Harvesting Big Data to Examine Agriculture and Climate Change

AREC280
Fall 2023

Course Description

Data analytics and data science are the driving force behind the digital revolution which has changed the way we are able to analyze and interpret the world. The explosion of data offers both opportunities and challenges that require new tools and methods of analysis. This course applies sophisticated digital tools to an age-old question: What is the impact of climate change and extreme weather on agricultural productivity? In this hands-on introduction to data analysis and visualization with real-world data, students acquire the tools to understand the impacts of climate change and more. Students will learn by doing and engage in a semester-long exploration of the relationship between climate, extreme weather and agricultural productivity. Class time will be devoted to team-based projects and activities with the class divided into teams of 4-6 students assigned by the instructor. Teams will engage in both guided and unstructured exploration of parallel subsets of the data and share their findings at the end of modules organized around a research question. Students will produce meaningful research outputs including data products, visualizations, a fact sheet, a research paper and the course will culminate with a research poster presentation session that showcases the findings of student team research.

Prerequisites and Expectations:

This course is designed for students from all majors and there are no prerequisites. No prior coding experience is required or assumed. Access to a laptop with the capability to install the required software and internet access is recommended.

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301-405-7180

Office Hours
To be determined

Class Sessions
2309 ESJ
Time to be determined

Teaching Assistant
To be determined

TA Office Hours
To be determined

Academic Peer Mentors
To be determined

Learning Outcomes

The objective of the course is to develop a foundation in data science that is rapidly becoming essential knowledge across a wide variety of disciplines. After successfully completing this course you will be able to:

- appreciate the complex relationships between climate change and agriculture
- demonstrate basic data science skills used to organize, summarize, analyze and visualize large tabular and geospatial data
- produce reproducible workflows that exemplify best practices in scientific research
- present the results of research in written, visual and digital formats
- develop strategies for communicating results and recommendations from data analysis to a non-technical, decision-making audience

Carillon Mission

Carillon Communities creates an inspiring and supportive living and learning environment for first year students. Carillon promotes an environment where students develop a sense of belonging and trust to support their academic success and innovative thought. In Carillon, students consider their own interests and knowledge, and become more active agents in their own education.

Tips for Success in this Course:

1. Participate. Teamwork and peer learning are a critical part of the course. You can learn a great deal from working with your peers to ask questions and solve problems. Participation can also help you articulate ideas and develop critical thinking skills.
2. Manage your time. This class uses a flipped format where class time is devoted to parallel team-based data analytics, visualization and research activities. It is important to develop a regular routine that allows you to complete other course activities outside of class including check-ins, practice exercises, coding tutorials, assigned readings and other assignments. Give yourself plenty of time to complete these activities including extra time to handle any technology related problems.
3. Login to ELMS-Canvas regularly, multiple times a week to view tutorials, announcements, readings, assignments, due dates and other course related materials.
4. Do not fall behind. This class moves at a quick pace and each week builds on the previous. It will be hard to keep up with the course content if you fall behind in the pre-work or post-work.
5. Use ELMS-Canvas notification settings. ELMS-Canvas can ensure you receive timely notifications in your email or via text. Be sure to enable announcements to be sent instantly or daily.
6. Ask for help if needed. If you need help with ELMS-Canvas or other technology, contact IT Support If you are struggling with a course concept, reach out to your classmates, the TA, or the professor for support.
7. Be creative. Go above and beyond.

Course Health and Safety:

It is our shared responsibility to know and abide by the University of Maryland's health and safety policies. Please refer to Covid19 information for UMD. for more information. As of August 29, 2023 university policy does not require wearing a mask in classroom settings, but recommends wearing a mask while indoors for added protection. Please be respectful of different personal circumstances of fellow students and instructors and recognize that some may choose to wear masks, while others may not. This course will follow university policy and course health and safety guidelines will be updated if university policy is modified.

Course Organization and Materials:

The course is organized into modules designed around a motivating question, one or more data sets that will be used to address the question, concepts and skills developed, and accompanying learning activities and assessments.

The course is designed to utilize the 60 seat media-share Terp Classroom in the Edward St. John Learning Center, a unique learning space on campus. This is not a lecture format course. Class time will be devoted to team-based projects and activities with the class divided into 10 teams of 4-6 students assigned by the instructor. Teams will engage in both guided and unstructured exploration of parallel subsets of the data and share their findings throughout the course. Depending on group dynamics, team groupings may rotate once during the semester to increase opportunities for each student to work with other students in the class. Teamwork principles are guided by R.M. Felder and R. Brent, *Teaching and Learning STEM: A Practical Guide.*

The description of course modules in the syllabus provides the anticipated timetable for the number of class sessions allocated to each module. Required learning materials for each module are listed below. Many of

these are linked directly in the syllabus. This syllabus is a working document and learning material may be modified and enhanced throughout the semester.

Online Course Site: elms.umd.edu

ELMS is the main hub for course materials, announcements, assignments and due dates. To help you get started please see the Orientation to ELMS for Students. The online course materials can be accessed from any device with an internet connection. Your fellow students or the consultants at the University computer Help Desk can help you if you have questions about accessing the campus network and ELMS.

AREC280 Shared Google Drive

All data and team projects will be housed on a Shared Google Drive for the course: AREC280 Fall 2023. Shared drives are shared spaces where teams can easily store, search, and access their files anywhere, from any device. You should install Google Drive for Desktop which has options for local and online folder and file access and automatically syncing of local files to the cloud. After installing Google Drive for Desktop you will be able to access shared data for the course directly from R-Studio. See: Drive for desktop cheat sheet for more information including installation instructions for PCs and Macs. **Important: To connect to the AREC280 Shared Google Drive you should use your login-id@terpmail.umd.edu id to authenticate. The course shared folder will not be accessible from non-umd ids.**

Data Analytics Software:

This course utilizes open source R version 4.2.1 (https://www.r-project.org/) and R Studio Desktop version RStudio 2023.07.1 (https://www.rstudio.com/products/rstudio/download/). These applications are free and available for Windows, Mac, Linux, and many versions of Unix. They should be installed before the start of class following the steps outlined in"Installing R and R-Studio" at: Chapter 1 Getting Started with Data in R | Statistical Inference via Data Science (moderndive.com)

We will use open-source R packages available on the CRAN repository. Packages can be installed directly through R-Studio following the steps outlined in "Installing additional packages using the packages tab" at the bottom of Before we Start – R for Social Scientists (datacarpentry.org). The **tidyverse** package should be installed before the start of class. This is a collection of packages designed to create and work with tidy data (see Tidyverse packages). Among them are:

- readr and readxl (for reading and writing data including excel workbooks)
- dplyr and tidyr (for data manipulation and tidying)
- ggplot2 (for plotting and visualizing data)
- broom (for regression analysis)
- lubridate (for working with dates and times)
- stringr (for working with text)
- rmarkdown (for communicating results)

As the course progresses packages will be installed for working with spatial data.

- sf, raster, gdal, ncdf4, rgeos, terra, exactextractr, countrycode, rnaturalearth, rnaturalearthdata, usmap, spdata, stars

Textbooks:

- *R for Data Science*, by Wickham and Grolemund. The book is free and open source and licensed under a Creative Commons license.
- ggplot2: Elegant Graphics for Data Analysis, by Wickham, Navarro and Pederson. This book is free and open-source.
- Geocomputation with R, by Lovelace, Nowosad, and Muenchow. This book is free and licensed under a Creative Commons license.

DataCamp Modules:

DataCamp has developed a set of outstanding course modules that combine short video tutorials with interactive coding exercises in R. Students will be enrolled by the instructor in a course organization on DataCamp at no cost. AREC280 course uses chapters from DataCamp modules to teach concepts and help you learn how to code in R. Each week several chapters will be assigned to be completed at the beginning of the following week (6am Tuesday). Completing these will help prepare you for working with data each week. DataCamp modules will be graded as 1=credit, 0=no credit check-ins. Chapters are divided into sections with "XP" points. To receive credit for a weekly check-in you must earn at least 70% of the total XP for that week's chapters. **Note your XP before you begin the chapters for each week.** This will allow you to keep track of the XP earned during the week by calculating the difference between the current value and the XP you started the week with. Most check-ins will require several hours to complete so allocate your time appropriately. If you receive less than 70% on assigned chapters you can make up the deficit by earning additional XP on supplementary chapters for that week. Motivated students may also want to work through these supplementary chapters to build their skills.

Expectations for Completing Assigned Work Out of Class:

When all students read the assigned material and complete the corresponding DataCamp chapters before class, the nature of the class meeting changes to the benefit of everyone. You will have thought about the material, you will have been introduced to important concepts, you will have practiced coding, and you will arrive with your own questions. This means you will be prepared to fully engage with your classmates in data analysis, scholarly inquiry and research. The learning experience will be better for everyone.

Course Requirements and Grading (2023 dates will be updated):

DataCamp readiness check-ins (At least 70% of assigned XP. XP can be earned on assigned or supplementary chapters. Low score dropped.)	12%
Other check-ins, assignments, data analysis, research process and coding exercises (Low score dropped)	12%
Climate and agriculture fact sheet (Due 6am, date TBD)	24%
Research paper (Due 6am, date TBD)	30%
Research poster (Must be submitted to Engineering Copy Center by end of the day, date TBD)	10%
Research poster presentation (During final exam date and time)	5%
Peer assessments of your contributions to team products	5%
Your peer evaluations of your teammates	2%

Behavior that disrupts the class and learning experience of other students will lower your grade. This includes the use of cell phones during class and the use of laptops for non-class related activities. Cell phones should be muted and put away for the duration of the class.

Team Data Analysis and Visualization Explorations:

Sample Explorations:

What are the differences in agricultural productivity growth across countries?

What does data from different climate indicators say about how climate is changing?

How does a changing climate influence global agricultural productivity and how can this relationship be modeled?

How can we use spatial data to examine variations in climate and agricultural productivity and the relation between the two?

Final projects will be designed and implemented by individual teams under guidance of the instructor.

Fact Sheets:

Fact sheets should be a two-page informative, factual summary of a selected inquiry into the impact of climate change and/or extreme weather on agriculture. Fact sheets should be supported by scientific evidence and data and utilize data analytics and visualization to present information in an intuitive and convincing manner. Fact sheets should reference sources indexed in the Web of Science. Sample fact sheets and a rubric will be provided on ELMS.

Research Papers:

Each student will write an individual research paper analyzing the impact of climate change on agriculture. Papers should be no more than 5 pages of text not counting references, in 12 pt. font, typed double-spaced with one inch margins. An additional 3 pages of data visualizations or tables may accompany the text. All sources must be cited and papers must include references to sources indexed in the Web of Science. Papers should include original data analysis and/or visualizations. Data visualizations and tables must be accompanied by reproducible code to be uploaded separately to the course google drive. Paper formatting guidelines and a rubric will be provided on ELMS. Please read these carefully. Formatting guidelines are adapted from the Proceedings of the National Academy of Sciences manuscript template: https://www.pnas.org/author-center/submitting-your-manuscript.

Research Posters and Poster Presentations:

The last portion of the course will be devoted to parallel team research projects. Teams will identify a research question related to the impact of climate change or extreme weather on agriculture. Teams will explore and analyze data, test hypotheses, and visualize results. The final product for each team will be a research poster in a format suitable for presentation at a professional scientific poster session. Sample posters will be provided on ELMS. Posters must be submitted in digital format by the final day of class for printing at the campus print office. Each student will present their team's poster in a poster presentation session to be held during the final exam period for the class. You must attend this session to receive poster presentation credit. Poster and presentation rubrics are provided at the end of the syllabus.

Course Modules and Tentative Timetable:

Motivating question	Data	Concepts/skills learned	Class sessions
Introduction to extreme weather data: US hurricanes 1851-2019. How has US agricultural productivity changed over time?	HURDAT2 Hurricane Database, NOAA Hurricane Research Division Agricultural Productivity in the U.S., USDA Economic Research Service	Introduction, data science fundamentals and the data science workflow. Loading, viewing and saving data. Data types.	3
How has global agricultural productivity changed over time by country?	International Total Factor Productivity Data for Agriculture, USDA Economic Research Service	Tidy data. Data wrangling. Grouping, subsetting and reshaping data. Summary statistics. Exploratory data analysis. Visualizations.	4

How has global agricultural productivity been influenced by climate?	Climatic Research Unit High Resolution Global Climate Data and derived products, Univ. of East Anglia, UK	Joining data. Correlation vs. causation. Linear models. Using nested data. Choropleth maps	6
How do extreme weather events vary over space and time? In studying the impact of climate how can we control for other factors that influence the agricultural productivity?	Global Drought SPEI indices, the Spanish Higher Council for Scientific Research – CSIC.	Spatial data. Coordinate systems and projections. Working with spatial and tabular data. Spatial visualizations. Regression models.	6
Team defined research questions	Project specific data.	Formulating a hypothesis, data synthesis, research-based analytics, communicating your results, poster preparation/presentation	10 (Beginning around Nov. 3, no class Nov. 24 – Thanksgiving)
Research Poster Presentations (during final exam date and time set by campus)			

Note: Final exam date and time is determined by campus. Any adjustments to course schedule will be posted on ELMS. Monitor the course ELMS page for current deadlines. In the unlikely event of a prolonged university closing, adjustments to the course schedule, deadlines, and assignments may be made.

Readings and Other Learning Materials:

All materials are available on ELMS or through links to the source material on the web.

1. Introduction

- Union of Concerned Scientists, Climate change and agriculture: A perfect storm in farm country, Mar. 20, 2019, https://www.ucsusa.org/resources/climate-change-and-agriculture.
- McCarl, B.A. and T.W. Hertel. 2018. Climate change as an agricultural economics research topic, *Applied Economic Perspectives and Policy,* 40(1), 60-78.
- Hand, D.J. 2008. Surrounded by statistics, ch. 1 in *Statistics: A Very Short Introduction,* Oxford, Oxford University Press.

1.a. Introduction to R and R Studio

- *R for Data Science,* ch. 1 and ch. 2
- Getting started with data in R, ch. 1 in *Statistical Inference via Data Science: A ModernDive into R and the Tidyverse,* by C. Ismay and A.Y. Kim, 2021.
- *R for Social Scientists* Overview of R and R Studio (DataCarpentry.org)

1.b. Data science workflow

- Soto, C. 12 of the biggest spreadsheet fails in history, Oracle Small-to-Medium Business Blog, Oct. 21, 2019.
- Wilson G, et.at. 2017. Good enough practices in scientific computing. *PLoS Computational Biology,* 13(6): e1005510.
- Borer, E.T. et.al. 2009. Some simple guidelines for effective data management, *Bulletin of the Ecological Society of America*, 205-214.
- *R for Data Science,* Workflow: scripts
- Introduction to R for Geospatial Data: Project Management with RStudio
- *R for Data Science,* Workflow: projects
- Read, Q. Tips for a smooth R(Studio) workflow and reproducible R code, National Socio-Environmental Synthesis Center (SESYNC), Aug. 13, 2020.
- *R-Studio-ide cheatsheet*

1.c. U.S. agricultural productivity

- Agricultural Productivity in the U.S., Economic Research Service, USDA.

1.d. Loading, viewing, saving data

- *R for Data Science,* Data import
- *tidyr Data Import cheatsheet*
- *R for Data Science,* Tibbles

1.e. Data types

- Quick-R: Data types

2. Global agricultural productivity

- Fuglie, K. Accelerated productivity growth offsets decline in resource expansion in global agriculture, Economic Research Service, USDA.
- Fuglie, K. and N. Rada, 2013. Growth in global agricultural productivity: an update, *Amber Waves*, Economic Research Service, USDA.
- International Agricultural Productivity, Economic Research Service, USDA.

2.a. Tidy data. Grouping, subsetting, summarizing and reshaping data.

- Wickham, H. 2014. Tidy data, *J. Statistical Software*, 59(10), 1-23.
- *R for Data Science*, Tidy data
- *R for Data Science,* Data transformation
- Data wrangling with dplyr and tidyr cheat sheet
- Tips and tricks, Appendix C in *Statistical Inference via Data Science: A ModernDive into R and the Tidyverse,* by C. Ismay and A.Y. Kim, 2021.
- Hand, D.J. 2008. Simple descriptions, ch. 2 in *Statistics: A Very Short Introduction,* Oxford, Oxford University Press.
- Dalpiaz, D. 2020. Summarizing data, ch.4 in *Applied Statistics with R.*

2.b. Exploratory data analysis

- Loehle, C. and E. Staehling, 2020. Hurricane trend detection, *Natural Hazards*, 104:1345–1357
- *R for Data Science,* Exploratory data analysis
- Healy, K. 2018. Look at data, ch. 1 in Data Visualization: A Practical Introduction.

2.c. Visualizations

- Lu, D and L. Gamio, Here's every billion-dollar weather disaster in the U.S. since 1980, *Washington Post*, originally published Aug. 25, 2015, updated Oct. 20, 2017.
- *R for Data Science,* Data visualisation
- Healy, K. 2018. Make a plot, ch. 3 in Data Visualization: A Practical Introduction.

- Healy, K. 2018. Show the right numbers, ch. 4 in Data Visualization: A Practical Introduction.
- Diez, D., M. Çetinkaya-Rundel and C.D. Barr. 2019. Summarizing data, ch. 2, *OpenIntro Statistics* (4th edition), https://www.openintro.org/book/os/. A pdf copy is available on ELMS under a Creative Commons license.

2.d. Advanced visualizations

- *R for Data Science*, Graphics for communication
- Information is beautiful
- Reddit r/dataisbeautiful
- McCandless, D. 2010, The beauty of data visualization, TED talk, TEDGlobal 2010.

3. Modeling the impact of climate and extreme weather on agriculture

- Keane, M. and T. Neal, 2020, Climate change and U.S. agriculture: accounting for multidimensional slope heterogeneity in panel data, *Quantitative Economics*, 11, 1391-1429.
- Exploring the links between weather and agricultural productivity (2 min YouTube video), Ariel Ortiz-Bobea, Cornell Univ (UMD AREC Ph.D. alum)
- Walsh, M. K., et.al. 2020. *Climate Indicators for Agriculture*. USDA Technical Bulletin 1953. Washington, DC. 70 pages.
- Liang, X.-Z., et.al. 2017. Determining climate effects on US total agricultural productivity, *Proceedings of the National Academy of Sciences*,E2285–E2292.
- Ortiz-Bobea, A., et.al. 2021. Anthropogenic climate change has slowed global agricultural productivity growth, *Nature Climate Change,* 11, 306-312.
- Chen, C., B. McCarl, 2009. Hurricanes and possible intensity increases: effects on and reactions from U.S. agriculture, *Journal of Agricultural and AppliedEconomics*, 41(1) 125-144.
- Mendelsohn, R.O. and Massetti. 2017. The use of cross-sectional analysis to measure climate impacts on agriculture: theory and evidence, *Review of EnvironmentalEconomics and Policy*, 11(2), 280–298.
- Harris, I., Osborn, T.J., Jones, P. et al. 2020. Version 4 of the CRU TS monthly high-resolution gridded multivariate climate dataset. *Sci Data* 7, 109. https://doi.org/10.1038/s41597-020-0453-3.
- FAOSTAT Temperature Change, UN Food and Agriculture Organization (monthly, seasonal and annual mean temperature anomalies, i.e., temperature change with respect to a baseline climatology).

3.a. Joining data

- Garrick Aden-Buie, tidyexplain: Joining data
- *R for Data Science,* Relational data

3.b. Correlation vs. causation

- Altman, N., Krzywinski, M. 2015. Association, correlation and causation. Nature Methods 12, 899–900.
- Barrowman, N. 2014. Correlation, causation and confusion, *The New Atlantis,* Summer/Fall.
- Smeets, I. 2012. The danger of mixing up causality and correlation, TEDxDelft.
- Vigen, T. Spurious correlations. (website of 30,000 spurious correlations)

3.c. Linear models

- Hand, D.J. 2008. Statistical models and methods, ch. 6 in *Statistics: A Very Short Introduction*, Oxford, Oxford University Press.
- Nuzzo, R. 2014. Scientific method: Statistical errors. *Nature* **506,** 150–152. https://doi.org/10.1038/506150a
- Diez, D., M. Çetinkaya-Rundel and C.D. Barr. 2019. Introduction to linear regression, ch. 8, *OpenIntro Statistics* (4th edition), https://www.openintro.org/book/os/. A pdf copy is available on ELMS under a Creative Commons license.
- Romer, D. 2018. A non-technical introduction to regressions, UC Berkeley.
- Gallo, A. A refresher on regression analysis, *Harvard Business Review,* Nov. 4, 2015.

3.d. Using nested data

- *R for Data Science,* Many Models

3.e. Introduction to spatial visualizations – choropleth maps

- Drawing beautiful maps programmatically with R, sf and ggplot2 — Part 1: Basics (r-spatial.org)

4. Spatial features of climate and extreme weather

- The Standardized Precipitation-Evapotranspiration Index (SPEI), a multiscalar global drought index. CSIC, the Spanish Higher Council for Scientific Research.
- Vicente-Serrano, S.M., et.al. 2012. Performance of Drought Indices for Ecological, Agricultural, and Hydrological Applications, *Earth Interactions*, **16**, 1-27.
- Barichivich J, Osborn TJ, Harris I, van der Schrier G and Jones PD. 2020. Drought [in "State of the Climate in 2019"]. *Bulletin of the American MeteorologicalSociety* **101**, S1-S429. doi:10.1175/2020BAMSStateoftheClimate.1.

4.a. Spatial data types: vector and raster

- *Geocomputation with R*, ch1. Introduction and ch. 2.1-2.3 Geographic data in R
- M. Branion-Calles, *A GIS Crash Course Using R*, ch. 2.1 Spatial Data 101
- Pebesma, E. Simple features for R

4.b. Coordinate systems and projections

- Gimond, M. 2020. Coordinate systems, ch. 9 in Geodesic geometry.
- M. Branion-Calles, *A GIS Crash Course Using R*, ch. 2.2-2.5 Geographic coordinate systems, map projections, and choosing a projection
- M. Frazier, Overview of coordinate reference systems (CRS) in R, National Center for Environmental Analysis and Synthesis (NCEAS)
- ESRI. How-To: Hurricane Map
- *Geocomputation with R*, ch. 2.4-2.5 Geographic data in R

4.c. Spatial visualizations and maps

- Gimond, M. 2020. Good map making tips, ch. 6 in Geodesic geometry.
- Kahle, D. and H. Wickham. 2013. ggmap: Spatial visualization with ggplot2, *R Journal*, 5(1), 144-161.
- Appelhans, T., et.al., mapview: Interactive viewing of spatial data in R.
- Healy, K. 2018. Draw maps, ch. 7 in Data Visualization: A Practical Introduction.
- *Geocomputation with R*, ch. 8 Making maps with R

4.d. Geospatial joins

- Pebesma, E. Manipulating simple features
- Gimond, M. 2020. Spatial operations and vector overlays, ch. 8 in Geodesic geometry.
- *sf cheatsheet*

5.a. Communicating your results - Introduction to RMarkdown

- *R for Data Science,* Communicate: Introduction and RMarkdown
- *R-markdown-2.0 cheatsheet*
- Xie, Y., J. Allaire and G. Grolemund. 2020. R Markdown: The Definitive Guide.

5.b. Integrating RMarkdown in Your Research Workflow - Analysis notebooks

- *R for Data Science,* RMarkdown workflow

6.a. Research projects – additional data sources (list is not comprehensive)

- FAOSTAT, Food and agriculture statistics of the UN Food and Agriculture Organization.

- Quick Stats, National Agricultural Statistics Service, USDA (see Guide to NASS Surveys and Programs for a list of available data).
- GEOGLAM Crop Monitor Country Crop Calendars
- U.S. Drought Monitor data, National Drought Mitigation Center at the University of Nebraska-Lincoln, the United States Department of Agriculture, and the National Oceanic and Atmospheric Administration.
- PRISM Climate data, PRISM Climate Group, Oregon State University.
- NASA GRACE groundwater and soil moisture data.
- CropScape – Cropland Data Layer, National Agricultural Statistics Service, USDA
- Global Food Security Analysis-Support Data Project (croplands.org)
- rOpenSci: The rnoaa package (R interface to many NOAA data sources including: severe weather, tornadoes and storm events.)
- Storm Events Database, National Centers for Environmental Information, NOAA.
- FEMA disaster declarations summaries, Federal Emergency Management Agency, US Department of Homeland Security.
- Soil Moisture CCI. European Space Agency. (40 years of satellite derived soil moisture levels.)
- USGS Short-Term Network Flood Event Data Portal
- Earth Engine Data Catalog
- Princeton Global Meteorological Forcing Dataset
- Global Mean Sea Level Data Integrated Multi-Mission Ocean Altimeter Data for Climate Research Version 5.1 Jet Propulsion Laboratory. Globally averaged Sea Surface Height Anomalies, September 1992 to present with a lag of up to 4 months. The data are reported as variations relative to a 20-year collinear mean.
- CSIRO Global Sea Level Rise Data
- US National Levee Database

6.b. Poster presentations

- Tips for presenting a scientific poster handout
- How to make your scientific poster stand out and Tips for presenting your scientific poster at a conference (Scientifica NeuroWire)
- How to create an awesome poster (Cornell Engineering)
- Poster template (TBD)
- UMD Engineering Copy Center Poster Printing

Policy Regarding Late or Missed Assignments:

Assignments are due at date and time listed on ELMS. The grading policy is designed to accommodate "life happens" circumstances. For this reason, late assignments will generally not be accepted and missed check-ins will not be excused. In the case of religious observances, athletic events, and planned absences known at the beginning of the semester, university policy requires that you inform your instructor of these during the schedule adjustment period.

In the event of unforeseen circumstances be responsible. Accommodations are easier to arrange if you provide advance notice and contact the instructor by email or through ELMS as soon as you know there is an issue.

Policy on Academic Integrity:

The University has a nationally recognized Honor Code, administered by the Office of Student Conduct. The Honor Code sets high standards for academic integrity for all students at the University of Maryland. Every student in this class is expected to read and understand university policy on academic dishonesty, and to

adhere to the Honor Code. Any suspected cases of academic dishonesty (cheating, fabrication, facilitating academic dishonesty, or plagiarism) will be dealt with in accordance with the provisions of this code. The standard sanction under the Code of Academic Integrity is a grade of "XF". The grade appears on the student's transcript with the notation "Failure due to academic dishonesty." **As future professionals, you should pursue a commitment to high ethical standards and honesty during your time at the University of Maryland.** It is your responsibility to read the Honor Code and know what it says, so you can start your professional life on the right path.

Course assistance websites, such as CourseHero, are not permitted sources and using material from these sources constitutes a violation of academic integrity.

Copyright:

Class lectures, exams, assignments, handouts and other materials are protected by copyright. A faculty member is the exclusive owner of copyright in the materials they create. You may take notes and make copies of course materials for your own personal use. You may not record, reproduce or distribute lecture or other course materials without my express written consent. Persons who distribute or display or help others publicly distribute or display copies or modified copies of an instructor's course materials may be considered in violation of the University Code of Student Conduct, Part 10(m), Theft of Property or Services. Such conduc is subject to disciplinary action and can potentially result in suspension from the University. All suspected cases of copyright infringement will be referred to the Office of Student Conduct.

Students with Disabilities:

If you have a documented disability and wish to discuss academic accommodations with me, please contact me as soon as possible.

Learning Assistance Resources:

I encourage you to visit tutoring.umd.edu to learn more about the wide range of campus resources available to you. Everyone can benefit from help to sharpen their communication skills (and improve their grade). Visit https://english.umd.edu/writing-programs/writing-center and schedule an appointment for a virtual session with the campus Writing Center. There are a wide range of resources to support you with whatever you might need (see Studemt Resources), and if you just need someone to talk to, visit counseling.umd.edu or one of the many other resources on campus. Most services are free because you have already paid for them, and everyone can benefit from these resources… all you have to do is ask.

Campus Policies

It is our shared responsibility to know and abide by the University of Maryland's policies that relate to all courses including policies for:

- Health and safety (Covid19 information for UMD)
- Academic integrity
- Student and instructor conduct
- Accessibility and accommodations
- Attendance and excused absences
- Grades and appeals
- Copyright and intellectual property

Please visit https://www.ugst.umd.edu/courserelatedpolicies.html and review the Office of Undergraduate Studies' full list of campus-wide policies. Follow up with me if you have questions.

Majoring in Agricultural/Resource/Environmental Economics:

The Department of Agricultural and Resource Economics offers a major with concentrations in Environmental and Resource Economics, Agricultural and Resource Economics, and Agribusiness. Advanced courses cover topics such as Economics of Climate Change, Natural Resources and Public Policy, Energy and Environmental Economics, Economics of Land Use, Environmental Economics, and Data Science for Environmental and Resource Economics. If you are interested in becoming an AREC major please talk to the instructor.

Judge's Name _____ **Poster Title:**_____ **Team #**

Category	Exceptional 8	Excellent 7	Very Good 6	Good-Poor 5-0	Score
Context and motivation	• Study's motivation is clearly and concisely stated • Background information is clearly relevant, well-summarized and connections to inquiry are clear	• Motivation for the study is clear but could be more concisely presented • Relevance of some background information is vague and/or connections not well summarized.	• Context is identified but somewhat unclear • Background information is partially relevant and lacks precise connections to inquiry	• Context is lacking • Background information is weakly relevant and poorly connected to inquiry	
Visualizations and appearance	• Visualizations effectively present and summarize information that enhances understanding of the main findings • Visualizations are easy to interpret and labeled correctly • Text (excluding reference list) is readable at a distance • Spelling and grammar is good	• Visualizations are appropriate and contribute to understanding findings but could be more effective • Visualizations require some explanation • Relatively minor labeling issues • Text is mostly readable • Spelling and grammar is good	• Visualizations illustrate aspects of the analysis • Visualizations hard to interpret • Important labeling issues • Portions of text are difficult to read at a distance • Minor spelling & grammar issues	• Purpose of visualizations is unclear • Appearance of visualizations is poor • Poor labeling • Most text is difficult to read • Significant spelling and grammar problems	
Inquiry Methods	• Clearly explains process of inquiry and methodology • Data is well-suited to inquiry • Overall research design is good • Methods are concisely presented and appropriate for inquiry • Avoids unnecessary details	• Inquiry process is identified • Data is appropriate for topic • Description of methodology is satisfactory • Overall research design could be better connected to inquiry • Limited unnecessary details	• Process of inquiry followed but not clearly identified • Data appropriate for inquiry • Some aspects of methodology are difficult to understand • Unnecessary details are included	• Inquiry process and methodology is not a part of the presentation • Data collection lacks purpose • Disorganized	
Findings	• Analysis and main findings are clear, easily understood, supported with evidence and concisely presented • Main findings clearly linked to the inquiry, data and analysis • Significance to science and society is conveyed effectively • Main take-away is easily identified	• Appropriate conclusions & analysis • Findings are connected to the inquiry and data • Significance to field and society is conveyed effectively • Main take-away is identifiable but could be strengthened	• Conclusions are mostly appropriate • Conclusions are weakly connected to data • Significance to society is vague • Main take-away could be more clear	• Conclusions are not grounded in the study • Conclusions are not clearly identified • Findings are poorly presented • Main take-away is unclear or questionable	
Title and Sources	• Authors are clearly identified • Title conveys meaning and is accessible to a general audience • All data and scientific sources used in the poster itself are properly cited. • All items in the reference list refer to sources that are referenced in the poster • Any image credits provided	• Authors are clearly identified • Title conveys meaning but requires specific knowledge for understanding • A reference for one element is either missing, not cited properly, or appears in the reference list but is not referenced in the poster	• Authors are clearly identified • Title is weakly connected to study • Two or three needed references unclear or missing	• Authors are not clearly presented • Title is difficult to connect with the study • More than 3 references unclear or missing	
Comments:				**Total Score - out of 40 (sum category scores)**	

Judge's Name _____ **Presenter's Name:** _____ **Team #**

Category	Outstanding 6	Very Good 5	Fair 4	Score
Personal Demeanor	• Speaks clearly and is easily heard and understood • Establishes eye contact with everyone • Confident presentation • Encourages questions and discussion and listens well	• Speaks too softly or hesitates too often • Uneven eye contact • Exhibits some degree of self-assurance • Listens to questions	• Is difficult to hear or understand • Fails to make eye contact • Lacks confidence • Shows little interest in questions or discussion	
	Outstanding 8	**Very Good 6**	**Fair 4**	**Score**
Oral Communication	• Demonstrates clear interest in the topic • Spoken presentation is clearly planned and organized • Presentation contains smooth transitions and meaningful connections between sections • Narration is engaging and easily understood • Professional presentation	• Exhibits some interest in topic • Advance preparation is evident but could be better organized • Transitions could be improved • Narration is adequate • Jargon not adequately explained • Generally good presentation	• Does not demonstrate interest in the topic • Presentation is not well-prepared • Presentation lacks logical flow • Overall weak presentation	
	Outstanding 12	**Very Good 10**	**Fair 8**	**Score**
Presentation Content	• Clearly communicates importance of topic • Clear description of methods of inquiry • Clear explanation of main findings and their relevance for the inquiry • Explanations are thorough and concise	• Communicates basic understanding of topic • Methods of inquiry described but some elements are unclear • Findings are presented but not thoroughly and concisely explained • Inadequate discussion of relevance for inquiry	• Fails to exhibit a basic understanding of the topic • Lacks clarity • Unclear or confusing explanations • Presentation is not clearly connected to the poster	
	Outstanding 4	**Very Good 2**	**Fair 0**	
Timing	• Presented 6-7 minutes	• Presented 5-6 minutes	• Presented less than 5 minutes	
	Outstanding 10	**Very Good 8**	**Fair 6**	**Score**
Audience Questions	• Is able to explain and elaborate on questions concisely and professionally • Responses to questions enhance audience understanding	• Answers most questions effectively • Occasionally misinterprets the questions or gives off target answers	• Only able to answer simple questions • Answers do not contribute to understanding	
Comments:			**Total Score - out of 40 (sum category scores)**	

Presenters, remember to introduce yourself and your poster title at the start of your presentation. Presentations should be 7 minutes with 5 minutes for questions and discussion. 3 minutes for judges to evaluate the poster and presentation and 2 minutes to rotate.