Review: Bowker's Topics

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- I think that in addition to mastering a subject area and becoming a leading expert, a doctor of biology should have a curious mind and a wide knowledge base, critical thinking skills, and solid communication skills.
- My approach to comps is to gauge your knowledge of key concepts, and demonstrate your critical thinking ability by asking you to think about them in a possibly new direction. Because I think you should have a wide knowledge base, I think anything from science is fair game (there will be a wildcard), but obviously we will mostly talk about *community ecology*, and mostly about *species interactions*.
- Statistical questions may come up, more philosophical than quantitative. Also there will be at least one demonstration of your communication skills.
- I don't like the reading list approach, I prefer to list themes. You can call, write or meet me if your want clarification, but I will withhold some details otherwise its not a test.
- Judging from many conversation with you I'm not terribly worried about your ability to think on your feet.

- Here's some things to think about:

    1. Explain ecological networks and what their properties tell you in a way that anyone with an undergraduate education can understand. Explain why some network structures can promote community stability in an easy way. You might use analogy or examples from everyday life. Any visual aid must be drawn on a board, no power point.
    2. Explain any links your work might have to practical applications. Can you link the network structure and species interactions of endophyte communities, corticolous lichens, alpine plants to ecosystem function? Should Conservation Biologists, Ecological Restorationists, or land managers pay attention to your work?
        - Analogy of the blindmen and the elephant
        - Most work in ecological networks employ node deletion or addition
        - I'm interested in how the network can evolve through the change in traits determining connections

- Concepts to review:

    1. Roles of facilitation in community structure and function.
        - Stress gradient hypothesis = competition at low levels and facilitation at high levels (along with tolerators)
        - When times get tough, help each other out as long as the cost is not too high.
        - Cardinales = enhanced ecosystem function through facilitation = diversity shifts alter the probability of positive interactions and therefore ecosystem function (in this case energy flow)

2. Bayesian vs. frequentist vs. information theory vs. data mining approaches to statistical inference.
   - Bayesian = posterior probability, uses prior knowledge, more flexible framework
   - Frequentist = uses likelihood, long-run frequency, primarily Null Hypothesis based
   - Information theory = AIC, model comparison
   - Data mining = exploring large amounts of data for patterns
3. Community stability and resilience (In the sense of Buzz Holling)
   - Resilience = time to return to equilibrium/steady-state = engineering resilience
   - Ecological resilience = buffering against change
   - Interlinked systems = panarchy
   - Systems are in a continual state of flux
   - There is an interplay between the predictable and the chaotic
   - Stability = a basin of attraction for the system and how deep that basin is (i.e. how difficult it is to push it into another system state or basin)
4. Species interactions and ecological niches. You don't need to cite any specific papers, but know the authors of key concepts.
   - Darwin's tangled bank and coevolution
   - Competition
     * Lotka-Volterra = competition equations
     * N-dimensional Niche = Hutchinson

    * Fundamental vs Realized Niche = Hutchinson
    * Broken Stick = MacArthur
    * Competitive exclusion = Paine (Pisaster and Mytilus; Cthamalus and Balanus)
    * Intermediate disturbance = Connell
    * Ghosts of Competition = Connell
    * Tilman = R-star
  - Mutualism
    * Hamilton = extension of LV equations to mutualisms
    * Albert Bernard Frank = coined the term mycorrhiza
    * Thompson = Geographic theory of co-evolution
    * Judy Bronstein = wasp-fig mutualism
    * Mutualistic networks = Jordano, Bascompte
  - Co-occurrence Patterns
    * Diamond
    * Simberloff
    * Stone and Roberts
    * Gotelli
    * Keddy and Weiher = assembly rules
    * Maestre = crusts
5. Alternative ecosystem states and possible interfaces with network theory
  - Rapid, sudden transitions between states
  - Historically have focused on single populations (groups)

- Inter-connectedness of systems can cause percolations and waves through the system
- What network structures promote stable states?
    - Centrality (dependency)
    - Nestedness (i.e. redundancy and niche space)

6. Intransitive competition and possible interfaces with network theory
    - intransitivity and biodiversity maintenance at global scale
        - Rock-Paper-Scissors (Laird and Schamp)
        - Allesina = network representation with analytical solution