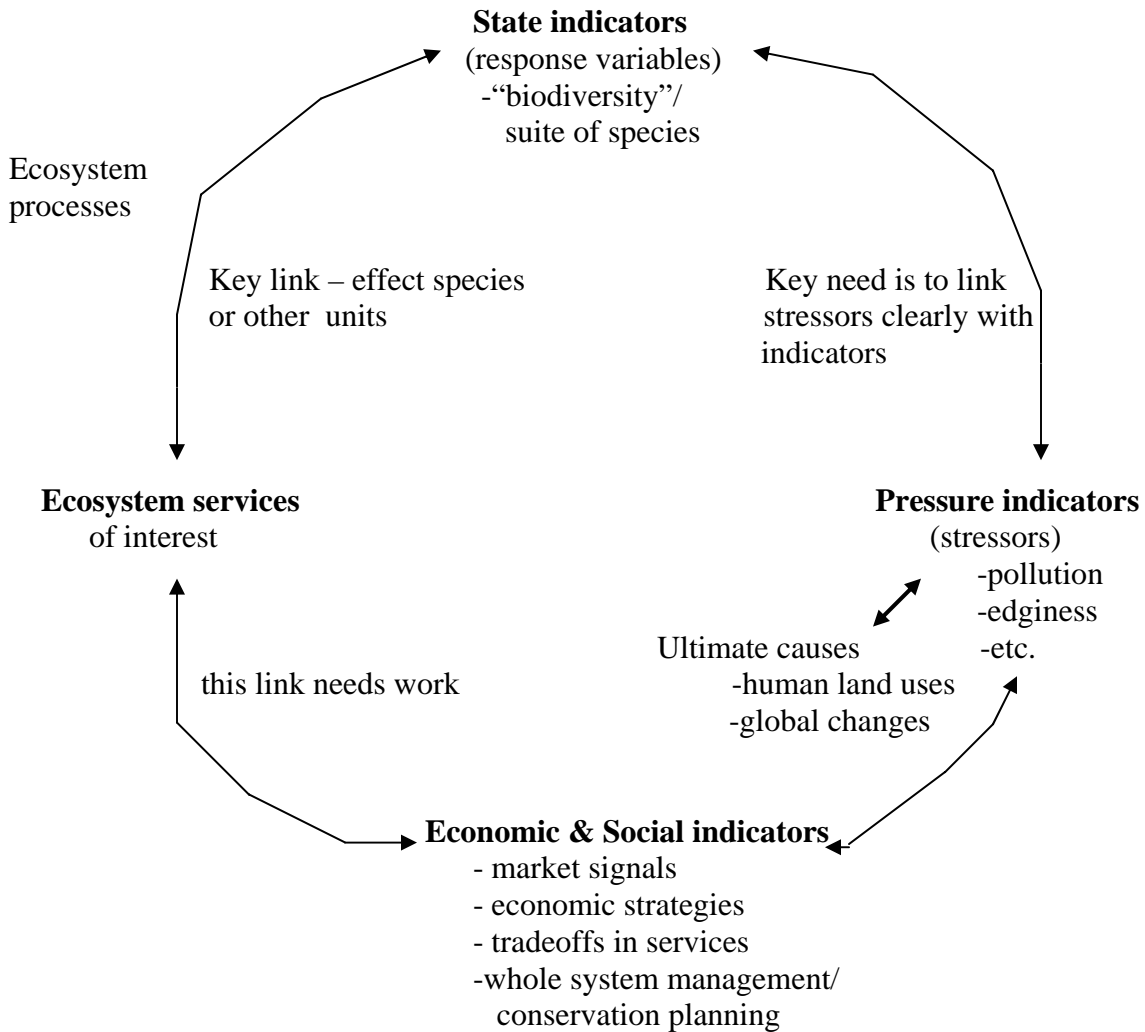


Niemi and McDonald (2004) notes



- fig. 1 – different scales of applicability
- policy-relevant indicators need 4 components
  - o assessing problems
  - o diagnosing stressors
  - o establishing trends
  - o ease of communication and measurability
- variability vs sensitivity (level of taxonomic resolution) → biomarkers
  - o can't have species be so variable that you can't see the sensitivity through the noise, also watch out for time lag b/w stress and response
- statistical design of monitoring program
  - o at what scale are you doing it?

- single indicators/taxa don't usually work for other taxa, rare species
  - o use a suite of species/indicators
    - Noss 1999 – categories
      - Different response sensitivities
      - What about effect species? (besides keystone species)
  - o facilitates linking to stressors
- Multimetrics help address some of these issues
- Criticisms/Needs for indicators
  - o Know appropriate spatial/temporal context, scale of services and providers (multiple nested scales)
  - o Overall conceptual framework – what do you want the indicators to tell you?
  - o Integrating science and values
  - o Validation – does it tell you what you want it to?
    - Natural disassembly observations, experiments → key factors affecting services
  - o Clear goals
  - o Objectivity of indicator
  - o Clear program/statistical design
  - o Good data management
- ID key ecosystem service providers
  - o Functional inventory
    - Key species
    - Trait correlations (response and effect)
    - Redundancy
    - Interactions
    - Management scenarios
  - o Functional attribute diversity
    - Need to identify key indicator attributes
      - Both those providing and responding/indicating