s of vie

Drought trigger clear as day

WHEN I was a kid we never had drought after drought.

Then we started with daylight saving. We started with a little bit, but now we have six months of the year daylight saving.

It has just become too much for the environment to cope with.

It is so logical, for six months of the year we have an extra hour each day of that hot afternoon sun.

I read somewhere that scientific studies had shown there is a lot less moisture in the atmosphere which means we get less rain.

I believe this one hour extra sun is slowly evaporating all the moisture out of everything.

Why can't the Government get the CSIRO to do studies on this, or better still, get rid of daylight savings.

They have to do something before it is too late.

— **CHRIS HILL,**
Albury

Quantitative Thinking in the Life Sciences

Dec 5th - Wrapping things up

Today

- Class project details – Lean on your classmates
- Contrast statements!
- Extra sources of information
- Simulation bonuses
- Course Evaluations

Housekeeping

- Our Final is: MON 12/10/2012 07:30 - 10:15

- Class project due on our finals day
- All other (late) assignment due Today!

Class Project:
An exercise in self-plagiarism!

Manuscript format!
Polished for publication in journal format (e.g., Ecology)
Presented as a single document with figures/tables embedded, references and appendix attached

1. Introduction
   - Introduce your system,
   - Why it is important to the scientific community
   - What questions will you hope to address
2. Methods
   - How will you actually collect data
   - How did you simulate your data
   - Why did you choose the parameters that you used (This could be in the introduction)
3. Results
   - Data simulation
   - Test results
   - Figures / tables
4. Discussion and conclusions
   - Is it likely that you will be able to answer your questions
   - What other steps are you going to take to improve the design
   - How will your results inform the scientific community
     - Why should we care?
   - Conclusions based on your simulations
5. References
6. **Appendix!!! Annotated R code!**

Differences in treatment means

Contrast statements

Tukey's hsd code works well (Away to R!)

There are also contrast statements in aov()

```
large.woody.debris = NULL
harvest.type=NULL
sim.data = data.frame (large.woody.debris = large.woody.debris,
                       harvest.type=harvest.type)

harvest.names = c("slash","burn","hack", "beetle colony","green logging")
harvest.means = c(2,3,3,5,7)
harvest.sd = c(1,1,1,1.5,2)
harvest.samples = c(15,25,20,23,17)

count = 1
for (x in 1:length(harvest.means)) {
                       for (y in 1:harvest.samples[x]) {
                                              sim.data[count,1] = (rnorm(mean=harvest.means[x],
                                                                         sd=harvest.sd[x],n=1)
                                                                         # still want to add in measurement error
                                                                         + rnorm(mean = 0, sd = 1, n = 1))
                                              sim.data[count,2] = harvest.names[x]
                                              count = count + 1
                       }
}
hist(sim.data[,1])
sim.data

mod1 = aov(sim.data[,1] ~ as.factor(sim.data[,2]))
mod1
summary(mod1)
coefficients(mod1)

summary.lm(mod1) # looks at first alphabetical against others (beetle kill vs others)

# Suggested for looking at differences between treatments
TukeyHSD(mod1)
```

Extra resources:
R Cheat sheets, information sheets, & online help

R search tool (e.g., treatment means)
http://www.inside-r.org/search/apachesolr_search/treatment%20means

Spatial Cheat sheet in R:
http://www.maths.lancs.ac.uk/~rowlings/Teaching/UseR2012/cheatsheet.html

Tom Hobb's distribution cheat sheet:
http://classes.warnercnr.colostate.edu/nr575/files/2011/01/Distribution_cheat_sheet10.pdf

Tom Short's r reference card (Hat tip Ally!)
http://cran.r-project.org/doc/contrib/Short-refcard.pdf

Statistical Methods help page by Quick R
http://www.statmethods.net/

Time Series analysis
http://cran.r-project.org/web/views/TimeSeries.html

Time Series tutorial
http://www.stat.pitt.edu/stoffer/tsa3/R_toot.htm

Other bonuses of simulating data

Elk model revisited

- We have an idea of Rocky Mountain NP's Elk Carrying Capacity
- We have an idea of the natural growth rate of Elk in the park

What if we wanted to economic factors?

To R we go!

Entertain hypothetical situations

Skills

- Bow hunting skills (AKA probability and statistical theory)
  - You have a conceptual understanding of the link between probability and statistics
  - You have an increased understanding of the importance of variability and error
  - You have an increased understanding of distributions and why they are important

- At this point:
  - You can read data into R and write data from R into other programs e.g., Excel
  - You can manage and manipulate data in R
  - You can simulate data
  - You can test if your simulated data, given the variability in the system, will answer your questions
  - You have been developing non-linear, population dynamic models
  - You have sources for help when you get stuck
    - Realize that Google and R are best friends
    - The R user community is great
    - Classmates!

Course Evaluations

- College of Agriculture and Life Sciences course evaluation to be delivered to
- Supplemental in my mailbox in Plant and Soil Science departmental office (downstairs)

Always add leprechauns!