Assignment 1:

For assignment one we will be creating two conceptual models: one of a model that we will build upon over the next 4 assignments, and the other to present in class. Please work in groups of 2-3.

Conceptual model to be presented in class:

Identify an environmental problem that would benefit from information that could be provided by model. Summarize the goal of the model in a single paragraph. Draw a conceptual model model, which again includes all that apply: inputs, outputs, reservoirs. Specify whether the model is stochastic or deterministic, spatially lumped or distributed, and the time step of the model. Put your conceptual model on a single slide and be prepared to present the key inputs and outputs of the model, the type of model, and the purpose of the model.

Conceptual model that will be built upon:

This will be a conceptual model of almond yield anomaly. Review the Lobell et al. 2006 paper; specifically look at the equation for almonds in table 2. Draw a conceptual model to represent this equation. Be sure to include all that apply: inputs, outputs. What is the output of the model? Be sure to understand what anomaly means! We will go over this together in class

Assignment 2:

For assignment two we will be building the almond model (from Lobell et al. 2006) in R. The conceptual model, from the last assignment, should have laid the foundation for what needs to be done, now your job is to figure out how to implement it in R. As a side note: there are always multiple ways to code something in R; of course focus on getting the correct answer first, but also remember that we want to strive for our code being as simple and streamline as possible. Style counts.

Here are some ideas to think though. First, the climate data is going to need to be subsetted. How the almond function is written will dictate how the climate data is going to be stored, after it is subsetted. Second, we want to build a clean function that is versatile. Here are two model outlines to follow

* Almond\_model <- function(clim\_var1, clim\_var2, parameters){……}
* Almond\_model <- function(clim, parameters){……}

The first example is where the climate variables are separately input into the function, and the second is where a data frame is the input in the function. The first demands that the data is subset beforehand, the second subsets the data as part of the function, but demands the dataframe be structured in a specific way.

Here is the end product we are looking for: calculate the almond yield anomaly for each year, and summarize the data. We will leave how to summarize the data up to you. Think about what metrics would be best to explain the trends in outputs. Tables, graphs, and summary metrics are all acceptable. We encourage you to discuss these ideas with your fellow classmates. Make sure to include axis labels, units and captions. Finally, write one paragraph summarizing your findings. Submit pdf of rmarkdown.

Three answers to check your model against:

2000: 9.59

2001: 159.51

2002: 0.24

Assignment 3:

For assignment 3 we will be doing a sensitivity analysis with the almond model. We want you to do the sensitivity on 0.0043P^2 term, which means that you’ll be varying the 0.0043. To vary this term use the rnorm( ) function, where n=500, the mean is equal to the parameter (0.0043), and the standard deviation is 0.001. You will use the output of this rnorm in place of the 0.0043, in order to do the sensitivity analysis. This means that you will write a script that will calculate the yield anomaly for each year, over parameter uncertainty, which means 500 times for each year. The code in makingfunctions1 that was written to show you how to do sensitivity analysis will be a helpful guide.

Turn in an pdf of your rmarkdown with the code and a boxplot, where the x axis is years and the variation in the boxplots are due to the parameter uncertainty (similar to the boxplot of power and Keff at the bottom of makingfunctions1).

NOTE--this assignment is going to be quite hard. It will absolutely challenge your ability to code, and may even demand that you rewrite your almond model. Prepare to take some time on this one; even translating the data at the end to be used in ggplot is not trivial. Use makingfunctions1 as a guide. Many things can be modeled from this guide, but some will have to be changed.

Assignment 4:

In assignment 4 we will bring together the almond model and the net present value model (NPV) to calculate the NPV. Assumptions are as follows:

* Almond production costs $3800/acre
* Almond profit is $2.50/lb
* Almond production on average is 1 ton/acre/yr

You will need to use the assumption above to translate the anomaly into tons per year, and then calculate the net profit from this. With the net profit, you can then use the time discount in the NPV equation to calculate NPV. Use makingfunctions3 as your guide.

Turn in a PDF of an rmarkdown with your code, a plot of year vs NPV, and the sum of NPV.