Mt. Lemmon Field Trip: 24 March 2007

BRING: field notebook, water bottle, lunch, snacks, jacket, hat, (money?, binoculars?, camera?) etc.
We will be in the field from 0700h to about 1800h (meet S side BSE [corner of 4th & Highland]).

Hypothesis (bring completed in your field notebook): What do you predict the relationship of vegetative biomass (we will estimate with the Basal Area Factor method) will be with elevation? Why?

Trip Goals:
1. Introduction to Sky Islands
2. Learn about elevational zonation and the vegetative communities on Mt. Lemmon
3. Discuss dendrochronology, fire history, forest management
4. Learn about adiabatic cooling
5. Measure relative and absolute humidity
6. Discuss and measure (temperature) microhabitat differences
7. Approximate biomass as a function of elevation using Basal Area Factor method
8. Build community

Introduction:
The Sonoran desert of southern Arizona is dotted with mountains that rise out of the desert basin to heights of almost 3200m (11,000 ft.). The cool climates and increased precipitation on these mountains offers appropriate conditions for many plants and animals which do not typically inhabit the desert floor. The ecosystems found on these mountains are so different from the surrounding area that they are described as **sky islands** in a desert sea.

Important relevant physical relationships:
- As altitude increases atmospheric pressure decreases.
- As atmospheric pressure decreases air temperature decreases; a phenomenon called adiabatic cooling.
- As air temperature decreases the atmosphere's ability to hold water decreases. The water then precipitates as rain or snow.

Mountains also have other effects on local climate. Rain tends to fall on the windward side of a range leaving air dry as it moves down the leeward side of a range. Also, each one thousand foot increase in elevation is analogous to moving 300 miles north toward the pole. The difference is that driving to Mt. Lemmon is cheaper, in terms of time and fossil fuels, than driving to Canada!

Please refer to the several readings available on your lab course website for additional background information.
http://eebweb.arizona.edu/courses/Ecol206/206Lab2007ongoing.htm

Data to collect: At each stop (we will make 5 data stops in dramatically different vegetative zones) record:
- Location and Time
- Mileage
- Elevation (feet or meters)
- Ambient air temperature (Celsius or Fahrenheit; °C(9/5)+32=°F)
- Sky temperature (Celsius)
- Warmest and Coolest spots (using infrared thermometer "gun"; Celsius)
- Absolute and Relative humidity (using wet and dry bulbs and conversion table)
- Barometric Pressure (inches of mercury [Hg])
- Weather data from Tucson International Airport via NOAA weather radio (including temperature, humidity, and barometric pressure)
- Dominant vegetation and description of community; do you see multiple habitat types at a given stop?
- Soil type, slope and aspect
- Standing biomass (ft^2/acre) as estimated by Basal Area Factor method ("tree count around a point, when multiplied by the basal area factor, gives basal area/acre")

Graphs to make in lab during the week following our trip to the Lemmon:

A. Plot barometric pressure as a function of elevation. What is the rate at which barometric pressure changes as a function of elevation? What else changes as a function of elevation? Why? Do you need to correct for changing barometric pressure over the course of the day? How would you go about this?

B. Plot sky temperature as a function of elevation. What is the rate at which sky temperature changes with elevation? Why?

C. Using elevation (in feet or meters) as the independent variable, plot basal area (square feet/acre) and ambient temperature (F or C) as two different dependent variables on the same graph. What conclusions can you draw from this graph? What is the adiabatic lapse rate? Think of a way to correct for increasing temperatures over the course of the day. How does this change your graph? Why does standing biomass change with elevation?

D. Plot the difference between the hot spot and cool spot at each site as a function of time of day, ambient temperature, and elevation. Which is most meaningful? Why? When and where did you find the absolute hottest and absolute coolest temperatures? What temperatures do you think you missed?

E. Plot relative and absolute humidity as a function of elevation. Why are they different? How does each of them change and why? Do you have to control for changes in temperature?

Questions to discuss on Mt. Lemmon and in lab:

1. What is a sky island?
2. How might global climate change affect the sky island vegetative communities?
3. What are the major vegetative communities you observed on Mt. Lemmon? How would you describe each one?
4. Are the plants within each community distributed evenly, randomly, or clumped? Why?
5. What differences do you observe on the south facing slopes vs. the north facing slopes at the same elevation?
6. What limits the distribution of major plant species between zones?
7. How does species richness or abundance change across vegetative zones?
8. What differences do you observe in the structure, morphology, and physiology of plants at each stop?
9. What affect do riparian areas have on vegetative communities? Why?
10. What percent of the atmosphere do we go through as we move from Tucson to the top of Mt. Lemmon? How do you know?
11. What is the likely fire regime in this area without human influence? How have humans changed the fire regime? What effects do these changes have on Mt. Lemmon ecology? How should we manage our national forests? Who should pay for either management, or fighting fires, or both?
12. How do you figure out the fire regime that occurred 150 years ago?
13. What is a skeleton plot? Why core a tree on both sides? What is reaction wood?
14. How does the Basal Area Factor method work?
15. What differences among potential microhabitats did you observe today? Describe their importance for vertebrates (ectotherms and endotherms), invertebrates, plants, bacteria, annuals, perennials, etc.
16. What was your most interesting biological observation of the day?
17. What should be done about bears, mountain lions, and other ‘nuisance’ species on Mt. Lemmon?
18. How do humans influence biological communities? At what scales?
19. Why is pie so expensive in Summerhaven? What lessons does this provide for conservation biologists?
20. Should summerhaven be rebuilt? Should Summerhaven residents be allowed to purchase fire insurance with their homeowner’s plan?
21. What other question(s) should we have asked you in conjunction with this lab?
22. How could you calculate the amount of energy we used to take our field trip to Mt. Lemmon?