

## Outline – Conceptual Manuscript

### 1. Introduction (see ms)

(last paragraph of Huston paper)

- concept and importance of biodiversity
- ecology suffers from lack of general knowledge of patterns and the mechanisms that give rise to them
- biodiversity is scale-dependent, therefore comprehensive answers to critical questions that include aspects of biodiversity will remain elusive unless scale is explicitly and adequately addressed, particularly at broad-scales

### 2. New initiatives (NEON, etc.) provide unprecedented opportunities to deepen and expand ecological understanding at relevant spatial and temporal scales beyond those afforded by current approaches to environmental research

Question guides design, guides data collection

- Broad-scale approaches rely on measurements made at scales different from the scale of inference
- Opportunistic use of data/Data collected for other purposes to address broad-scale questions

- Limitations of the status quo/current approaches:
  1. lack of statistical power (lack of replication of synoptic/syntopic measurements at different scales)
    - due to extrapolation, lack of correspondence btw measurements
  2. incomplete gradients (Australian studies) – the extent and the sampling along them
  3. mismatch between domain of scale of pattern and mechanism driving patterns (Bioscience)
- To avoid the status quo, requires synoptic/syntopic approaches

### 3. Recommendations

1. Specify Goals of the Network – explicit statement of the questions
2. From questions, develop conceptual model to...
3. Identify Relevant Spatial and Temporal Extents and Foci
4. Establish Sampling Design and Select Indicator Variables
5. Specify Sources and Estimate Levels of Uncertainty
6. Define Methods of Analysis
7. Determine Statistical Power of Sampling Design Within the Framework of the Conceptual Model

## 8. Develop a Plan for Ongoing Analysis of Data and Identify Benchmarks for Evaluating the Adequacy and Efficiency of the Network

- Relevant extent – geographical and ecological – knowledge of gradients
- Scaleability – need to extrapolate to multiple foci (e.g., area, number of individuals, size of individuals, dispersion of individuals)
- need balance between being able to address current questions but also need to be able to address latent questions (can't measure everything, so measure some well)
- recommendations for key questions
- measure but not monitor, need coordinated synoptic measurements in order to forecast change
- integrated data management, complete documentation (metadata) – requires explicit funding – synoptic measurements produce unprecedented quantities of data that will require coordinated, integrated strategies of data management
- call for funding for synoptic research as a test of the adequacy/efficacy of network (time frame for evaluation?)

## Conclusion

Progress in ecology requires a synoptic approach

- ecology needs to become a synoptic science
  - meteorology has branch analyzing data taken simultaneously over a large area, integrated in 'real' time
- ecology needs to become syntopic science as well (take multiple measurements within the exact same space)

Some sciences have networks (blah blah)

Now have impending network opportunities

A goal of a network should be to understand broad-scale patterns and processes with respect to space and time

- construction of network should be guided by eight steps
  - o sites should be distributed across the full extent of gradients in the area composing the network and potentially nested within each ecophysiological region
  - o within sites, explicit design to examine scale-dependence within site and to facilitate adjustment to common foci for cross-site comparisons
  - o considerations of domains of causality above and below that a particular research question should be considered (flexibility should be included) – i.e., hierarchy theory
- provide a specific example to illustrate process of eight steps and of what would happen if don't follow eight steps
  - (could be experience of LTER synthesis - continental – regional – proposal to address question, what would it include?) – diagram that illustrates points, if we could design it 'right' where would the sites be located and what syntopic measurements would be taken