Methods in Experimental Ecology - PCB 6466
Final Exam – November 25 to December 6, 2013

Source of image: http://www.talltimbers.org/

Instructions: This exam was made available on the class website on Monday, November 25th. Upon reviewing the exam and **no later than Monday, December 2nd**, please inform both instructors about your decision on either completing the exam alone, or in a group. In the latter case, include the names of the participants in your email. Think about this decision carefully, since once you commit to a certain group, every member will receive the same grade and should therefore have contributed equally to the final result. Also on the email indicated above, you must clearly state if you want either Exam 1 or Exam 2 to be replaced by whatever grade you get for this exam. Failure to mention this before the deadline will be taken to mean that you want all your exam grades to be taken into account when calculating your final grade. **The exam should be returned to both instructors by Friday, December 6 at 12:00 midnight.** No exams received after this will be graded, so please make sure that you receive a confirmation that your file was received properly.

E-mail a single Word document with your results. All analytical work needs to be done in R and OpenBUGS. Scripts and output from these programs should be included as an annex for full credit, but **any important results should be displayed completely within the main body of the text**. Each person/group is free to organize and present their text as they see convenient, but we expect the final result to be a self-standing scientific report worthy of graduate students. This includes proper structure of sections, labels, spelling, grammar, presentation, citations, formatting, etc.

The dataset to be analyzed is available on the website as the file `Wire_grass_exam.txt`. The column labels correspond to: `ID`= individual plant measure identifier (there are as many as plants and measures); `Observers`= group of persons responsible for the measurement; `tag`= tag number associated to the pot containing the plant(s); `lg`= maximum clump height in cm; `lf`= number of grass blades (tillers); `tp`= plants per pot, either single (1) or multiple (2); `IDI`= id for the individual plant measured (repeated twice because each plant was measured independently by two groups).

On September 8th 2013, you kindly helped to measure the height and count the tillers of hundreds of grass clumps of wiregrass *Aristida beyrichiana* (formerly called *Aristida stricta*) scheduled to be transplanted to the field. The main purpose of the study in which you participated is to evaluate the effect of microhabitat and ridge elevation on wiregrass growth and survival, with hopes of learning how to make successful reintroductions for restoration of native ecosystems. We hope our classes gave you an opportunity to appreciate the complexity involved in the design and analysis of ecological studies such as this one.

Your assignment is to analyze this dataset, making sure you include **ALL** of the following points:

- What are we trying to understand with this portion of the study? i.e. why did we measure the plants before transplanting them to the field?

- Taking into account our visit to the Sandhill scrub where some of the plants will be transplanted, what microhabitats should be considered in this study and why? Why is ridge elevation a relevant variable? Come up with an experimental design of how the wiregrass plants should be deployed and monitored in the field, and justify your decisions.

- Why did we measure these two variables (lg and lf)? Why not only one of them? Characterize their distribution and present all the information you consider relevant to justify any decisions about how to use them in your analyses.

- Using both frequentist and Bayesian frameworks for your analysis, formulate scientific hypotheses and then select the appropriate model(s) to test them using the data you were given. Use plots as needed, justify your methods, explain your findings and any differences on the inference based on the two frameworks used.

- Be careful to identify all the possible sources of variation that are relevant and measure their contribution to the explained variance of your model(s). If you are using model I regression, defend the selection of which variable(s) are better selected as the predictor variable(s) "X" and which is the appropriate response variable "Y".

- Provide confidence/credibility intervals for every parameter in your model(s).

- Interpret the results of your model(s) in a biological context and with reference to your experimental design.

- Search for information that can be used as a basis to construct an informed prior, and then perform a new Bayesian analysis using these as your prior distributions for the estimated parameters. Interpret and conclude on your findings. Cite and provide pdf copies of the source(s) you used.

- Remember to check for outliers and possible errors. Carefully consider the need of transformations or the use of non-linear models.