Field Botany Review / Overview BIO 2500

I. Big Idea – Field Botany – Understanding plants in their context (plant community)

A. Rationale – plants are major determiners of the structure of biotic communities
B. Aspects – "scaffolding", stratification, zonation, distribution, population (e.g. cover)

II. Skills to Study Biotic Communities

A. Plant Identification – review common plant species to visualize and illustrate concepts
1. Taxonomic Key usage – more proficiency via Take-Home Tree Practical
2. Morphology – leaf dissection, leaf attachment, inflorescences
3. Life Cycle / Life History – annual, biennial, herbaceous perennial, woody perennial

B. Population Sampling
1. Impossible to know actual population (for population mean, μ)
2. Statistical sampling – "representative sample" (for sample mean, X)
3. Verifying if sample is representative – sufficient sample size (n); repeat sampling
4. Decision on Null Hypothesis (H_o)
a. Statistical Tests of difference of means – e.g. *t*-test
b. Probability of Error – compare computed *t*-value with critical *t*-value from table, distributed according to probability (α level) of making Type-I error

Application of Skills

A. Overview
1. Value – land stewardship, "con-service" (Gen. 2:15; "serving-with" creation)
2. Challenge – developing management strategy to "build" prairie community
3. Current Strategy – using combination of fire, soil disturbance, and reseeding

B. Chronology – see webpages
http://www.cedarville.edu/academics/sciencemath/silvius/research/projects.htm
1. In 2005 (fire/disturbance/reseeding)
a. Result – reduced abundance of Indian Grass (IG) and Tall Goldenrod (TGR) – increased abundance of annuals, Common Ragweed, Giant Foxtail
2. In 2007 – regain IG and TGR to undisturbed level; "window" for increased native species richness (Silvius, J.E., Zehring, J.R., T.A. Lawler, 2010)[1].
3. In 2009 – controlled burn (April) then did late spring mowing in 2010 (Plts 3-4)

C. Methodology
1. Sampling of 30-m wide treatment plots via
a. Random placement of transects within subplots (strip plots, 10-m wide)
b. Random placement of 0.25-m^2 quadrats along transects – cover estimate
c. Nested within 19-m^2 semi-circles for citing "satellite species"

D. Species Comparisons:
   1. Abundance; Relative Abundance (p_i) – estimate of population size (cover estimate)
   2. Coefficient of Conservatism (C_c)

E. Biotic Community Assessments
   1. Species Richness – Total number; or, number per sample point
   2. Evenness a. based on mathematical and graphic display of rank abundance curve
      b. Computed by Shannon Evenness (E' = H'/ln species richness)
   3. Biodiversity – 1. plus 2.; Shannon-Wiener Index (H')
   4. Comparing Communities:
      a. Jaccard Coefficient – percent similarity (S_j) of two communities
      b. Shannon-Wiener Index (H') – species richness plus evenness (see E.2.)
      c. Floristic Quality Assessment Index (FQAI) – a biological integrity index
      e.g. FQAI = $\Sigma C_c / \sqrt{}$#Native (Andreas, 2004, Equation 6)

F. Discussion Points for 2010
   1. Effect (residual?) of 2005 disturbance followed by 2009 fire on
   2. Parameters 1. through 4. above
   3. Effect on abundance (cover) of selected plant species
      a. Indian Grass and Tall Goldenrod
      b. Annuals – Common Ragweed, Giant Foxtail
      c. Total Legumes

   Sampling Error Sources – e.g. diverse samplers gaining experience

G. Scientific Writing Skills – see PowerPoint "11poprairiedata" and see next page.

References:

Andreas, B.K., J.J. Mack, and J.S. McCormac. 2004. Floristic Quality Assessment Index (FQAI) for vascular plants and mosses for the State of Ohio. Ohio Environmental Protection Agency, Division of Surface Water, Wetland Ecology Group, Columbus, Ohio. 219 p.

Silvius, J.E. 2009. *Botany Laboratory Manual*. Cedarville University Print Services, Cedarville, OH.

Silvius, J.E., Zehring, J.R., and T.A. Lawler. 2008. Use of Soil Disturbance and Reseeding to Increase Prairie Plant Species Richness in a Post-Agricultural Field in Southwestern Ohio. Poster Presentation, 21st North American Prairie Conference. Winona State University, Winona, MN.

Note the following contrasts in scientific writing:

Figure Legend – weak start Figure 1 shows the proportional abundance of each species that was included in our samples.	Figure Legend – *concise with helpful details*: **Figure 1.** Rank-abundance curves for plant species of control and disturbed plots in 2010 at the Cedarville University Prairie Restoration Site.
Description of data, but without accurately stating the parameter in question or indicating how the parameter was affected or providing a concise conclusion: After thoroughly analyzing the data, I found that there is a difference in species richness between the disturbed and undisturbed communities of the prairie restoration.	Deduction: Concise statement of how the parameters were affected and the author's conclusion: Example: Disturbance increased species richness per quadrat in the disturbed plot relative to the control ($p < .05$).
Mixed signals about H_o: The 2005 disturbed plot had a higher species richness per quadrat than the control; however, when a *t*-test was performed, the computed *t*-value did not exceed the critical *t*-value, indicating that species richness did not differ.	Clarification: Arithmetic difference in means does not mean they are statistically different. Decisive and Concise: Mean species richness per quadrat did not differ between "Control" and "Disturbed" plots in 2009 (*t*-test; $p > 0.1$).
Proving a H_o is Incorrect: Our statistical analysis of mean species richness proved that the difference in means was significant.	Probability of H_o being Incorrect: Species richness was higher in the disturbed plot than in the control plot with a $p > 99.9\%$ in support of rejection of our H_o.
Most Common Pronoun – Abuse: "This data suggests...."	Most Common Pronoun – Correction: "These data suggest..." or "This datum suggests..."