Papers Reviewed –Ch 3

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I. Methodologies

(Bollen, Van de Sompel, Hagberg, & Chute, 2009) A principal component analysis of 39 scientific impact measures

(Clark, 2005) Why environmental scientists are becoming Bayesians

- (p3) In this paper, I describe the underlying structure of HB that can be exploited for a broad range of ecological problems. I attempt to clarify some of the motivation for Bayesian approaches and some concepts that are often vague or contradictory, even in statistics literature. Because techniques have developed in parallel across many disciplines, the literature on uncertainty is vast and diffuse.
- Note this reality (p2) ==> Models of nature, including experimental ones, routinely entail dilemmas: simplify the research problem in the interest of generality, or admit the complexity to attain some realism
- The issue of variability (p2) ==> Stochasticity is central to the complexity dilemma, because it encompasses the elements that are uncertain and those that fluctuate due to factors that cannot be fully known or quantified. Decisions concerning what will be treated deterministically in models, what is assumed stochastic, and what can be ignored are the basis for model and experimental design
- What about novelty?!
- Ecologist cannot predict (p3) ==> Complexity and scale challenges translate directly to prediction. Despite a long research tradition on demography, population dynamics, and species interactions, ecologists frequently have little to offer when confronted with pending climate-forced range shifts, fragmentation, design of reserves, and where and when biodiversity loss is likely to have feedback effects on ecosystem services. When challenged for answers, there is temptation to abandon all pretence of prediction and fall back on scenarios that are loosely linked to data.
- my justification ==> The capacity to more directly apply ecological understanding should be a compelling justification for research.

II. Models

(Scheller & Mladenoff, 2004)

- short list of ecosystem processes ==> Ecosystem processes (e.g., net primary productivity, decomposition) (p 211)
- Keep it simple ==> Based on our objectives and the computational limitations of complex landscape simulations, the biomass module was designed to minimize complexity. Biomass is calculated using a low number of parameters that can be estimated across an entire landscape (p. 213)

- chose to keep cohort structure and add state variables ==> We elected to preserve the existing cohort data structure, as it has been well validated and integrated with various disturbance modules, and add new state variables that supplement the existing data and allow aboveground living and dead woody biomass calculations.

- BiomassSuccession misses soil food web carbon and does not estimate belowground root mass ==> Biomass that is incorporated into the soil layer (soil organic carbon, SOC) was not modeled. (p. 214)

- All simulated mortality events (the death of a species-age cohort) either transferred the living biomass for a cohort to the dead biomass pool (in the case of fire or wind) or removed the living biomass from the system (in the case of harvesting). (p. 214)

- 1st major assumption ==> The principle assumption was that an equilibrium condition would develop after many decades, whereas a cohort's mortality would equal growth, and [aboveground living biomass for each cohort = (B_{ij})] biomass would cease to increase. (p. 214)

- 1st major assumption ==> Linear relationship: $B_{ij_{t+1}} = B_{ij} + ANPP_{ij} - M_{ij} \;\; i = spp, \; j = age, \; ij = spp - age \; cohort \; (bin)$

- 1st major assumption ==>

- 2nd major assumption ==> ... at the long time steps (10 years) modeled, disturbance does not significantly decrease maximum potential productivity by reducing available soil nitrogen. (p. 214)

- 2nd major assumption ==> impact on SFWs for logging/windthrow seems ok; fire damages soil fungus but on average might be ok

- 3rd major assumption ==> ... (species-age) cohort biomass data implicitly incorporates density information. Density was not explicitly calculated for either our growth or mortality functions. reductions in density over time are difficult to predict in mixed-species,mixed-age forests. Future research will explore variation in initial biomass as a function of seed rain and initial density.(p. 214)

- $ANPP_{max}$ estimated a variety of ways ==> expert knowledge, Forest Inventory and Analysis (FIA) data, gap models, ecosystem process models (p. 215) ... maximum aboveground biomass (AGB) is now an input parameter....the relationship between above ground net primary productivity (ANPP) and AGB is not linear beyond $\sim 10 Mg\ ha^{-1} yr^{-1}$.... separate input for maximum AGB better accommodates shrubs and grasses that have different relationships between ANPP and AGB (p. 5 Biomass Succession v3.5 User Guide)

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III. Plant-soil models to check out

(Bever, Westover, & Antonovics, 1997)

IV. Ecological networks

(Williams, 2010) Simple MaxEnt models explain food web degree distributions

- the MaxEnt models shows that, in many food webs, one does not need to consider detailed ecological processes to be able to predict the consumer, resource, or undirected degree distributions. While many features of food webs are clearly nonrandom and require an ecological explanation, their degree distributions are largely explainable by a simple null model based in statistical rather than ecological theory (p.)

(Fath, Scharler, Ulanowicz, & Hannon, 2007) Ecological network analysis: network construction

- assumption — it is necessary that the network model be a partition of the environment being studied, i.e., be mutually exclusive and exhaustive
- blasts reductionist approach — network models aim to include all ecological compartments and interactions and the analysis determines the overall relationships and significance of each. The difficulty of course lies in obtaining the data necessary to quantify all the ecological compartments and interactions. When sufficient data sets are not available, simple algorithms, called community assembly rules, have been employed to construct realistic food webs to test various food web theories. Once the network is constructed, via data or algorithms, the ENA is quite straightforward and software is available to assist in this (p.)

(Bascompte, 2009)

- These [mutually beneficial] interactions play a major role in the generation and maintenance of biodiversity on Earth and organize communities around a network of mutual dependences. (p. 417)
- mutualistic networks are (i) heterogeneous, in which the bulk of species interact with a few species, and a few species have a much higher number of interactions than would be expected from chance alone; (ii) nested, in which specialists interact with a subset of the group of species that generalists interact with; and (iii) built on weak and asymmetric links among species (for example, in some cases when a plant interacts strongly with an animal, the animal tends to depend less on the plant) (14). Therefore, mutualistic networks are neither randomly organized nor organized in isolated compartments, but built cohesively around a core of generalist species. (p 417)
- the nested structure of mutualistic networks maximizes the number of coexisting species (p 418)
- Studies such as (A) focus on coevolution at a community scale and set the foundation for predicting how global change will propagate through such networks. Studies such as (B) provide a framework to address the simultaneous influence of all patches on gene flow and quantify the importance of a single patch for the persistence of the entire metapopulation.

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