

**ESM 333/334 – Methods of data collection, analysis, representation,
and modeling in Environmental and Social Sciences**

Winter 2020 Syllabus

ESM 333: Monday & Wednesday 11:30 am - 1:20 pm

ESM 334: Monday 2:00 pm - 3:50 pm

SB1 424

Instructor: Brian C. Turner, Ph.D.

Contact info: bcturner@pdx.edu

Office: Harrison Street Building Room 108

Office Hours: Wednesday 2:00 pm – 4:00 pm or by appointment; in person or via Zoom

TA: Lara Jansen

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Office: SB1 314

Office Hours: Wednesday 3:00 pm – 4:00 pm or by appointment

Course Overview

Environmental data is an important part of our daily lives. We use environmental data to make decisions at the daily, personal level (carry an umbrella, snow conditions for skiing) to policy decisions at the national and global scales (Kyoto Protocol). In this class we take a peek under the hood and look at the methods and tools that are used to transform environmental data into information that drives our decisions - big and small. The lab associated with the class will give you hand-on experience with some of the tools and methods; while the final project for the class will give you an opportunity to put these skills to practical use by following data through its lifecycle from collection, analysis, representation, modeling, and communication of results. Weekly class work will include a mix of reading, discussions, and hands-on activities in addition to the lab.

Learning Goals

- 1) Understand the methods and tools used to transform data into information.
- 2) Be able to effectively communicate and critique environmental information.
- 3) Be able to showcase personal understanding of the environmental data life cycle through a project.
- 4) Be able to explore and discuss ethical and/or political issues relating to environmental data in a constructive manner.

Instructor Inclusivity Statement

It is my intent that students from all backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. But there is always room for improvement. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, please let me know of any religious or other events that may conflict with any of our class meetings this term so that we can make arrangements for you.

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Text/Readings

The free online textbook R for Data Science by Garrett Grolemund and Hadley Wickham is required reading and reference for this course, and is available at, <https://r4ds.had.co.nz/>. Other readings and materials will be posted to the class D2L site.

Note: This syllabus is a tentative guide for the Winter 2020 quarter and may change. The instructor may update this syllabus throughout the term, and will repost on D2L.

Course Expectations:

- *Ask questions:* If something is unclear, please ask and we will try to clarify. Ask your classmates, ask the TA, or ask the instructor.
- *Be respectful:* This course has several online discussion sections. Please be respectful of the shared space and of other people as you interact with them online. Being respectful means not only approaching discussions and interactions in a responsible and thoughtful manner, but it also refers to being respectful of everyone's time by turning in assignments and participating in discussions in a timely manner. Adhere to the code of conduct: <http://www.pdx.edu/dos/codeofconduct>
- *Attend Class:* You can't learn if you don't show up. Students are expected to attend all classes. Please inform me (by email) if you cannot attend a class due to illness or personal issues.
- *Turn in work on time:* All late work will be docked 15% per week (starting immediately after the deadline), up to three weeks (45% deduction). Any work more than three weeks late will not be accepted. Any work submitted after March 19th will not be graded.
- *Make mistakes:* Mistakes are NOT a waste of time. Mistakes mean you are trying and by fixing the mistakes you are persevering and learning.

Miscellaneous:

- When emailing me, please include the course, your last name and a clue about your purpose in the subject line (for example, if you were writing with a question about an assignment, you might write, "ESM 333: Smith week 5 assignment question" in the subject line).
- Unless otherwise specified, all assignments must be submitted to D2L. Please do not email them to me directly unless you encounter technical issues. If this occurs, you can email me to mark your submission time but I will have you resubmit to D2L later.

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Course Schedule

Week	Lecture 1 Monday 11:30 am - 1:20 pm	Lecture 2 Wednesday 11:30 am - 1:20 pm	Lab Monday 2:00 pm - 3:50 pm
Week 1 1/6 & 1/8	Class Overview, What is data?	Scientific Process & Intro to R and R Studio	Intro to R
Week 2 1/13 & 1/15	Intro to digital databases and citation software, What is a Question?	Data collection methods, Public data sources, Data organization	Intro to the Tidyverse
Week 3 1/20 & 1/22	Closed for Martin Luther King Jr. Day	Intro to Data - Lab	Closed for Martin Luther King Jr. Day
Week 4 1/27 & 1/29	What is a project? Systems approach to projects	Data exploration and manipulation	Working with data
Homework 1 due by 11:59 pm on January 31 st on D2L			
Week 5 2/3 & 2/5	What is a graph? Data analysis I	Data analysis II	Data Visualization I
Check-In 1 due by 11:59 pm on February 7 th on D2L			
Week 6 2/10 & 2/12	What are statistics? Statistical modeling I	Statistical modeling II	Data Visualization II
Homework 2 due by 11:59 pm on February 14 th on D2L			
Week 7 2/17 & 2/19	What is a result? Interpreting results	Communicating Results	Modeling with data
Check-In 2 due by 11:59 pm on February 21 st on D2L			
Week 8 2/24 & 2/26	Group Work	What is a conclusion? Data storage, archiving, publishing	Communicating with data
Homework 3 due by 11:59 pm on February 28 th on D2L			
Week 9 3/2 & 3/4	Geospatial data and analysis	What is the story? Why should I care? How to give a good talk/poster	Mapping with leaflet
Check-In 3 due by 11:59 pm on March 6 th on D2L			
Week 10 3/9 & 3/11	Group Work	Final Presentations	Group work
Final Projects due by 11:59 pm on March 19 th on D2L; Presentations if needed			

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Assignments & Projects:

There are two grades for this class. Each grade is independent of the other, so keep your grade in one does not directly affect the other.

- 1) ESM 333, the lecture portion of the class. This grade will be based on the following:

In-Class Activities. *25% of ESM 333 grade*

- Daily in-class activities. Must be present in class to complete.

Homework. *25% of ESM 333 grade*

- Three assignments designed to serve as practice for components of the research project. Primarily to be completed outside of class.

Research Project. *50% of ESM 333 grade*

- The final assignment will consist of a group project working with environmental data set(s). Consists of three check-in events with the instructor to track progress, a peer review of another group's project, an in-class presentation and a final individual report. Individual rubrics can be found on D2L.
- 2) ESM 334, the lab portion of the class. This grade will be based on lab assignments (listed below), each worth 10% of the final ESM 334 grade. All labs are due by Friday at 11:59 pm the week they are assigned.

Lab 1. *Introduction to R – Due by 1/10/2020 at 11:59 pm*

- Introduction to basics, Vectors, Matrices, Factors, Dataframes, and Lists
- Estimated completion time: 4 hours

Lab 2. *Introduction to the Tidyverse – Due by 1/17/2020 at 11:59 pm*

- Data wrangling, Data visualization, Grouping and summarizing, Types of visualizations
- Estimated completion time: 4 hours

Lab 3. *Introduction to Data in R – Due by 1/24/2020 at 11:59 pm*

- Language of data, Study types and cautionary tales, Sampling strategies and experimental design, and Case study
- Estimated completion time: 4 hours

Lab 4. *Working with Data in the Tidyverse – Due by 1/31/2020 at 11:59 pm*

- Explore your data, Tame your data, Tidy your data, and Transform your data
- Estimated completion time: 4 hours

Lab 5. *Data Visualization with ggplot2 (Part1) – Due by 2/7/2020 at 11:59 pm*

- Introduction, Data, Aesthetics, Geometries, and qplot and wrap-up
- Estimated completion time: 5 hours

Lab 6. *Data Visualization with ggplot2 (Part2) – Due by 2/14/2020 at 11:59 pm*

- Statistics, Coordinates and Facets, Themes, Best Practices, and Case Study

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- Estimated completion time: 5 hours

Lab 7. *Modeling with Data in the Tidyverse – Due by 2/21/2020 at 11:59 pm*

- Introduction to modeling, Modeling with basic regression, Modeling with multiple regression, and Model assessment and selection
- Estimated completion time: 4 hours

Lab 8. *Communicating with Data in the Tidyverse – Due by 2/28/2020 at 11:59 pm*

- Custom ggplot2 themes, Creating a custom and unique visualization, Introduction to RMarkdown, Customizing your RMarkdown report
- Estimated completion time: 4 hours

Lab 9. *Interactive Maps with leaflet in R – Due by 3/6/2020 at 11:59 pm*

- Setting up Interactive Web Maps, Plotting Points, Groups, Layers, and Extras, and Polygons
- Estimated completion time: 4 hours

Lab 10. *Group work in class – just be there and work during lab on 3/1/2020*

General student information:

ESM department and School of Environment webpages:

<http://www.pdx.edu/esm/> and <http://www.pdx.edu/environment/>

Advising & Career Services: <https://www.pdx.edu/careers/> and

<https://www.pdx.edu/careers/what-can-i-do-degree-environmental-studiesenvironmentalsciences>

Library Research Tutorials: <http://guides.library.pdx.edu/home/howto> and

<http://guides.library.pdx.edu/biology>

Safe Campus: If you have not done so already, please complete the [Safe Campus Module in D2L](#). The module should take approximately 30 to 40 minutes to complete and contains important information and resources. If you are uncomfortable completing the module, please send an email to saveact@pdx.edu to request an exemption. If you or someone you know has been harassed or assaulted, you can find the appropriate resources at Sexual Misconduct Prevention & Response: www.pdx.edu/sexual-assault/. PSU's Student Code of Conduct makes it clear that violence and harassment based on sex and gender are strictly prohibited and offenses are subject to the full realm of sanctions, up to and including suspension and expulsion. <http://www.pdx.edu/sexual-assault/safe-campus-module>

Learning Center/Free Tutoring: <http://www.pdx.edu/tutoring/> or PSU library Room 245

Writing Center: Help with class assignments, resumes, etc.. <http://www.writingcenter.pdx.edu/> Cramer Room 188. Please consult the Purdue OWL regarding plagiarism and other writing issues: <https://owl.english.purdue.edu/owl/resource/589/01/>

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Math Help: <https://www.pdx.edu/math/math-resource-lab>; Department of Mathematics and Statistics provides free tutors for lower division algebra, calculus and statistics:
<https://www.pdx.edu/math/resources>

Disability Resource Center: If you are a student with a documented disability and are registered with the Disability Resource Center, please contact me so that we can arrange whatever academic accommodations you need.

Veterans: If you are a Veteran and have questions about University services or need assistance with your transition from military to campus life, please contact Chris Goodrich, Coordinator of Veterans Services at the Office of Veterans' Services, SMSU room 425.

Multicultural Centers: <https://www.pdx.edu/dmss/multicultural-student-center>
<https://www.pdx.edu/dmss/native-american-student-community-center>
<https://www.pdx.edu/dmss/la-casa-latina-student-center>

Queer Resource Center: www.pdx.edu/queer

Undergraduate Students:

See the ESM www site for scholarship opportunities.

LSAMP (Louise Stokes Alliance for Minority Participation) is dedicated to enhancing the undergraduate experience for underrepresented students in Science, Technology, Engineering, and Mathematics. Funded by the National Science Foundation, our LSAMP program focuses on: Creating a community among LSAMP scholars that values excellence, diversity, and persistence; and Expanding opportunities for LSAMP scholars through participation in undergraduate research experiences and leadership initiatives. If you're interested in finding out more, visit our LSAMP center in 103 Epler Hall, talk to ESM-LSAMP faculty advisory member Cat de Rivera <derivera@pdx.edu>, SRTC 238e, or check out: <http://www.pdx.edu/lsamp/home>

McNair Fellows program - for first-generation to college students as well as students from backgrounds underrepresented in the sciences.