````
---
title: "Environmental Modelling"
description: ESM 232 / EDS 230  Spring 2022
site: distill::distill_website
output:
  html_document:
    df_print: paged
  pdf_document: default
---

```{r setup, include=FALSE}
knitr::opts_chunk$set(echo = FALSE)

# Learn more about creating websites with Distill at:
# https://rstudio.github.io/distill/website.html

# Learn more about publishing to GitHub Pages at:
# https://rstudio.github.io/distill/publish_website.html#github-pages

```

```{r, out.width = "100%", fig.cap = "Image: A hillside a bloom - a place where I run my
ecohydrologic model RHESSYs" }

# UPDATE IMAGE HERE
# or copy/paste this code elsewhere, updating the file path, to add other images to your
site!
knitr::include_graphics("img/flower-hill.jpg")
```


## Course description

<p style="color: #ba5e00"><b> Environmental Modelling: An overview.</p></b>

Computer-based modeling and simulation are widely used tools in both practical
environmental problem solving and in environmental research. Models give us a way to look
at the world through a mixture of data and theory. A good model can help us to understand
how the world works and how decisions that we make might change the world in ways that are
important to us. There are many different types of models, from simple to complex, and
models are often tailored to answer a specific questions. This course will give you skills
that help you to choose which model, or modeling technique, is right for you - given the
task at hand. The course will cover designing a new model and evaluating existing models.
We will emphasize best practices, such as sensitivity and uncertainty analysis, that help
to design and use models to reliably support environmental problem solving. This is a
skills based course and we will use R (a data analysis and programming environment) as our
basic platform.

Class will include a mix of lectures and in class hands-on examples, using students' own
computers. I will often provide an R-markdown document for you to go through prior to
class so you can learn at your own pace and we will then use class time for the hands-on
examples and assignments.



## Teaching team

**Instructor:** Naomi Tague
(https://tagueteamlab.org/)

-   **Office:** Bren Hall 4516
-   **Office hours:** email to set a time
-   **Email:** tague@ucsb.edu
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Teaching assistant: Rachel Torres

- **Office:** Bren Hall 1005
- **Office hours:** T, TH 10:45-12
- **Email:** ratorres@bren.ucsb.edu

Where we will be

- **Lectures:** Tues, Thur 9:30am - 10:45 am (**BH 1414**)
- **Make-up Class** May 9 5-8pm; May 10 5-8pm (**BH 1414**)
  - note you only need to attend one of these - see sign up [here](https://docs.google.com/spreadsheets/d/1e1_Gfblja_Rye9xVoe7LMmqUrrUDKtG4oZUNPgn2_U8/edit?usp=sharing)

Learning objectives

- Gain familiarity with different types of models and the situations where you might use them

- Understand how to choose the 'right model' for the job
- Know how to build simple models including
  - input-output models
  - basic dynamic models
  - matrix models

- Gain some basic skills that are useful in applying models including
  - parameter sensitivity analysis
  - uncertainty analysis
  - model calibration and evaluation

Computing

- I will assume that everyone has some basic R skills (from ESM 203, ESM 232, MEDS program courses or other courses), including how to use ggplot, and Rmarkdown and build simple functions, as well as a basic understanding if *git* and *Github*

- Many classes will be working classes so bring these to class

Tentative topics

Week	Lecture topics
April 17	Into and Conceptual Models
April 24	Constructing Simple Models in R
May 1	Sensitivity Analysis
May 8	Choosing and Evaluating Models
Special Class	Model Calibration
May 15	Dynamic Models
May 22	Stability and Sensitivity with Dynamic Models
May 29	Matrix Population (Discrete Dynamic)
June 4	Optimization and Wrap Up

Assignments

There are 8 assignments. Some assignments will be done in groups. Assignments will vary in

length but most will be short coding assignments with a 1- paragraph write up. Assignments can be submitted as a link to your *GitHub* repository that has assignment files - the link will be submitted on *Canvas* - that way we can keep track of grading for each assignment. If you find *GitHub* too challenging then you can also submit files directly (if you do this, please make sure you zip multiple files together)

Protocols and Guidance

* Learning to program is hard and I may not always explain in a way that is accessible to you - So if you don't understand something *ASK*
    * ideally ask in class - you will help me to learn how to explain (or find an answer if I don't know it) and you will help others
    * if you don't feel comfortable asking , reach out to me or Rachel

* Environmental modeling and the coding involved gets better with practice and play - Don't just read the Rmarkdown - try the code, try variations on the ideas presented, make up stuff to try, get your feet wet

* Programming means making mistakes, expect it, stay calm and try again - if you get frustrated step away and come back; be creative

* **Respect and Support each other**
  * when working in groups, pay attention to your partner, if they are not at your skill level, help them learn - recognize that we all have different backgrounds
  * listen - different perspectives contribute to modeling - ask questions; figure out how different people *see* the world (what is there conceptual model)
  * you learn by helping others - do that!

* If you are really struggling, reach out to Rachel or myself, we can help (or if you just want to chat about something)