Geomorphology **Session: Red beans and rice slope stability and evolution lab**	**Materials needed:** **For each group of four students:** **1. Copy of the lab write up** **2. Clear, acrylic slope failure box** **3. Electronic balance with 0.1 g precision** **4. Bucket or 4 liter beaker for catching beans** **5. Dry Erase marker for marking sidewall slope profiles** **6. Enough red beans or rice to fill slope failure box to within 1 inch of top** **7. Five gallon bucket for dumping weighed beans** **8. Post-it notes for labeling profiles on the sidewall (if desired)** **9. Long cm scale ruler for measuring slope lengths** **10. Tape** **11. 11 x 17 sheets of paper** **12. A copy of the Densmore et al. article** **13. A broom and dustpan for cleaning up red beans and rice on the floor!**

Goals of the session:

At the end of this lab, students should be able to:

1. **Explain how a relatively simple experiment can provide insight into how slopes and landscapes evolve over long timescales**
2. **Describe how a slope profile that looks like it is out of equilibrium may actually be an equilibrium slope profile**
3. **Qualitatively describe how slopes fail due to undercutting and downcutting by a stream**

This lab also demonstrates to students:

1. **The process of hypothesis generation and testing**
2. **Techniques of data collection, reduction, analysis, and synthesis**
3. **Basic concepts of measurement.**
4. **The importance of a clean, well-written lab write-up**
5. **Basic concepts of time series analysis, data normalization, and cumulative frequency plot analysis.**

Estimated time	Outline
(10 min)	I. Give students time to read through the lab.
(15 min.)	II. Briefly describe the experiment and ask them to predict the results a. Need to describe what will happen b. Need to have them describe the material in the boxes as thoroughly as possible c. Then they need to predict how the failures will occur.
(20 min.)	III. Give them time to practice making slope failures and weighing the material. This will happen whether you make the time explicit or not, because they will want to jump right in and get going, which will lead to several aborted initial attempts, aka: practice!
(1.5 hours)	IV. Run the experiment up to about 70 time steps
(20 min)	V. Input results into Excel spreadsheet
Outside of class time	VI. Share results with class and complete analysis and write up

Notes

- **The movement of the sliding door can be sticky and requires practice.**
- **You must emphasize that bumping the table or the apparatus will result in seismic events that will screw up the results and require them to start over.**
- **I tape a sheet of paper around the outlet to act as a funnel to catch the beans, otherwise, they'll spill everywhere.**
- **I have taken digital photos of their sidewall slope profiles at the end of their experimental runs, then e-mailed these photos out to everyone for use in their write-up. You can compile them as a pdf and send out the pdf file.**
- **One thing to avoid: they should empty their bean collection bucket after every slope failure and not take a running total; if groups collect their data differently, it's nightmare when it comes time to analyze the data.**

Activity(ies)

Read through the lab write up.