### Environmental change in the big-data era

Environ 89S; spring 2021

What are the changes happening now and where are they leading us? This course combines key topics in climate change, biodiversity, and big data, examining scientific issues, their importance for the public at large, and how well we understand them. 89S courses focus on student discussions. In this case, discussions consider a combination of scientific literature, contemporary media, and analysis of data. Our first meeting provides logistics for the class and introduces the software package R.

#### Course objectives

* Evaluate how information on environmental change is generated and interpreted
* Analyze and critique the evidence
* Learn and apply the language R to basic modeling problems

#### Students will have learned skills to

* Recognize basic types of data and methods used to analyze them
* Gain a first exposure to concepts in modeling and computation
* Incorporate analyses into discussion and debate

#### Three vignettes

* Rising CO2, climate change, and who pays?
* Declining biodiversity: climate, agriculture, and other stressors
* Fisheries declines

#### Cross-cutting themes

Data sources

* Monitoring networks
* Citizen science

Inferring cause, predicting change

* Foundations: classical statistics, probabilistic (Bayesian) modeling, machine learning
* Quantifying relationships, prediction: trends, sensitivity, interactions, hidden variables
* Big data: special challenges

Computation—applications to each of three vignettes

#### Assignments

* exerciseTemplate.Rmd (if it does not download as a .Rmd file, I will email it)
* Post to Sakai

#### Grading

* 30% Participation in discussions: *background complete, contribute during meetings*
* 45% Group and individual assignments: *mostly short answer*
* 25% Final presentation and report: *includes your reviews of colleague presentations*

#### Approximate schedule

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | Topics | Tools | due | A | I |
| jan | 21 | 1. [Overview](https://duke.zoom.us/rec/play/eh31DBsjAOp2cbADSWLXZYvUTxrjAs68BV5lZjjrVe_LdwRYN_6HxYAggbFgY8BmqTdv8hv60R6johAp.D-mn1_LpKKkSGXfK?continueMode=true&_x_zm_rtaid=HHStl1x4QVqNhzpAArnbAA.1615320027940.04dbd36a878fed26d0f3cd6de234f292&_x_zm_rhtaid=684) | [background concepts and R](https://rpubs.com/jimclark/715835) |  |   |   |
|  | 26 | 2. [CO2 emissions and global warming](https://rpubs.com/jimclark/721349) | Discussion, R tutorial |  |   |   |
|  | 28 | [3. Mauna Loa data](https://rpubs.com/jimclark/721349) | Working group analysis |  |   |   |
| feb | 2 | *Optional field trip*: on campus |  |  |   |   |
|  | 4 | [4. Extreme events](https://rpubs.com/jimclark/721363) | Code and interpretation  | #3 | x |   |
|  | 9 | [5. Drought, flood, fire, hurricanes](https://rpubs.com/jimclark/723480)  | Discussion |  |   |   |
|  | 11 | 6. [Who’s fault? NY city vs big oil](https://rpubs.com/jimclark/724431) | Debate preparation | #4, 5 |   |   |
|  | 16 | [7. Debate](https://rpubs.com/jimclark/724431) |   | #6 |   |   |
|  | 18 | [8. Birds-eye view on the biodiversity crisis](https://rpubs.com/jimclark/727432) | Breeding bird survey | #7 |   | x |
|  | 23 | [9. Discussion: scientific evidence](https://rpubs.com/jimclark/729708) | BBS data | #8 |   |   |
|  | 25 | 10. [eBird evidence](https://rpubs.com/clanescher/730898) | [Ebird data](https://rpubs.com/margaret-swift/eda-with-ebird) |  | x |   |
| mar | 2 | [11. BBS data](https://rpubs.com/jimclark/733006) | Hurricane impacts, trends over time |  |  | x |
|  | 4 | 12. [Which species in decline?](https://rpubs.com/jimclark/733006) | BBS data and review of GLMs, interactions |  |  x |   |
|  | 9 | **No class** |  |  |   |   |
|  | 11 | 13. [Breeding-bird data](https://rpubs.com/jimclark/737316) | Synthesis discussion | #9-11 |   |   |
|  | 16 | 14. [Endangered species act background](https://rpubs.com/jimclark/739842) | Prepare position statements | #12 |   | x |
|  | 18 | [ESA Debate](https://rpubs.com/jimclark/739842): property rights/private industry | Working group rebuttals | #13, 14 |   |   |
|  | 23 | [15. Fisheries on the brink](https://rpubs.com/jimclark/743844) | ESA rebuttals, Review storyMaps |  |   |   |
|  | 25 | [16. Fisheries data](https://rpubs.com/jimclark/744966) | Exploratory data analysis |  | x |   |
|  | 30 | [16. Fisheries data](https://rpubs.com/jimclark/744966) | Working group analysis |  |   | x |
| apr | 1 | [17. Seasonal trends](https://rpubs.com/jimclark/748579) | Paragraphs on Fisheries response | #15,16 |   |   |
|  | 6 | [Prepare final presentation](https://rpubs.com/jimclark/750430) | Working group rebuttals |  |   |   |
|  | 8 | Long-line fisheries | Interactions, Debate preparation |  |   | x |
|  | 13 | Debate | Final outline |  |   |   |
|  | 15 | Final presentations |  |  |   |   |
|  | 20 | Final papers due |  |  | x |   |