that situates the method within quantitative inquiry broadly and within your specific field. This can be a Traditional Review or Systematic Review (see https://guides.library.ubc.ca/litreviews for more information). You may also incorporate a bibliometric analysis into your review, if appropriate.

**Option 3: Research Paper** (with permission of the instructor – please confirm by February 15)

**Instructions for research paper assignment**
A journal-style article that involves the quantitative (or mixed-method) analysis of one or more datasets. The main body of your paper should be about 3,000-5,000 words, not including tables, figure captions, or appendices. Choose a target journal and audience, and use the font, heading format and reference style of the journal. On the first page, include the following:

- **Title**
- **Target Journal and audience**
Assignment 9: Course Reflection
Reflect back on your experiences in the course. Has your thinking changed? If so, how? Has exposure to new concepts and methods generated new types of questions? Revisit your submission for Assignment 1: Do you still agree with your definition of quantitative research? If not, how would you change your definition and why? If your definition still holds, what examples from the course confirmed this for you?
Submission details: Upload a 1-page maximum (single-spaced, 12-point font) document (.docx or .pdf) to Canvas. All completed submissions for Assignment 9 will receive full marks.

Course Policies (per university requirements)

Academic Honesty (from the UBC-Vancouver Academic Calendar)
Academic honesty is essential to the continued functioning of the University of British Columbia as an institution of higher learning and research. All UBC students are expected to behave as honest and responsible members of an academic community. Breach of those expectations or failure to follow the appropriate policies, principles, rules, and guidelines of the University with respect to academic honesty may result in disciplinary action.

It is the student's obligation to inform himself or herself of the applicable standards for academic honesty. Students must be aware that standards at the University of British Columbia may be different from those in secondary schools or at other institutions. If a student is in any doubt as to the standard of academic honesty in a particular course or assignment, then the student must consult with the instructor as soon as possible, and in no case should a student submit an assignment if the student is not clear on the relevant standard of academic honesty. Further details here: http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,286,0,0

Attendance
Regular and active attendance is central to achieving the learning objectives of this course. If you are unable to attend class due to unforeseen events (e.g. ill health or other personal challenges that arise during a term), please advise the instructor by email. Please do not attend class if you are feeling sick or unwell.

Per university regulations, attendance is expected. If you expect to miss more than one class during the term due to conflicting responsibilities, please discuss this with the instructor before
the add/drop date. Generally speaking, missing more than one class during the term will negatively affect your grade.

Late Assignments
A 10% reduction/per day beyond the assignment deadline will apply in the absence of a granted extension. If you experience unforeseen circumstances (e.g. ill health or other personal challenges) and are unable to complete an assignment on time, please contact the instructor to request an extension. All requests for accommodation must be made in writing via email. Thus, even if we have spoken in person, the student must provide written documentation of the reason for the missed class/late assignment.