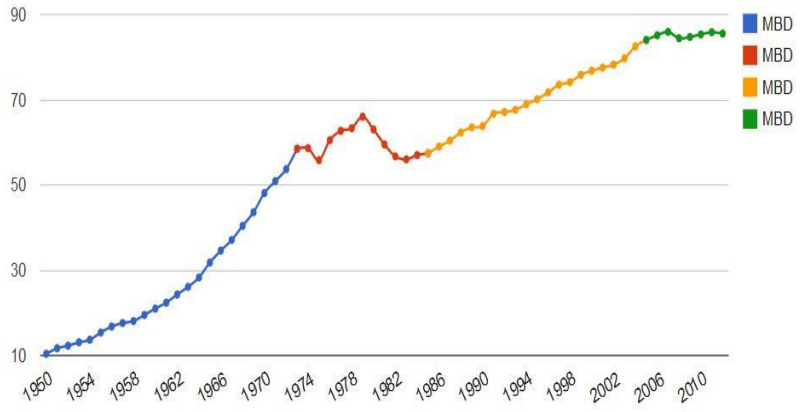
ENVS 298: Environmental Accountability and Data Visualization

Fall Quarter, 2014

SYLLABUS

CLASS TIME	**MWF 10:00 – 10:50 Library 101/CRN 17339**
INSTRUCTORS AND CONTACT INFORMATION	**Professor G. Bothun** Office: 417 Willamette Hall Office hours: TBA Email: *dkmatter@uoregon.edu*
COURSE DESCRIPTION	This course is designed to show how various environmental issues can be objectively framed in data aspects and how effective environmental policy can occur when the data view of the issue takes precedence over the anecdotal view. This course will also demonstrate that the gigantic effort underway to monitor emission space, land use changes, consumption patterns, transportation habits, etc, makes it possible for very accurate monitoring and subsequent accountability if this data can be made accessible to the policy world. That is the central role of data visualization – how do you represent a complex problem in an accessible format that promotes immediate understanding of the **scale** of the problem. This latter aspect of the course becomes possible now, given the very large and relatively easy to use open source software (OSS) visualization tools (e.g. the google playground). The course is an introduction to role that data and data representation play in scientific reasoning, inference and analysis. This class is designed for non-science majors, with an emphasis on how data is used to frame scientific issues. Most all of scientific data is represented by graphs, charts, or other visuals and this class will emphasize student-driven construction of various visual representations of environmental and physical data sets using existing open source tools and graphical libraries. The intent is to increase the graphical and scientific literacy on the part of the students, using environmental matters as the hook, by immersing them in a visually driven data world that promotes better understanding of the issues.
TEACHING ASSISTANTS	The teaching assistants for this course are "fellows" in the University of Oregon's Science Literacy Program (SLP), a new initiative funded by the Howard Hughes Medical Institute. Spanning several departments, SLP fellows will hold office hours and also help orchestrate in-class activities. One of their main tasks is to serve as resources, for example helping you understand a wide variety of scientific content fairly quickly. Make use of them!
LEARNING OBJECTIVES	1. Why is the data view important? – students will gain experience in how to organize and represent data in order to support a scientific argument, 2. How can the data view be communicated? - students will obtain an understanding of basic techniques associated with interpreting data and translating that interpretation to everyday language and experience so as to produce broader public understanding (this is a current problem in

	communicating climate change science to the policy world), 3. How is data related to problem solving? - students will develop problem solving skills relating to how to deal with both bias and ambiguity in data, the interplay between data and scientific hypothesis is a key theme to the course. 4. How does science work? - students will be exposed to the interplay between data and scientific hypothesis as a key theme to the course and that science works by a process of consistency between model and data, very relevant to the climate change issue.
ASSIGNMENTS	*Homework* – There will be b--weekly homework assigned that will provide practice in using the ideas and concepts explored in class. The students will be allowed to collaborate on these exercises and we have already programmed interfaces to various graphing libraries. An example assignment is given below to illustrate the nature of this class: A working example, generated by our extant interfaces, also serves to illustrate the basic principles and activities of this class. The multicolored graphic below shows world oil usage, in units of millions of barrels per day (MBD) from 1950 to 2012. The graph takes about 10--15 minutes to make using our tools. It's a complex data set in the sense that a) not a single waveform (function) describes the whole time period and b) different time periods represent different growth forms. Moreover, the most recent years (green) provide an excellent example of actual data combatting widespread urban legend. Specifically, the blue part  represents our initial exponential use of the resource which, of course, was not sustainable. The red part represents world politics (Arab Oil Cartel) and, importantly, world production at the end of this phase was the same as the beginning. The orange part represents a mostly linear production pace, from which reasonable predictions could be made which lead to price spiking via speculation. Then the trend radically changes to asymptotic behavior indicating that, starting in 2005, world oil refinery infrastructure became saturated (at about 86-88 MBD) and **demand decoupled from supply** thus eliminating the Peak Oil scenario. Refining/distribution no longer scale with demand. That is the data truth.

TEXTBOOK	There will be no required textbook for this class; one doesn't exist.
READINGS	Additional readings will be provided by the instructors on the course Sakai (our likely successor to Blackboard site. These will include, but are not limited to, the following: **List of potential readings:** • Governing by the Numbers: The promise of Data-Driven Policymaking in the Information Age: http://www.americanprogress.org/wp-content/uploads/issues/2007/04/pdf/data_driven_policy_report.pdf • Case Studies as Published in the Social and Environmental Accountability Journal (Taylor and Francis): http://ideas.repec.org/s/taf/seaccj.html • Tracking Carbon with Transparency: Improving Accuracy and Accountability in the International Global Warming Agreement http://www.nrdc.org/globalwarming/files/trackingcarbon-fs.pdf • Data Driven Energy Efficiency in Buildings: http://arxiv.org/abs/1404.7227 • Finding Evidence of Climate Change in a Billion Rows of Data: https://source.opennews.org/en-US/articles/finding-evidence-climate-change-billion-rows-data/ • Framing the Climate Change Debate: The Role of Science: http://www.ucl.ac.uk/environment-institute/research/ippr • Fostering Graphical Literacy: http://onlinelibrary.wiley.com/doi/10.1002/TRTR.1174/full • Examining the role of Big Data in the Future of Newspapers: http://www.naa.org/News-and-Media/Blog/Examining-the-role-of-big-data-in-the-future-of-newspapers.aspx
GRADING	*Participation / Preparedness/In-class contributions* – 15%. *Homework Assignments* – 30% *Midterm Exam* – 25% *Final Exam* – 30% **Final Grade:** (A-/A/A+)=86-100%; (B-/B/B+)=71-85%; (C-/C/C+)=50-70%; D=40-50%; F=0-40%.
CALENDAR	A rough schedule for the term:

Week	Topic	Activities
1.	Course Introduction	How data can be used for environmental enforcement of policy and accountability; Google Earth as a Tool
2.	Using the tools	Many active learning group learning activities using our interface tools to the Google chart library
3	Estimation – how to frame a problem	How to think/estimate on your feet the scale of various things – e.g. how many Douglas fir trees exist in Oregon
4	Waveforms of change	Evaluation Time-Series data to uncover the features
5	Global Climate Change data sets I	Analysis and construction of many different visual representations of climate data
6	Global Climate Change II	Using other forms of environmental data, sea ice loss, frequency of hurricanes, tornadoes, etc.

	7	Changing US Demographics and consumption habits	Mobility, age groups, jobs evolution, growth of suburbia, regional metro-plex evolution, census data, transportation data and patterns.
	8	Understanding Risk and Probability	Evaluation of climate change risks and likely scenarios; making probability distributions from data
	9	Data driven Model making	Predicting the future based on past trends and the uncertainties in that approach
	10	Data Literacy Summation	Classroom discussion about the, hopefully discovered by now, value of data and data accuracy in informed decision making

EXPECTED WORKLOAD	Students should expect to spend approximately 6-8 hours a week on various readings and doing the homework assignments. Students should read ahead on the course material and come to class prepared to contribute as active participants.
NECESSARY CAVEATS	Students are expected to abide by university policies on academic honesty, avoiding plagiarism, fabrication, cheating, and academic misconduct. The Student Conduct Code (http://conduct.uoregon.edu/) provides definitions of these terms and explanations of the university policy on the subject. The UO Library also provides a guide to avoiding plagiarism (http://libweb.uoregon.edu/guides/plagiarism/students/). You are responsible for understanding these regulations and abiding by them. Academic dishonesty will be dealt with severely, as it is disrespectful to your fellow students and your instructor, as well as being against both university regulations and state laws.
STUDENTS WITH DISABILITIES	If there are aspects of the instruction or design of this course that result in barriers to your inclusion then contact Disability Services in 164 Oregon Hall, 346-1155, who will then notify the instructor.
STUDENT SUCCESS FOR THIS COURSE	**Plan ahead and start early!** The homework assignments are a vital part of this course, and it is important to them early not only to understand the subject matter but to better develop your overall data skills and data literacy. In all the assignments there will be several approaches to the problem in we will spend one lecture per assignment on a collective debrief that will show the various ways you or your group handled the problem. Be prepared to discuss and explain your approach. Do not blow off these assignments as mere busy work, they are meant to develop your skills and reasoning power. In general, it will be crucial to keep up with the course and not fall behind; later topics will build on earlier ones. **Make use of available resources.** Your most valuable resource is each other – form a Network, learn how to use Google collaborative tools to deal with various tasks. The world is evolving into a highly collaborative work mode where "credit" for individual contribution now pales in comparison to the deliverable. Learn to function like that, learn to work in a way that makes the whole greater than the sum of the parts. If that is the main learning outcome of this course, then you have been successful and the course has been successful.